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Aims and scope

SAR is a peer-reviewed journal that publishes 1.the creative analyses, new concepts and transdisciplinary and integrative view-points on humans well-being, nature, culture and civilization in the form of reviews and view-point articles; 2.the original research articles, 3.case reports, 4.commentaries and letters to editor. The SAR journal aims to promote cooperation between science, art and religion in Bosnia and Herzegovina and educate for better world, public and global well-being, compassionate society and empathic civilization.

The SAR's mission is to advance the global standards of science, art and religion by publishing impactful translational research as well as to engage diverse thought leaders and communities interested in public and global well-being and care.

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There are three good reasons to add religion to science and art in academy which involve 1.bridging world views and practices, 2.bridging methods of knowing the world and life; 3.mutual enriching; all this for the better world and empathic civilization.

The purpose of this journal consists of three parts: to promote communication across the frontiers; to promote synergy between science, art and religion; and to promote compassionate society and empathic civilization in Bosnia and Herzegovina.

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Contents

Our guiding ideas of talking across the boundaries and frontiers are to promote synergy between sciences, arts and religions as well as cooperation between all the three constitutive nations in Bosnia and Herzegovina for the better world for all people.

WHERE SCIENCE MEETS HUMANITY: THE THREE GOOD REASONS TO ADD RELIGION IN ACADEMY

> "Our time is distinguished by wonderful achievements in the fields of scientific understanding and the technical application of those insights. Who would not be cheered by this? But let us not forget that knowledge and skills alone cannot lead humanity to happy and dignified life. Humanity has every reason to place proclaimers of high moral standards and values above discoveries of objective truth. What humanity owes to personalities like Buddha, Moses, and Jesus ranks for me higher than all the achievements of the inquiring and constructive mind" – Albert Einstein, Human Side

The Science, Art and Religion (The SAR) is a new, peer reviewed transdisciplinary and integrative journal/publication of the International Academy of Sciences and Arts in Bosnia and Herzegovina. There are three good reasons to add religion to science and art in academy which involve 1.bridging world views and practices, 2.bridging methods of research and knowing the world and life; 3.mutual enriching; and all this for the better world and empathic civilization. It is not surprising that the purpose of this journal consists of three parts: to promote communication across the frontiers; to promote synergy between science, art and religion; and to promote compassionate society and empathic civilization in Bosnia and Herzegovina. As the world is in a constant change, with big crises from time to time, such as the present COVID-19 pandemic, syndemic and infodemic one, we cannot rely on yesterday's solutions. An important way to learn and progress is a synthesis of multiple and different perspectives and discovery of the deep structure beneath the many and varied surface structures of phenomena. Our background is an epistemology of collective intelligence, a powerful combination of many individual intelligence, the basic system of knowledge from which all other knowledge is derived. According to Robert Dilts (1994) a person's epistemology is the system of fundamental presuppositions, assumptions, convictions, and beliefs from which we as individuals and collectives operate and experience the world and self in the world. Our strategy of creation of the new academy and its journal began as an act of making a positive difference and contribution through three fundamental processes: conceptualization, implementation, and evaluation.

Science, art and religion are autonomous human activities with different principles, methods, interpretations, and conclusions which through history have been largely separated from one another. What is common to them is that they all make us more human. Science is related to human needs for understanding and knowledge, art to human needs for beauty and harmony, and religion to human needs to the sacred and spiritual, transcendental, and mystic experiences. Despite their fundamental differences, they are all essential components of the common culture of humanity and they all question and search for answers and solutions. However, the truth is not always what is claimed to be the truth so that the truth in general is commonly working hypothesis, best suited to open the way to the next better one. There are three fundamental categories in science, art and religion: the meaning of the truth, the meaning of the experience, and the meaning of the purpose (see Kurjak et al. 2018, Jakovljevic & Jakovljevic 2019a). Scientific, artistic and religious "truths" may be and commonly are complementary, but expressed in different languages. Overarching theories that unify all the scientific and humanistic disciplines promise to provide the scientific "holy grail" that has eluded scholars and intellectuals for centuries. We are tired of "I am right, you are wrong", "I am OK you are not OK" thinking which results in destructive confrontations, conflicts,

wars of the world-views and problems that cannot be solved. We need paradigms change from destructive, formalistic and mechanistic types of thinking to a much more constructive systems thinking, in other words to make transition from a paradigmatic to holodigmatic approach (Jakovljevic & Jakovljevic 2019a). In addition to present and needed sub-specializations we also need a common language that builds bridges over academic rifts and easily exports insights across disciplinary borders.

The triad of science, art and religion reflects the statement that what is important comes in threes. The three expresses important structures and represents a key to the integrity and interdependence of all existence. Of course, this statement represents a belief. Beliefs and belief systems are frameworks for thinking, feeling and behavior. We can differentiate three types of beliefs: beliefs about cause, beliefs about meaning, and beliefs about identity. Science, art and religion are on the surface grounded on different belief systems. Therefore, the conversation between science, art and religion commonly is complicated. Beliefs involve cause, meaning and frontiers (see Dilts et al. 1990). It seems that "each difficult conversation is really three conversations going on at once: the what happened conversation, the feeling conversation, and the identity conversation" (Butler-Bowdon 2009). However, the difficult conversation between science, art and religion is an opportunity for a joint learning, recognizing the joint deeper structure and contribution to a better world and empathic civilization. From dichotomy perspective one use to say that the science is to master the material world, while the religion and art master men's souls and minds. As brain/body, mind and soul are intimately connected and interactive so science, art and religion are likewise intimately connected and interactive as different form of human cognition and behavior. For understanding of relationships between science, art and religion it is very important to think in plural with an "s" to all these three words (Kurjak et al. 2018).

Our "Hero's Journey involves three main interconnected goals in Bosnia and Herzegovina: 1. helping in healing old wounds and resolution of conflicting complexes; 2.promoting collective development and well-being, and 3. collective spiritual growth. Guiding principles across the boundaries and frontiers are to promote synergy between sciences, arts and religions as well as to foster cooperation between all the three constitutive nations to promote compassionate society and empathic civilization in unified Bosnia and Herzegovina. This first issue of our journal is the beginning of Hero's Journey on the way full of disagreements and possible conflicts of the world-views. Disagreements are commonly about one of three things – where we are starting from, where we want to get to, and how to get there. The power of purpose in promoting synergy and fostering cooperation in Bosnia and Herzegovina and at international level is essential. A usual statement of purpose for some project needs three parts: the goals we want to create, commitment and metrics. The general goal of our journal is a horizon of the learning organization, culture of dialogue, systems thinking and a breadth of vision of synergy and cooperation which we want and hope to have built at each critical milestone and at the end of our Hero's Journey. The second part is a deep commitment to the goals we want to create, and transform the vision into reality. The third part is to develop metrics by which we can measure our progress and keep us moving forward together on our Hero's Journey.

This SAR journal, for the beginning, is a special edition of Psychiatria Danubina that release double issues twice a year. The journal welcomes review articles, original research articles, brief reports and short communications, case study/report, commentaries, correspondence, technical notes, etc. We invite our readers to participate and help us gather comprehensive information and transdisciplinary concepts on cooperation between science, art and religion as well as between different nations and cultures for the better world, compassionate society and empathic civilization.

Miro Jakovljevic
Editor in Chief

Asim Kurjak
President of the IASARBiH

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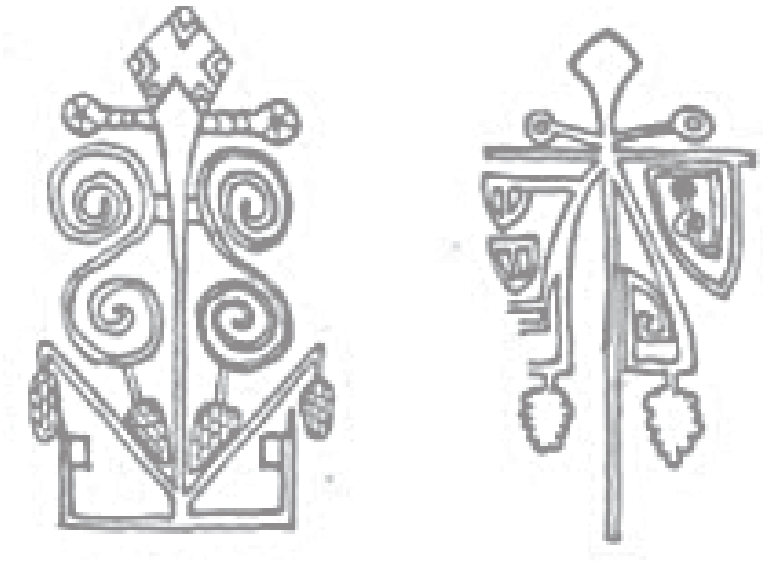

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SCIENCES, ARTS AND RELIGIONS: THE TRIAD IN ACTION FOR EMPATHIC CIVILIZATION IN BOSNIA AND HERZEGOVINA

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SUMMARY

From historical or traditional perspective sciences at one side and arts and religions on the other side are strictly divided epistemology fields with no much mutual engagement and understanding. Digital revolution is changing significantly all fields of science, art and religion changing regimes and methods of knowledge and values production, communication and relationships. Big Data approach promises to provide the scientific Holy Grail, a single overarching theory or multiple theories and models that unify all the scientific disciplines from biology snd neuroscience to music and spirituality. Brain is place where biological, psychological, social and spiritual mechanisms meet each other and interact. Global empathic civilization seems to be a key to the very survival of humankind and life on our planet. Spiritually integrated sciences, arts and religions in creative dialogues and synergy as allies can significantly contribute to the healing of our broken world and promoting compassionate society and empathic civilization

Key words: synergy – science – art – religion - brotherhood in humanity - compassionate society - empathic civilization

INTRODUCTION

All what is important come in triads

The science, art and religion are what we usually name as the cornerstones of the culture. However, science is not a monolithic field and "indeed there are great many "ships of science" (Rosnow & Rosenthal 1997). It is the same with art and religion. Furthermore, from historical or traditional perspective sciences at one side and arts and religions on the other side are strictly divided fields with no much mutual engagement and understanding. It is commonly forgotten that the religions, visual arts, literature, poetry and music are also methods for exploring the world, particularly our subjectivities. The way we understand and study individual, public and global world and life is changing rapidly. Digital revolution in our 21st century is changing significantly all fields of society, science, arts and religions. As Homo sapiens are a story telling or narrative beings, people think in stories and narratives in addition to facts, numbers, graphs and equations. All big stories from the 20th century have collapsed and new narratives are emerging with a shift from a homo centric to a data centric world view. Emerging techno-humanism argues that Homo sapiens have completed their cosmic task and high technology is going to create a much superior Homo Deus with upgraded physical and men-

tal abilities (Harrari 2017). Dataism is promising to give all scientists a common language that easily enables them to get insights across disciplinary borders. Big data algorithms informed by a constant stream of data from various sensors could monitor not only our technology and industry but also our behavior and social, political, spiritual and religious life.

Our global world dominated by narcissistic and paranoic psychocultures and characterized with competitive and confronting ethics and many political and war conflicts across the globe is broken and needs healing processes (Jakovljevic & Tomic 2016, Jakovljevic et al. 2019). We have become used to hearing that we are living in the selfish society in which self-interested and self-sufficient individuals forgot to love one another and made money instead (Gerhardt 2010). According to John Steinbeck "...the things we admire in men (indeed all of humanity), kindness and generosity, openness, honesty, understanding, and feeling, are the concomitants of failure in our system. And those traits we detest, sharpness, greed, acquisitiveness, meanness, egotism, and self-interest, are the traits of success. And while men admire the quality of the first, they love the produce of the second" (see Srića 2021). Knowledge, empathy, solidarity, cooperation and unity are the key factors to long-term survival and flourishing of humankind. The present COVID-19 syndemics is cruel but crucial lesson for the future of humankind (Jakovljevic et al.2020). The crucial message is that we should reexamine and improve our basic understanding of how human society and global world operate in health and disease from the multidisciplinary and transdisciplinary scientific, artistic, religious, philosophical and spiritual approach. Bringing together multiple disciplines and universities with knowledge sharing is the best way to provide transdisciplinary integrative approach to our understanding the world and life and creating empathic civilization giving us better chance for surviving. An important observation is that "geniuses perceive their work as either coming from or serving something larger then themselves" and that they have "mission beyond individual identity" to widen our maps of the world rather than to give the one 'right' answer (Dilts 1995). According Dilts (1995) geniuses help us to widen and enrich our maps of the world by discovering, creating and offering alternatives and different points of view taking all perspectives relevant to the system in which one is interacting as well as considering and aligning all levels of experience in relation to the system one is in. Geniuses usually think rather systematically than mechanically and fragmented and operate from dynamic models divided into three interactive parts, humorously named 'Holy Trinities' in Neurolinguistic Programing – NLP (Dilts 1995). Leonardo da Vinci used three perspectives; Walt Disney three roles or position of Dreamer, Critic and Realist; Sigmund Freud three parts of personality: Id, Ego and Super-Ego.

The present situation with blame games in Bosnia and Herzegovina reminds me on the story about four people named Everybody, Somebody, Anybody, and Nobody who wanted to change and to do something what Everybody could have done. So, Everybody said "I want change and Anybody can do it". Somebody said "If only Anybody would start to change and work, I will join". But Nobody said "I will change". Finally Everybody stayed same blaming Somebody for waiting for Anybody to start changing. So, Nobody changed. It ended up that Everybody blamed Somebody when Nobody did what Anybody could have done. This little piece of humor is about leadership, taking responsibility, cooperating and fulfilling them. It is about people passing the bug onto others rather than taking their responsibility. The International Academy of Science and Art in Bosnia and Herzegovina (IASABaH) and it's journal Science, Art and Religion (SARjournal) are organized to change and be changed and grow on the principles of art and practice of transforming learning organization, concept of supermind, collective intelligence and culture of dialogue. Supermind, defined as a powerful combination of many individual minds, represent a group of individuals operating together in creative and intelligent ways, while collective intelligence is the result of groups of individuals thinking and acting together in creative and intelligent ways (see Malone2019). As more and more intelligent individuals are closely connecting and acting together serving a purpose larger than themselves the concept of the greatest good for the greatest people has chance to become reality in our COVID-19 age.

ALL WHAT IS IMPORTANT COME IN TRIADS

> "It is sometimes important for science to know how to forget the things she is surest of – Jean Rostand (1958)

In our journal we want to connect in the reader's mind elements seemingly far apart such as science,

art and religion. Science, art and religion involve different systems of ideas, beliefs and practices (see table 1). They are distinct on the surface, but closely related in their deep structures. Science, art and religion produce different types of knowledge within different cultures and civilizations. Sciences are related to the search for the truths, arts for the beauty, and religion for the sacred. However, they all have their own truths because truth is a function of our conceptual system and it is predicated on our understanding (Lakoff & Johnson 2003). William Sheakspire claimed "there is nothing either good or bad but thinking makes it so". There are three good reasons to add religion to science and art in academy: 1.bridging world views and practices, 2.bridging methods of knowing the world and life; 3.mutual enriching, all for our better future.

The statements that all what is important come in triples, triads, trinities, troykas, trialogues, or threeness have been registered throughout history all over the world. Of course, this statement represents a belief. Beliefs and belief systems are frameworks for thinking, feeling and behavior. We can differentiate three types of beliefs: beliefs about cause, beliefs about meaning, and beliefs about identity. The Trinity Symbol is of universal significance, considered sacred and powerful throughout history in many cultures all over the world. It can be interpreted in many different senses: spirit-soul/mind-body in a circle of synthesis of health; past-present-future enclosed in the ring of eternity, art-science-religion in a circle of culture, unconsciousness, pre-consciousness and consciousness in the field of the individual, collective and cosmic (universal mind) mind. The symbol of the triad or trinity can be understood as a key to the integrity and interdependence of all existence. According to Pythagoras three is a perfect number, symbol of Deity. One or unity is God alone, two the diversity, and three, being the sum of 1 and 2 expresses important structures (Sartorius 2002). Classical mythology had three Graces, three Fates, three main Gods: Jupiter (haevens), Neptune (sea) and Pluto (hell), three form of love: Eros, Philos and Agape. In Christianity there is a Holy Trinity; the Father, the Son and the Holy Spirit. Psychoanalyst Melanie Klein defined the three basic human drives: Eros, Thanatos and Curiosity (the epistemic instinct). The triune brain (the primitive brain – reptilian complex; the limbic system - paleomammalian complex; and the new cortex – neomammalian complex) elicit different experiences and behaviors. The number three expresses important structures: the beginning, the middle and the end.

The trinity God, Man and Nature as well as becoming one with God, The Universe/Nature and Self (Ourselves) is essential for understanding the concept of this article. There are three fundamental categories in science, art and religion: the meaning of the truth, the meaning of the experience, and the meaning of the purpose (see Kurjak et al. 2018, Jakovljevic & Jakovljevic 2019a). According Arthur Schopenhauer all great new ideas go through three stages: the first they are ridiculed, then they are violently criticized and finally they are accepted as having always been 'self-evident". Our statement that all what is important comes in triples is jus a belief and beliefs serve a different role in human discourse. Three major sources of different beliefs are science, art and religion. With regards to beliefs, it is important to make "distinction between conviction, as passionately held commitments to what is regarded to be of ultimate reality or ultimate in its importance, and assumptions, as more loosely held beliefs that are adopted strategically and only so long as they serve useful purposes" (Griffith & Griffith 2003).

Our world has become connected and united more and more by Infotech, like neurons in giant brain which is a fertile ground for collective thinking, learning, experience and strong collaboration at national, international and global level. The common experience leads to shared frame of reference and collective mental model. As the systems theory goes, the whole is more than the mere sum of its parts and the interconnections between them are interdependently dynamic as well as the mature of parts is determined by the whole and the parts cannot be comprehended independently of the whole

SPIRITUALITY ADDS A NEW DIMENSION TO LIFE, SCIENCE, ART AND RELIGION

> "I want to know how God created this world. I am not interested in this or that phenomenon, in the spectrum of this or that element; I want to know his thoughts; the rest are details" – Albert Einstein"
>
> God is too big to fit into one religion – Newberg & Waldman (2010): How God Changes Your Brain

Sciences, arts and religions operate on different levels/dimensions, but spirituality may significantly affect each of them. However, spirituality is for sure one

Table 1. Some useful terms and definitions (adapted from Kuhn 1962, Corsini 2002, Huck 2007, The Concise Oxford English Dictionary 1964, Webster's New World College Dictionary, 4th Edition, 2010; Dictionary.com, The Oxford English Dictionary,, Krickel 2018; Wikipedia 2019, Harrari 2011

Science: an organized and systematic body of knowledge gained and verified through applications of scientific methods of empirical observations. *Normal science* works with paradigms whereas *revolutionary science* creates new paradigms

Meta-science: a theory or science of science; the systematic investigation of the scientific enterprise; the use of scientific methodology to study science itself

Philosophy of science: application of philosophical methods to philosophical problems as they arise in the context of science involving ethical issues, epistemological issues and metaphysical issues

Scientific method: a method of acquiring knowledge by observing a phenomenon, formulating one or more hypotheses, further observing and experimenting, and refining and re-testing hypotheses and discovering laws and principles that govern phenomena,

Scientific explanation: an account of some fact, phenomenon, or event based on combination of facts, observations, and logic subjects to further proof. *Etiological explanation*: a phenoenom is explained by the mechanism that consists of preceding causes of the phenomenon: *Constitutive explanation*: a phenomenom is explained by the mechanism that underlies or constitute the phenomenon.

Scientism: "exclusive reliance on a narrow conception of science": "an excessive readiness to accept as authoritative any claim made by the sciences and to dismiss every kind of criticism of science or its practitioners as anti-scientific"

Sciosophy: "any system of thought not supported by scientific methods such as astrology, phrenology, numerology, etc."

Scientology: "a controversial human-development system with a spiritual and religious dimension developed by L. Ron Hubbard"

Epistemology: the study of knowledge, branch of philosophy dealing with issues about origin and legitimacy of knowledge and truth. "What do we really know and what we don't know"? How do we know what we know? What is true and what is reality?

Episteme*:* a philosophical term from the Ancient Greek which can refer to knowledge, science and understanding vs. ***doxa*** - common belief or opinion.

Epistemics: The use of logic, philosophy, psychology, and linquistics to study knowledge and how it is processed by human beings

Epistemic: Pertaning to the need to know, often considered to be a fundamental drive or one of the basic motives of human behavior.

Epistemophilic learning is a collaborative knowledge building through distributed cognition, creative cooperation and shared understanding and vision.

Nomology: 1.the science of law or laws; 2.the science of the laws of mind. The branch of science and philosophy concerned with the laws or principles governing the operation of mind". *Nomological*: "relating to or expressing basic physical laws or rules of reasoning"

Mechanisms: "systems or sequences of causally interacting parts organized such that they produce the phenomenon to be explained"

Blind somebody with science - to confuse or overwhelm somebody by giving an impenetrable explanation using technical terms and concepts

Metaphysics: the branch of philosophy that studies the essence of things. This includes questions of being, becoming, existence, and reality.

Metatheory: 1. The science of theories; 2. A set of general rules governing the construction of a theory. 3. A theory about theory.

Meta-evaluation: The systemic evaluation of evaluation procedures including methodological rigor, utility, cost, relevance, scope, importance, credibility, and time-lines

Meta-analysis: "Integration of the findings of a number of research studies by means of statistical techniques focusing on the same research question leading to meaningful quantitative data".
Ethics: A branch of philosophy that deals with moral values and system of beliefs focused on the differences between right and wrong. The science of morals, treatise on this, moral principles or rules of conduct.
Art: 1.the creation of beautiful or thought provoking works, e.g. in painting, music or writing, 2.beatiful or thought-provoking works produced through creative activity; 3.creation by human endeavor rather than by nature; 4. Ability or skill to do something well
Arts: 1.forms of creative beauty, activities enjoyed for the beauty they create or the way they present ideas; 2.nonscientific and nontechnical subjects at school or university
Art therapy: the use of artistic activities such as painting, drawing, sculpting, clay-modeling, music, etc. in psychotherapy and rehabilitation to assist individuals to obtain therapeutic goals.
Religion: 1. an organized system of values and beliefs that serve as moral and social guides. Many cultures have developed their own religious systems. Most religions may have developed concepts dealing with the origins of life, moral right and wrong behavior, and assumptions about afterlife. 2. a system of human norms that is founded on a belief in a superhuman order.
Religiocentrism: the conviction that a person's own religion is more important or superior to other religions.
Religious experience: any event of importance to an individual that has spiritual aspects connected with it (e.g. a person feels transported to s state of tranquility).
Faithism:1.discrmination towards a person or group of people solely dependent on their faith, beliefs or religion – used in place of racism when applicable; 2. belief that faith or religion is the primary determinant of human traits and capacities and that religious differences produce an inherent superiority of a particular religion of beliefs (https://definithing.com>faithism);
Fideism: exclusive or basic reliance upon faith alone, accompanied by a consequent disparagement of reason and utilized especially in the pursuit of philosophical or religious truth (Amesbury R: Fideism.Stanford Encyclopedia of Philosophy. https://plato.stanford.edu>entries)
Religious instinct hypothesis: a postulate that all humans have a tendency to want to believe in a religion, to practice certain rituals, and to act according to the principles of religion.
Religious identity: the sense of group membership to a religion and the importance of this group membership as it pertains to one's self concept (https://en.m.wikipedia.org>wiki).
Spirit: 1. The vital principle of life in a living entity which is said to enter the body sometime between conception and birth and exit the body at death. Most religions believe that, in unembodied state, the spirit can be a source of either benefit or harm to the living, Thus, prayers to and communication with such spirits are integral in many religious traditions. 2. A present mood or temper, such as being in low or high spirits.3. Attitude, such as school spirit, or the spirit of the law.
Spiritualism: 1. A metaphysical doctrine that the universe is basically nonmaterial, or incorporeal. 2. A belief that it is possible to communicate with the deceased through mediums.
Spiritism: Belief in communication with nonincarnate personalities or spirits.
Spirituality. 1. A quality of personality characterized by a tendency to be preoccupied with moral and religious issues rather than with affairs of the material world or intellectual pursuits. 2. The subjective experience of something sacred, numinous, or greater than self. Awareness of spirituality may be associated with religion or it may occur spontaneously anywhere, as in nature or in a deeply moving experience such as falling in love, or in a close encounter with death. Spiritual awareness is often characterized by feelings of awe, reverence, and love.
Sacred: Something to be revered, to be treated with the greatest respect, such as a religious statue, the name of deity.

of the most misunderstood words with many different meaning for different people. The word spirituality comes from the Latin word spiritus, which means "breath" and refers to the animating and vital principle of life (see table 1). We live in multiple realities of the three worlds – 1. a material, natural world we know through the five senses, 2. a nonmaterial world of our individual inner mental life that involves our ideas, emotions, wishes, values, and self-reflection and 3. a nonmaterial spiritual world of self-transcendence, intuition, imagination and cosmic mind. Spirituality is related to the spirit and I am prone to define

the spirit as "the pattern which connects" all thinks together in "larger Mind" (Bateson 1972, Dilts & McDonald 1997) or Supermind, Global Mind or Universal Mind (Malone 2019). Spirituality is about how people think, feel, act and interrelate in their efforts to find, define, and transform the sacred truths and values in their lives. The term spirituality is bridging the three domains of science, art and religion.

Mind is programed or predestined to make beliefs, values and narratives because without them it can't connect up all perceptions, experiences and knowledge. We base our actions on what we think or

Table 2. Atheistic vs. Theistic Philosophy and Science (according Richards & Bergin 2004, Chopra & Tanzi 2017, Jakovljevic 2018 modified)

View of deity – *Monotheistic:* There is a God, a Supreme Being who created the universe, the Earth, and human beings. God is eternal, omnipotent, and all-knowing. God loves and assists human beings. *Atheistic:* There is no God or Supreme Being, nor are there any supernatural gods or transcendent forces of any kind. The universe was produced and is maintained by natural forces, processes, and laws (e.g. the Big Bang, organic evolution).
View of human nature – *Monotheistic:* Human beings are creations of God. Human beings have an eternal soul or spirit. Human beings have free will and the capacity to choose good over evil, and to obey God's commandments. *Atheistic*: Human beings are the end product of millions of years of evolutionary processes as theorized by Charles Darwin and evolutionary scientists. Life originated upon this earth through natural processes; there was no God or transcendent force involved in the creation of life. Human beings do not have an immortal spirit or soul. Human consciousness can be completely accounted for with biological and physiological explanations. Human beings may or may not have free will depending on the particular naturalistic theory.
Purpose of life - *Monotheistic:* There is a transcendent, divine purpose to life. Human beings are here upon the earth to learn to be obedient to God's will, to choose good over evil, and to prepare to live in a joyful and peaceful afterlife. *Atheistic*: There is no sacred nor transcedent purpose or meaning in life. The only purpose or meaning in life is that which human being construct or invent for themselves. Pursuing truth and knowledge and contributing to the betterment and welfare of humanity is seen as meaningful purpose for science.
View of spirituality – *Monotheistic:* Spiritual reality is the primary one. Human beings can communicate with God through prayer and meditation. They grow spiritually as they obey God's will, worship him, and love and serve their fellow human beings. Trust in God which is love and wisdom helps find significance and meaning in suffering and illness and has protective effects on mental health. Practical beliefs: God is always listening. We live in a conscious universe. The human mind is a reflection of cosmic mind. No prayer goes unheard. If you wish hard enough, dreams come true- *Atheistic:* Spirituality is just another word for naturalistic phenomena (i.e. psychological, physiological and cognitive processes). There are no transcendent spiritual realities. There is no sacred dimension of life and existence. Human beings cannot communicate with a God because there is no God to communicate with.
View of morality – *Monotheistic*: God has revealed laws and commandments to guide human behavior. Obedience to God's laws promotes spiritual growth, harmonious social relations, personal happiness, and prepares human beings for reward in afterlife. *Atheistic:* There are no moral absolutes or universals. Universal ethics does not exist. Societies and groups may construct moral and ethical guidelines to help regulate social functioning and protect the welfare of individuals, but such moral and ethical guidelines are relativistic and may only be suitable for that particular society and group.
View of life after death – *Monotheistic:* The spirit or soul of human beings continues to exist after mortal death. There is an afterlife of peace and joy for those who live righteously in mortal life. The wicked are punished or suffer for their sins in the afterlife. *Atheistic*: There is no life after death. When human beings die, they cease to exist.
View of truth – *Monoteistic:* There has been a pregiven, impersonal, universal Truth that has been independent of all subjective and cultural interpretations (Ferrer 2002). This the highest Truth, superior to all others, is exclusively capable of including and defining all other truths. *Atheistic:* Everything is relative, there is no such thing as the universal truth independent of subjective and cultural interpretations.

believe that is true. However, the truth is a function of our conceptual system and it is predicated on our way of thinking, understanding and in what we believe. Changes in our beliefs, values or narratives may help us to solve many our problems.

In our context what is important is the fact that "the way we think, what we experience, and what we do every day is very much a matter of metaphor" and that "the essence of metaphor is understanding and experiencing one kind of thing in terms of another" (Lakoff & Johnson 2003).

Today one can speak about secular or atheistic and post-secular or theistic science as well as about atheistic and theistic pseudoscience (see table 2).

Modern (secular) and post-modern (post-secular) sciences have quite different views on deity, human nature, purpose of life, spirituality, morality and life after death. The differences between modern and post-modern science (see Best & Kellner 1997, Sims 2007) can be represented in the following shift od emphasis: machine – organism; control nature - respect nature; alienation from nature - reintegration into nature; determinism - indeterminism (free will); universalism – contextualism; reductionism (atomism) – complexity (holism); materialism (mechanism) - transcendent spirit (soul); value free – value responsible; ethical relativism – universals (absolutes); ethical hedonism (egoism) – altruism; physical realism – theistic realism; empiricism – epistemological pluralism; mono-perspectival – multi-perspectival (complementarity). Science, art and religion are three arcs of a circle which unite to form a complete whole. We must leave the old-fashioned concepts which assert something to be true, but which is false or not evidence-based. Religion must also keep its mind continually open to new truth and there is no end to the truths of God which will be constantly revealed to the perceptive and meditative mind.

PSYCHIATRY: A MEDICAL DISCIPLINE WHERE SCIENCE, ART AND RELIGION MEET ONE ANOTHER

> "If two individuals get together and exchange a dollar, they each walk away with one dollar. If the same individuals get together and exchange an idea, they both walk away with two ideas" - Thomas Jefferson

Psychiatry is an interdisciplinary medical specialty concerned with the study, diagnosis, treatment and prevention of mental disorders. It uses ideas, concepts and methods from sciences, arts and religions. Modern psychiatry utilizes insights from the most varied disciplines such as biology, neuroscience, pharmacology, physics, antropology, philosophy, ethics, axiology, psychology, sociology, informatics, etc. At the conceptual level contemporary psychiatry can be divided in four approaches: dogmatic, ecclectic, pluralist and integrationist (Ghaemi 2003). In practice most psychiatrists are still, more or less, dogmatic claiming to be eclectic in theory. The pluralist and integrationist concepts are the most challenging, particularly from the perspective of personalized medicine and person centered psychiatry. Psychiatry today is facing unprecedented challenges, old theories and concepts about mind and mental disorders are crumbling, and new ones emerging. The concept of predictive, preventive, precision, person-centered and participatory medicine (5PMed) is a new emerging paradigm in psychiatry. 5PMed promotes the paradigmatic shift from delayed interventional to predictive and preemptive psychiatry, from blockbuster to person tailored psychiatry, from palliative to preventive psychiatry, and from illness to wellness.

Divided self of psychiatry and fragmentary identities

Throughout its whole history psychiatry has always been characterized by different orientations in the forms of "schools", "fields", "branches" etc., some of which were dominating and fading during different periods of time. Theory and practice of current psychiatry are fraught with severe debate, conflicts of world-views and mutual annihilation. An unnecessary and unproductive polarization, mistrust and disrespectfulness between proponents of different disciplines contribute significantly to stigmatization of psychiatry and its divided professional identity. Psychiatrism, an injudicious and fallacious application of psychiatrics principles and methods in an unwarranted and uncritical way is significant problem. It is predicated on the fallacy of hypothetical concepts oversimplifying unscientifically complex problems of relationship, causality and synchronicity. From time to time situation in psychiatry, but not only in psychiatry reminds on the story about the blind men describing for the first time what an

elephant is like. One man holds the tail and says that an elephant is like a broom. Another holds a leg and says that an elephant is like a tree trunk. Others say an elephant is like a big pillow, a big hose, or a spear. Each blind man as well as fragmented discipline has an accurate portrayal from his specific vantage point but not the whole picture. Placed at the crossroads of biomedicine, the social sciences and the humanities, psychiatry has several partial or fragmentary identities related to its biologic, psycho-dynamic, socio-dynamic and culture subspecialties with many psychiatric schools (see table 3). Many of these schools, not only do not accept, but criticize and negate the most basic tenets and treatment principles of the others. Disparate psychiatric branches are rooted in different modern and postmodern philosophical and scientific view-points about the nature of human beings and the nature of psychiatric problems (see Jakovljevic & Jakovljevic 2019). Their proponents are talking different languages, making different assumptions and theories, use different criteria and methods and practice different systems of values. When looking at the table 1. psychiatry seems as a clash field where science, pop-science, pseudoscience, anti-science, religionism and fideism confront one another.

There have been several models of interactions between varied fields and schools in psychiatry: 1. The Contact model: There is some overlap between the fields and schools in psychiatry which can interact into conflict or harmony; 2. The Conflict model: Differed fields and schools are in essential and principal conflict because they have used different information processing styles and methods; 3. The Independence model: the fields and schools operate independently as separate disciplines which are quite removed from each other because they operate from different

Table 3. Psychiatry in reality: Syndrome of divided and fragmented professional identity (Jakovljevic & Jakovljevic 2019)

Biological psychiatry – Medical psychiatry - Biopsychiatry – Pharmacopsychiatry – Biophysical psychiatry – Biometaphorical psychiatry - Circuits-based psychiatry - Organic psychiatry - Clinical psychiatry – Descriptive psychiatry - Bihevioral medicine, Neuropsychiatry -
Psychodinamic psychiatry – Existential psychiatry – Humanistic psychiatry- Narrative psychiatry, Personalized psychiatry – Patients-friendly psychiatry - Patient-centered psychiatry - Positive psychiatry -
Social psychiatry – Communal psychiatry – Transcultural psychiatry (Intercultural psychiatry - Cultural psychiatry) – Etnopsychiatry - Interpersonal psychiatry - Moral psychiatry - Ecological psychiatry – Public health psychiatry – Preventive psychiatry
Transdisciplinary integrative psychiatry – Multidimensional psychiatry – Systems psychiatry - Holistic psychiatry - Integrative psychiatry - Complementary psychiatry – Comprehensive psychiatry – Psychiatry based on mental health sciences
New brave psychiatry – Energetic psychiatry – Quantum psychiatry – Atomic psychiatry -
Spiritual psychiatry – Transpersonal psychiatry - Pastoral psychiatry
General psychiatry – Special psychiatry - Law (forensic) psychiatry – Military psychiatry – War psychiatry – Industrial psychiatry – Community psychiatry
Modern psychiatry - Postmodern psychiatry – Postpsychiatry – Client friendly psychiatry
Prenatal psychiatry – Child psychiatry - Adolescence psychiatry – Adult psychiatry – Developmental psychiatry – Gerontopsychiatry - Feminists psychiatry – Female psychiatry
Academic psychiatry – Experimental psychiatry – Scientific psychiatry – Evidence-based psychiatry -
Evolutionary psychiatry - Molecular psychiatry – Genetic psychiatry – Nutritional psychiatry - Metapsychiatry – Computational psychiatry - Theoretical psychiatry -– Comparative psychiatry -– Consultative (Liaison) psychiatry – Creative psychiatry – Dialectical psychiatry – Ecclectic psychiatry -
Telepsychiatry (E - psychiatry) - Virtual psychiatry - Avatar psychiatry – Digital psychiatry
Antipsychiatry – Official psychiatry - Alternative psychiatry – Political psychiatry – Radical psychiatry – Critical psychiatry - Liberation psychiatry – Toxic psychiatry – Fragmentary psychiatry – Marketing based psychiatry – Ortodox psychiatry – Private psychiatry - Folk psychiatry

positions; 4. The Dialogue model of pluralism: even the fields and schools are separated they communicate on the common ground of epistemology; and. 5. The Integration model: it refers to transdisciplinary unification of different perspectives and paradigms (Jakovljevic & Jakovljevic 2019). Although, many of the fragmentary psychiatric schools lack respect for, aggressively criticize, and negate the fundamental tenets and treatment principles of others, it is evident that there are common threads in many of these schools. The challenges of the present time push main-stream psychiatry to move beyond the narrow and fragmentary frameworks that characterized the discipline in the last century. It is wrong to pit biological, psychological, social and spiritual concepts of mental disorders against one another as well as therapeutic procedures related to them. As different risk and ethiopathogenetic factors may be complementary, rather than competitive excluding one another, so varied explanations and models may be interconnected and complementary because they are just different ways of talking about the same issue.

Transdisciplinary integrative psychiatry connects science, art and religion

Transdisciplinary integrative approach in psychiatry tries to create an overarching theory that unifies all the scientific and humanistic disciplines dealing with human mind, mental health and mental disorders. The idea is very attractive and challenging: to offer all mental health scientists and practitioners a common language, bridge over academic gaps and easily exchange insights across disciplinary borders. The systems approach suggests that the only way to understand the complex issues of mental disorders and human suffering is to approach them in a holistic multi-perspective and holodigmatic transdisciplinary way using different levels of explanation and both analytic-focused top-down processing and heuristic-global bottom-top processing (Jakovljevic & Jakovljevic 2019). The various paradigms, perspectives and dimensions are interconnected and interdependent, and cannot be fully understood separately. Transdisciplinary integrative psychiatry is unique in being a creative network of natural sciences and humanistic sciences in which both are essential for gathering and integrating relevant, but very heterogenous data, information and knowledge in order to construct a coherent model of mental disorders and their possible treatment. According to systems thinking, the genome operate within the context of the body, the body within the context of the self, the self within the context of society, and the society within the context of the universe (Cloninger 2004). The phenotype of an organism is the joint product of the genotype and the environment. All systems are composed of various elements and their relations.

Four hierarchically related paradigms embodying different assumptions about phenomenological nature of mental health and mental disorders can be recognized: the body paradigm, the mind-body paradigm, the body-energy paradigm and the body-spirit paradigm (Tataryn 2002). *Body paradigm* is a framework in which an orthodox biological psychiatry and psychopharmacotherapy operate. The mind exists primarily as a by-product of brain activity and mental disorders are consequences of the disturbed brain functioning. Effective treatment of mental disorders works by modifying structural and functional neuroplasticity and abnormal brain functions. *Mind-body paradigm* is a framework in which the mind-body or psychosomatic/psychological medicine operates. The mental is real and irreducible to as well as it is non-identical with the physical/somatic, but it is physically influenced. Acute and chronic stress is associated with dysregulation of hormones, immune dysfunctioning and neurotransmitter imbalance that manifest as cognitive, affective and behavioral symptoms of mental disorders. *Body-energy paradigm* is based on scientifically validated forms of energy or information that are directed at the body/brain. Some recently introduced conceptual models assume that thoughts exist in fields, negative emotions are rooted in energy configurations, and psychological phenomena are fundamentally quantum physics events or processes (Gallo 2005). Representative energy-information treatment modalities that have been scientifically accepted by modern psychiatry are electroconvulsive therapy (ECT), transcranial magnetic stimulation (TMS), neurobiofeedback, etc. *Body-spirit paradigm* as well as body-energy is based on the beliefs that mind, body and spirit can be described in terms of putative subtle energies (Lake 2007). This paradigm is related to shamanic healing, reiki, qigong, and possibly homeopathy. Body-Mind-Spirit-Energy are four mutually interconnected ontological dimensions/ domains of human beings in health and disease. This approach relies on the body-spirit,

mind-body and body-energy paradigms integrating them. A proper model of the nature of human being should understand each person as a unified entity comprised of body, mind, and spirit who is inseparable part of various social systems as well as an all-encompassing cosmic order (Cloninger 2004).

Different schools in psychiatry have given rise to different perspectives of mental disorders and their treatment: the medical or disease perspective, the perspective of person, cognitive, behavioral, narrative, spiritual and systems perspectives (see Jakovljevic & Jakovljevic 2019). Each of these perspectives tends to analyze, understand, define and treat mental disorders in different ways, each with their own methods, albeit without enough success. Multidimensional profile from seven perspectives enables holistic and deeper understanding of mental disorders and may identify clusters of mechanisms that are amenable to treatment increasing probability of more successful treatment outcome. In fact it is word about three perspectives, the disease perspective, the perspective of person and the systemic perspective because the cognitive perspective, the behavioral perspective, the spiritual perspective and the narrative perspective are components of the perspective of person. As these four sub-perspectives are associated with well- defined disciplines in psychiatry and offer specific treatment methods they are described separately.

The disease perspective or medical perspective tries to work in psychiatry just as it does in somatic medicine. It rests on a logic that captures brain/mind abnormalities and includes this conceptual triad: clinical syndrome, pathological condition of brain/mind and aetiopathogenesis. However, there is no clear border between mental health and mental illness, mental health is not just absence of illness, nor mental illness is just the absence of mental health. This perspective focuses on identifying symptoms of the disease linking symptoms to specific pathophysiological process involved, and prescribing specific treatment. Searching biological markers biological psychiatry attempts to define mental disorders as „real" medical conditions. Treatment usually does not demand attention to the whole person and includes medications with neuropsychoactive actions. Some structural and functional changes have been reported in the brain of patients with mental disorders, but without diagnostic validity and specificity.

The perspective of person in psychiatry shifts from the strictly biological determinism to the appreciation of meaning and uniqueness of each patient. Patients are much more than diagnosis and object of treatment. They are decision-making persons, similar to other people, but unique as well. As a person, each patient is a unity of unique temperament and character traits and physical constitution. Personality dynamics and types have an essential impact in understanding and treating mental disorders. The perspective of person (lat. persona – human being, a part in a drama, assumed character) is related to what or who someone is, to their personality with vulnerability and resilience characteristics and specific way of being in the world. Personality characteristics may have important role not only in predisposing to mental disorders and response to diagnosis, but also they may have significant impact on treatment response and outcome. Mental illness and mental health are two ends of a one-dimensional continuum and they depend on a complex interaction of the three groups of factors: 1. „risk" or „vulnerability factors" (personality weakness and fragility) which enhance the likelihood of mental disorders, 2. „protective factors" that enhance the likelihood of recovery from trauma and stress, and 3. „generative or creativity factors "which increase revelatory learning, resource acquisition and development, accentuating personal growth. Treatment is focused on helping patients to use personality resources and strengths to increase their well-being and restore resilience and so that they can cope with stress more successfully. The focus in contemporary psychiatry is still on the pathological dimension while a tendency to approach mental disorders in terms of challenges, opportunities and posttraumatic growth, resilience and anti-fragility is of recent date. Resilience may be defined as a collection of protective and salutogenic factors that modulate the relationship between a stressful event, adversity or disease, and positive outcomes. Resilience is about the whole person, it includes biological, psychological, social and spiritual dimension of human existence. It enables individuals and communities not only to survive and adapt to challenges and adversities but also to be better off and to grow and thrive (post-traumatic growth) in addition to overcoming a specific adversity. Resilience is a very complex process ranging from surviving to thriving and anti-fragility. It includes positive transformation and personal growth, an indivisible part of mental

health and health in general, well-being and quality of life as well as recovery and treatment outcome. It is very important to note that "some resilience factors contribute to the development of other resilience factors, and, in consistency with a cascade model, together they contribute to predict personal recovery (Echezarraga et al 2018).

The cognitive-axiological perspective in psychiatry focuses on what someone is thinking about, perceives and learns about or assesses as valuable, i.e. which ideas and values in life should be followed. All that we are is a result of our thoughts and knowledge of ourselves and the world, and the defined values and goals we follow. What we think of us, that it is which determines or indicates our fate so that all psychological stressors are cognitively mediated. The basic tenet of this perspective is that much of mental disorder is result of errors, biases and aberrations in cognitive functioning. From *the cognitive perspective* mental disorders are results of dysfunctional and conflicting cognitive strategies, misinterpretations and misrepresentations. Some mental disorders may be related to the explanatory style how an individual interprets the meaning of what happens and how explains both positive and negative (adversity) events (McNally 2005, Reivich et al. 2011). Pessimists tend to attribute the causes of negative events to permanent, uncontrollable, and pervasive factors, while conversely, optimists tend to attribute the causes of negative events to temporary, changeable, and specific factors (Reivich et al. 2011). A negative cognitive style with deficit for retrieval of positive memories contributes to development and severity of some mental disorders, like depression, PTSD, etc. The negative cognitive triad about self (negative self-precept), world (hostile and demanding) and future (the expectation of suffering and failure) with the vicious circle of low mood contributing to negative thinking and vice versa, is essential characteristic of depressive disorders. The negative automatic thoughts that prevail in depression are sustained through systematic distortions of information processing. From *the axiological perspective,* mental disorders can be explained on the account of choosing a wrong life, social and spiritual values. Exposure to traumatic experiences often leads to thinking and asking about meaning, values and purpose within a personal and collective sense. Traumatic events commonly challenge one's core life values and beliefs about the world, safety, self-worth and the meaning of life. Individuals who are unable to resolve challenges to their moral and value beliefs might find themselves in a state of demoralization, disillusionment, nonsense and social alienation. Demoralization associated with negative thinking and characterized by feelings of helplessness, hopelessness, subjective incompetence, and a loss of mastery and control, was found to be very common syndrome in depression, and PTSD. According to some opinions, PTSD results from „the shattering of basic assumptions" that people have about themselves and their world that is a consequence of „information shock" (see Orr et al. 2004). Beliefs, thoughts, attributions, cognitive schemas and general attitudes structure meaning of life events and influence emotional arousal. The art of living, in hard and traumatic life situations, is to reveal their true meaning, values and the purpose of life. Simply said, life places tasks before us, sometimes very painful ones, at other time incredibly difficult ones. The purpose of something dreadful happening to us is that something better in the future will happen. The good that comes from all bad things happening to us means that it helps us to achieve our best, our essence.

The narrative perspective in psychiatry is based on the narrative self, logic of narratives (illness, therapeutic, recovery, quest and restitution narratives), and distressed states of the soul, which are quite natural, understandable and the result of adverse impressions and experiences (McHugh & Slavney 1998, Jakovljevic & Jakovljevic 2019). One's ability to create, live and tell a coherent, hopeful and self-actualizing story of his or her life is a fundamental component of mental health and well-being. Life stories can reflect four contextual visions of reality: 1. a romantic vision, in which life is an adventure and the person as a hero overcomes all difficulties and becomes a winner; 2. an ironic version in which there is disappointment in romantic ideals and illusions with a consequential emphasis on life's difficulties and multiple perspectives; 3.a tragic vision, that is filled with disappointments and loses, where the emphasis is on the life's limitation and acceptance of a certain amount of despair that can lead to a life of wisdom, and 4.a comic vision, in which things go from bad to better, life can be controlled, conflict occurs between people and situations, and not between people, and the desired resolution is to improve an ability to play the social role (McAdams 1993, Hoyt 2005). Mental disorders often point to stories of lost love, faith, power, joy, identity or tragic story of „dread frozen in memory", ex-

istential despair and life irony. Through illness narratives patients form their own explanations about the causes of their illnesses, in useful or harmful way. All therapies in psychiatry involve a therapeutic narrative and start with therapist listening to the patient's story and then helping him to recognize a new perspective on the problem and gain new coping and resilience skills (Hamkins 2014). Deconstructing hopeless and harmful into hopeful and useful narratives may help in achieving treatment success. Therapeutic narrative refers to explanations how mental health medications or psychotherapy work. Deconstructing narratives that fuel mental health problems and treatment failures is essential whenever desired treatment goals are not obtained. The restitution narrative presumes the illness to be cured or overcome so that the patient becomes the same or healthy again. While restitution story „yesterday I was healthy, today I am sick, but tomorrow I'll be healthy again" may work for some illness experience, it can be problematic in the context of some other mental disorders for which cure, or return to previous health as it was once, may not be forthcoming (Frank 1995). So, patients with severe major mental disorders need alternative narrative resources to preserve or reinstate sense of self, meaning, identity, hope, well-being and mental health. The quest narrative is characterized by the patient's search for meaning and the idea that something can be learned or gained from the illness experience (Frank 1995). The recovery narratives involve the four component process: recognizing the problem, transforming the self through recovery narratives, reconciling with the system, and reaching out to others. Establishing a personal relationship with the patient should help the patient to find a new self as a person with a mental disorder who can recover from that disorder with a new perspective on life. Main focus is on the person, not on the symptoms and problems. This approach allows the patient to reconnect with his or her true healthy self. Finding a new, true self is associated with a re-authoring life-story, personal growth, self-actualization and reaching one's full potential. A new story gives the new meaning to life, but also fashions the relations with people. The story teaches how to behave and live in general as well as with experience of the traumatic events, discovers the true values that should be followed, and the meaning of life in adversary and happy times

The systems perspective in psychiatry integrates the fragmented identities of psychiatry and different classes of neurobiological, psychodinamic, social and cultural processes studied by different scientific disciplines into an organized whole. From the systems perspective mental disorders arise from various dysfunctions and interactions within and between complex systems that operate from the epigenetic molecular, cellular and neuronal networks level all the way up to the level of family, society and culture. Mental disorders in general and specifically may reflect the problems in many different, more or less related systems that can be considered on three levels. Macro level addresses broad societal and cultural aspects of mental disorders. The meso level is related to the family and social networks. The micro level refers to the level of the individual as the person. Mental disorders and somatic diseases/illnesses can be conceptualized within different body, energy, mental, family, social and etc. systems. Experiential and behavioral manifestations of mental disorders are predicated on their underlying multilevel neurobiological systems as well as to cognitive-interpretative, narrative, behavioral and interpersonal processes that are at play prior to the onset of mental disorder, during the pathogenesis, throughout the course of disorder and response to treatment (Kirmayer & Krafa 2014).

The systems approach suggests that the only way to understand the complex issues of mental disorders and human suffering is to approach them in a holistic multiperspective transdisciplinary way using both analytic-focused top-down processing and heuristic-global bottom-top processing (see Feist 2006) The various perspectives and dimensions are interconnected and interdependent, and cannot be fully understood separately. According to the systems theory the whole is more than the mere sum of its parts, and the interconnections between the parts add a specific and distinct quality and dimension to the whole.

Systemic approach enables integration of different perspectives and paradigms into a holistic coherent model. Each of seven perspectives presented here offers a different map which is complementary to others and all together outline the field of transdisciplinary integrative holistic mental health science and practice. All this perspectives can contribute to the formulation of clinical problem in a different way, so a simple one-to-one application of perspective to a case is not successfull enough. How much each will contribute depends on the clinical characteristics of the case as well as on the treatment phase. At each

particular case or phase of the treatment, the psychiatrist needs to select the primary perspective that best fits the patient and then integrate the other six perspectives into the formulation and treatment.

The spiritual, transcendental or transpersonal perspective in psychiatry

> What distinguishes man is his spiritual life – Aristotle

This perspective represents a framework for the medicine of person and spiritual psychiatry with motto "there is no health without mental health as well as there is no mental health without spiritual health". The key terms are spiritual self, self-transcendence, finding a spiritual path and healing. The spiritual self is the higher self that aspires to rise above everyday conflicts and confusion in contrast to the other versions of the self – the outward, private, and unconsciousness self which are constantly in conflict (Chopra & Tanzi 2017). According to William Osler (1849-1919), the father of modern medicine, „faith has always been an essential factor in the practice of medicine. This is so whether we are speaking of faith in physician leading to compliance; faith in the efficacy of medical care, leading to the positive expectations and, perhaps, to a salutary placebo effect; or faith in a divine being, leading to the psychosomatic benefits, or – as the religious themselves might claim – a divine blessing, or an expectation of such. For Paul Tournier (1898-1986), pioneer of medicine of the person the twin pillars of medicine were science and faith and an integration of body, mind and spirit was necessary for health and wholeness (Pfeifer & Cox 2007). Medicine of the person and person-centered psychiatry offer a well grounded reason for incorporating spirituality and religion into psychiatrist assessment, diagnosis, case formulation, therapy, and as a component of psychiatric training and continuous professional development (Cox & Verhagen 2011). There are many ways to understand and define spirituality, as a human's characteristic and a personal experience. Spirituality can be viewed as „a distinctive, potentially creative and universal dimension of human experience arising both within the inner subjective awareness of individuals and within communities, social groups, and traditions (Sims & Cook 2009) as well as „ a facet of our individual humanity, linked to aspects uniqueness, meaning, identity, purpose, relationships, a sense of the holy, and the spirit and fire which drives us (Gilbert 2007). Ellison 1983) argues that spiritual dimension does not exist in isolation from the mind and the body and it is the spirit which synthesizes the total personality. Spirituality has been also argued as a belief system related to spiritual intelligence and transpersonal self providing a person with meaning and purpose in life, a sense of the sacredness of life, a vision of the better world and connection to that which transcends the self. This transcendental connection might be to God, a higher power, a universal energy, cosmic law, the sacred, or to nature. Spirituality can be defined as a quality of human beings who are concerned or preoccupied with higher meaning or purpose in life rather than with affairs of the material world (Slade 2011). It is an integrating force for physical, biological, psychological and social dimensions of human life and a potential source of strength and well-being. Spirituality may or may not be associated with a specific religion, but it is always related to the subjective experience of something sacred, transpersonal, transcendental and greater than self as well as to feelings of awe, reverence, and love. Transcendentality, vitality, meaningfulness and connectedness are essential elements of a spiritual experience which can be understood in either secular or spiritual terms (Slade 2011). Vitality is ability or powerful force of an organism to maintain its organic existence. It includes a creative attitude, being spirited, open to new experiences, and growing through inner exploration or meditation. Health, energy and enthusiasm are secular terms, while soul, grace and sanctity are spiritual terms related to vitality. Spirituality is associated with emerging of higher values and deeper meanings of life, frequently connected with a sense of mystery and awe. Art, science and literature are secular terms, while faith, scriptures and revelation are spiritual terms related to meaningfulness. Connectedness refers to a feeling of union or harmony with another being or thing which includes connection with a living, dead or imagined person, a cultural, ethnic or political group, humanity, nature or universe. Family, lovers and nature are secular terms, while God, fellowship and church are spiritual terms related to connectedness. Spiritual psychiatry has been medicine of the person, by the person, and for the person grounded on unconditioned love and empathy.

SPIRITUALLY INTEGRATED SCIENCES, ARTS AND RELIGIONS FOR THE BETTER WORLD, COMPASSIONATE SOCIETY AND EMPATHIC CIVILIZATION

> „Consider from what noble seed you spring:
> You were created not to live like beasts, but
> for pursuit of virtue and knowledge" - Dante:
> Inferno 26, 118-120

We live in the infodemic world divided into good guys and bad guys and people have a pro-us illusion of knowledge related to the relative truths, alternative truths and fake news, massive media manipulation and "we-they" schisms (Jakovljevic at all. 2020). There is a growing feeling associated with many evidence that things have got to change, but the question is how. Humankind has a dark side and a bright/light side and there is no strict dichotomy between the good people, the "we", and the bad or evil people, the "they" (see Simon 2008). Good people are far from perfect and we are neither all good nor all bad, we are beings of many sundry possibilities and combinations. The grand evils of humankind, such as the Holocaust, the Gulags, Srebrenica, etc. as well as atrocities of our everyday lives, reveal the fact that the most dangerous drives and act come from the "banality of evil" (see Hannah Arendt), from denying the evil part of our humanity and not overcoming of the "seven death emotions" (hatred, anger, fear, lust, revengefulness, jealousy, hubris/pride) and from following wrong beliefs and values and dark ideologies. Our world of ethical relativism, individualism, selfishness, global rivalries, free market where the well-being of future generations is commonly ignored seems to be floating over the abyss, in-between contradictions, instabilities and balance, war and peace, hatred and love, clash of civilizations and empathic civilization, dark anti-Utopia an Utopia... In the essence of the human condition is that we struggle against our dark demons that our spirits strives to harness these demons in the pursuit and the fulfillment of our human destiny (Simon 2008).

Fundamental questions here arise: 1.why culture of trust, compassionate society and empathic civilization is needed; 2.what are strengths and weakness, opportunities and threatens; 3.what kind of Bosnia and Herzegovina and world in general do we want, what kind of national and global leadership, local and global government and institutions; and 4.how can we achieve it; 5.is it science fiction and utopian dream (Jakovljevic et al. 2021). Trust, empathy and respect complementary to each other are key factors in building effective understanding, communication, and healthy and creative relationships in all human communities. Spirituality is related to the sacred dimension, trust/faith, empathy, respect, ultimate meaning and purpose of life and spiritual beliefs are of great importance for the bright side of humankind having a significant impact on our life, science, art and religion. It is very important to make distinction between sound spirituality and pathological spirituality, between healthy minded and distorted or sick faith. Healthy spirituality in its many forms is very important for promoting compassionate society and empathic civilization because it can bring us 1. a mission-discovery process, sense of meaning, personal integrity and purpose, 2. inspirations, values and the fuel to be good, do good and serve others, to cooperate, 3. a deep enjoyment of life, personal and collective growth and development, and synergy between sciences, arts and religions. Healthy spirituality has been linked with higher self-esteem and respect for others, more love, hope, positive thinking, positive mood states, forgiveness... According Ferrer (2002) spirituality is a basic transformative process that overcomes narcissism, self-centeredness, self-separation, self-preoccupation, and so on. According to some opinion religions make us more human (Newberg & Waldman 2010) and they may serve 5 purposes: 1. spiritual (meaning, purpose, hope); 2. self-development (positive identity); 3. resolve (self-efficacy, comfort); 4.sharing (closeness, connectedness to community); and 5. restraint (helps keep emotions and behavior under control) –(see Pergament 1997). Throughout the whole history religions have talked with greatest authority about ethics, community, meaning and purpose as well as they instructed people how to live, love and die well (De Bottom 2019) enhancing compassion and social awareness (Newberg & Waldman 2010). Christianity proclaims that returning good for evil has a way of winning even the most hardened hearts. Trust in providence which is love and wisdom, belief in power which is greater than oneself, which is source of significance and

hope, ability to find meaning in suffering and illness, gratitude for life which is perceived as a gift, ability to forgive have stress coping values and protective effect on mental health, personal and collective well-being. Love, empathy, mutual respect and trust create a light unto path to better future in better world. According to Newberg and Waldman (2010) for thousands of years the human brain has spontaneously generated spiritual and mystical experiences adding new dimension to human lives, cultures and civilizations.

It is very important to stress the very fundamental fact about ourselves: we are a species that has evolved to thrive on love, kindness, compassion and altruism associated with our interconnectedness and interdependency (see Jakovljevic & Tomic 2016, Jakovljevic 2018). Empathy is fundamental for establishing and maintaining all of our most significant relationships based on respect, trust, understanding, non-judging, partnership and friendship (Krznaric 2015). Love, empathy, compassion and altruism are the essence of humanism and human condition. Empathy is social glue that holds humans together which is very important for survival. With empathizing we see each other's humanity. Empathy leads to healthy, creative, flourishing and well-functioning families, communities, nations, societies and civilizations. Human beings are biologically wired to need connection, attachment, recognition, validation and belonging. Empathy is what enables us to extend our social affiliations and connect with other people in larger social, political, economic and religious units, blocs and cultures. People are encouraged to engage in conflicts and wars by those benefiting from them, so that one should work on developing immunity to warmongers (Staguhn 2007). Vengeance has been claimed to be the very essence of human nature, but it can also be overcome by virtue of forgiveness. Civilization represents an attempt to confine the aggressive and revengeful part of human nature; great religions have made it their mission, too. An operative faith, a faith that will move mountains, has been grounded in Love which practice patience in doing good. Loving what you are doing, and doing what you love with people whom you love and for the people whom you love is a key for wellness and well-being. Very few of us will do great things, but all of us can do small things with great love. Empathy is the invisible force that holds society and civilization together. It involves empathy for difference and openness to diversity. Education for love, empathy and compassion are pillars and foundation of the better future for all. Compassion society as the final and the noblest result of empathy (Ferrucci 2007) is an esprit de corps of the empathic civilization of love and peace. Choice between clash of civilizations or dialogue among them leading to the empathic global civilization of love is the most fundamental issue from the public and global mental health perspective (see Jakovljevic 2016). Love, kindness, gentleness, and compassion are like basic food for our minds, they are intrinsically related to our well-being.

Global empathic civilization seems to be a key to the very survival of humankind and life on our planet. Good news from the latest neuroscience research is that empathy and compassion can be taught, learned and cultivated. To empathize means to civilize and humanize, to civilize and humanize means to empathize (Krznaric 2014). Empathy has cognitive, emotional and behavioral dimensions so that we can speak about compassionate (behavioral) empathy, cognitive empathy, and emotional empathy (Rahman 2016). Cognitive empathy is ability to recognize how and what other people are feeling. Emotional empathy is capability to feel what and how other people are feeling. Compassionate empathy is desire and readiness to other people deal with their problems and emotions. Trust is usually established when people understand, empathize, wish and try to help each other. Trust is related to credibility and it involves five dimensions and drivers: 1.competence: ability to meet challenges and goals and to achieve the wishful results and outcomes; 2.fidelity: reliability and consistency in pursuing interests of relevant parties; 3.confidentiality: protecting private information; 4.honesty and openess: disclosure, veracity, telling the truth and avoiding falsehoods, misinformation and fake news; 5.faith: to rely on, to believe in (see also Laugharne & Priebe 2006). Moral psychology shows that empathy and trust act as social glue, increases cohesiveness and cooperation between individuals as well as between communities and societies. Resilient and anti-fragile communities tend to foster a culture with shared values, a shared mission or goal, open and authentic leadership, use of consensus not force, enjoyment of work, a positive atmosphere, a safe learning environment, and honest and authentic conversations (see Sinay et al. 2016). Peo-

ple all over the world are beginning to recognize their common humanity and to agree that selfish societies and narcissistic psychoculture are not an option for better future.

Promoting dialogue among nations and religions and creating an empathic humanistic cooperative political psycho-culture may contribute to the development of global civilization of love and piece (Jakovljevic 2017, 2018). Envision a future in which nations and religions in Bosnia and Herzegovina are infused with more empathy and compassion transforming our world into brotherhood in humanity (see Hasanovic 2021, Palavra 2021) based on universal, integrative and humanistic ethics. In search for empathic civilization and compassionate society we need a critical mass of harmonious leaders in all segments of our life such as politics, science, religion, business, culture, education, sports (Srica 2018). According to Srica (2018) harmonious leaders see through the eyes of others, they are generous, love consensus and want everyone to win. We agree with Steven Pinker (2018) that "we will never have a perfect world, but there is no limit to the betterments" if we continue to apply epistemophilia with conviction that life is better than death, love is better than hate, health is better than illness, freedom is better than slavery, peace is better than war...

Global empathic civilization seems to be a key to the very survival of humankind and life on our planet. Bosnia and Herzegovina is a right place for applying Strategic Harmony model and promoting principles of empathic civilization. According to Kabbalah and Judaism, at the beginning of the time, the world shattered into many pieces, and our job on earth is to do work of tikkun olam – the healing of the broken world (Harra 2011). Spiritually integrated sciences, arts and religions in creative dialogues as allies can significantly contribute to the healing of our broken world and promoting compassionate society and empathic civilization.

CONCLUSIONS

Global empathic civilization seems to be a key to the very survival of humankind and life on our planet. Bosnia and Herzegovina is a right place for applying Strategic Harmony model and promoting principles of mutual trust, respect and empathic civilization. Brotherhood in humanity is a life philosophy that all human beings belong to a single family/community based on shared logos, thelos, pathos, ethos and mythos. This philosophy is fundamental for public and global well-being which is predicated on universal human rights, trust, love, reverence, empathy and compassion. Spiritually integrated sciences, arts and religions in creative dialogues as allies can significantly contribute to the healing of our broken world and promoting compassionate society and empathic civilization.

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Ivan Jakovljevic: comments on the concept of article, literature searches, writing some parts of manuscript, approval of final version
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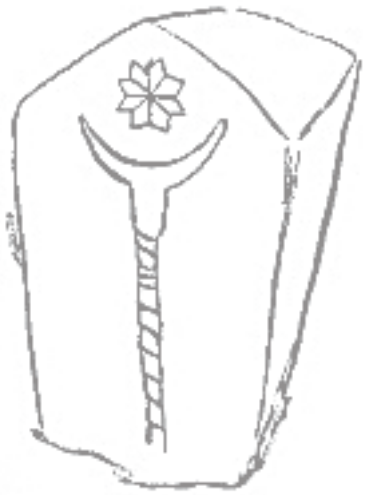
SAŽETAK

Kroz povijest tradicionalno gledano znanstvene discipline s jedne strane a religije i umjetnost s druge strane su bila strogo odvojena područja kulture bez zajedničkih pothvata. Digitalna revolucija je značajno promijenila sva polja znanosti, umjetnosti i religije promjenom metoda rada, istraživanja i stvaranja novih vrijednosti, ali i način komunikacije i odnosa. Big Data je u potrazi za stvaranjem znanstvenog Svetog Grala, jedne/og ili više teorija i modela koji ujedinjuju sve znanstvena područja od biologije i neuroznanosti do glazbe i duhovnosti. Mozak je mjesto gdje su biološki, psihološki, socijalni i spiritualni procesi i mehanizmi u složenim interakcijama. Globalna empatijska civilizacija čini se da predstavlja ključ za preživljavanje čovječanstva i održanje života na zemlji. Duhovno povezane znanosti, umjetnosti i religije u kreativnom dijalogu i sinergiji kao saveznici mogu značajno pridonijeti iscjeljenju našeg ugroženog svijeta i promociji suosjećajnog društva i empatijske civilizacije.

Ključne riječi: sinergija – znanost – umjetnost – religija - bratstvo u humanosti - suosjećajno društvo - empatijska civilizacija



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Review article

CONTROVERSIES ON THE BEGINNING OF HUMAN LIFE – SCIENCE AND RELIGION CLOSER AND CLOSER

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SUMMARY

One of the most controversial topics in modern bioethics, science, and philosophy is the beginning of individual human life. In the seemingly endless debate, strongly stimulated by recent technologic advances in human reproduction, a synthesis between scientific data and hypothesis, philosophical thought, and issues of humanities has become a necessity to deal with ethical, juridical, and social problems. Furthermore, in this field there is a temptation to ask science to choose between opinions and beliefs, which neutralize one another. The question of when human life begins requires the essential aid of different forms of knowledge. Here we become involved in the juncture between science and religion, which needs to be carefully explored.

Modern bioethics and science are strongly concerned for the respect of human life at both ends of its existence (birth and death), but other sciences (eg. Philosophy, technology, psychology, sociology, law, and politics) consider the beginning of human life according to different points of view. However, bioethical topics like this one cannot be treated from only one perspective (eg. Biological, philosophical, or religious) because conclusions might be not good enough or reductive. This reality should be regarded in all its richness: An embryo gives a biologist and a geneticist substance for consideration, but because we are talking about the beginning of human life, it requires philosophical-anthropological consideration and confrontation with theology; in its protection we have to include ethics and law. In experiencing and investigating social behavior, other disciplines, such as the history of medicine and sociology, have to be included.

It is hard to answer the question when human life should be legally protected. At the time of conception? At the time of implantation? At the time of birth? In all countries (except Ireland and Liechtenstein) juridical considerations are based on Roman law. Roman civil law says that the fetus has right when it is born or if it is born-nasciterus.

Few countries agree with definition of beginning of human personality at the time of conception. The majority does not grant legal status to the human embryo in vitro (i.e., during the 14 days after fertilization). Thus, even in the absence of legal rights, there is no denying that the embryo constitutes the beginning of human life, a member of the human family. Therefore, whatever the attitude, every country has to examine which practices are compatible with the respect of that dignity and the security of human genetic material.

The question when a human life begins and how to define it, could be answered only through the inner-connecting pathways of history, philosophy, medical science and religion. It has not been easy to determine where

to draw the fine line between the competence of science and methaphysics in this delicate philosophical field. To a large extent the drawing of this line depends on one's fundamental philosophical outlook. The point at which human life begins will always be seen differently by different individuals, groups, cultures, and religious faiths. In democracy there are always at least two sides, and the center holds only when the majority realizes that without a minority democracy itself is lost. The minority in turn must realize its best chance lies in persuasion by reason and thoughtfulness rather than fanaticism.

Key words: 4D sonography, scientific and religious controversies, ethical aspect, legal status of unborn

INTRODUCTION

In recent years, we have noticed robust increase of interest in the relationship between science and religion worldwide. In the past, the above mentioned, more or less autonomous intellectual activities often tried to dominate one over another, or they ignored each other. Only in recent times, most scientists and many theologians accept the view that scientific and religious "truths" are complementary and thus only methodologically independent. Today, science and religion are an important factor in the life of the people, the country and the world. Science along with religion is the greatest gift the Almighty granted on us.

Anticipating the future relations between science and technology, we can only extrapolate and wonder. In this century, we human beings have come to know who we are and where we are in ways unprecedented in all past millennia. We know the size, age, and extent of our universe; we know the deep evolutionary history of our planet, and ourselves as part of this story. These facts of science have required integration into our classical religious worldviews; and these blending of theory and principle in science and religion will continue. In this century, we human beings have gained, through science and technology, more power than ever before to affect, for better or worse, our own well-being, that of the human and natural worlds, and even planetary history. The fate of the Earth, the fate of all who dwell thereon, depends, in the next century, on the responsible use of that power. Everything depends on how we join science, ethics, and religion in practice (Rolston 1996).

Modern science is not interested in the Nature, but what we can say about Nature; one does not invent occurrences yet it interprets it. Science differs from religion in a way that its truth can and must be experimentally verified, and its methodological knowledge can be learned. Religion is dominated by irrational moment, and science by rational moment. Intellectual knowledge in science is expressed quantitatively, in the form of mathematical formulas and equations, but in religion qualitatively in the form of metaphors/apstractions. Technologies as practical expression of science on the other hand worship as practical expression of theology, and society of lay-

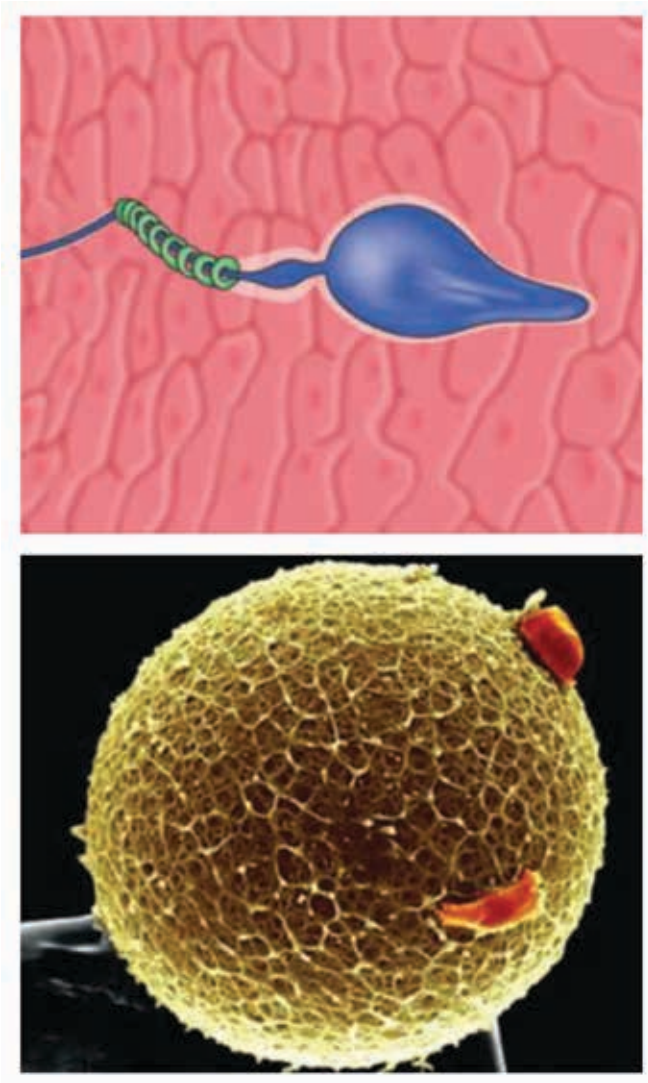


Figure 1. Schematic presentation of spermatozoa and oocyte

men as the basis of democracy, today represent the pragmatic Western system of real capitalism. Today more often than ever - a dramatic development of technology opens a range of possibilities, which are all generated by science, but often aren't sufficiently analyzed and all the alternatives and consequences aren't understood. Most of the alternatives and consequences are not even possible to be observed and understood, and they remain exclusively in the domain of science and technology. Our life is far richer than it can be described only by science and therefore the views of the great religions certainly must be taken in consideration.

At present, for instance, there is more dialogue and integration in physics, ample conflict and considerable independence between biology and religion. Whether that trend will continue depends partly on discoveries as yet unknown in physics, astronomy, and molecular and evolutionary biology.

Global leadership in science and technology has not translated into leadership in infant health, life expectancy, rates of literacy, equality of opportunity, productivity of workers, or efficiency of resource consumption. Neither has it overcome failing education systems, decaying cities, environmental degradation, unaffordablc health care, and the largest national debt in history. Basic human needs - elemental needs—are intrinsically different from other material needs because they can be satisfied. Other needs appear to be insatiable, as the consumption patterns of the United States clearly demonstrate. Once basic human needs are met, satisfaction with our lives cannot be said to depend on the amount of things we acquire, use, and consume. More technology-based economic growth is not necessary to satisfy humanity's elemental needs, nor does more growth quench our thirst for consumption. In terms of the social contract, we justify more growth because it is supposedly the most efficient way to spread economic opportunity and social well-being. I am suggesting that this reasoning is simplistic and often specious (Mayr 1982).

Despite that, there are still many unresolved issues which have not reached full agreement, however public discussion can never solve all the problems and bring satisfaction to all. It should be directed towards the truth, even if it eventually reaches only compromise.

Today, there is a great tendency from upper level for another dialogue between science and religion, which existed since the very beginnings of our culture. Religion existed before science, but science is not an extension of religion. Each of them must keep their principles, their different interpretations and their own conclusions. Although different, both are components of a common culture of humanity.

One of the most controversial topics in modern bioethics, science, and philosophy is the beginning of individual human life. In the seemingly endless debate, strongly stimulated by recent technologic advances in human reproduction, a synthesis between scientific data and hypothesis, philosophical thought, and issues of humanities has become necessary to deal with ethical, juridical, and social problems (Serra & Colombo 1998). Furthermore, in this field there is a temptation to ask science to choose between opinions and beliefs that tend to neutralize one another. Indeed, the question of when human life begins requires the essential aid of different forms of knowledge. Here we become involved in the juncture between science and religion, which needs to be carefully explored (Kurjak 2003a).

Obviously, the beginning of human life is seen differently by different individuals, groups, cultures, and religions. Fundamental to productive debate and reconciliation between minority and majority groups is an understanding of the ill-defined concept of "the beginning of human life" (Beller & Zlatnik 1995).

Entering this field, scientists have been remiss in failing to translate science into the terms that allow mankind to share their excitement of discovering life before birth. Regardless of the remarkable scientific development, curiosity, and speculations dating back to Hippocrates, life before birth still remains a big secret. Different kinds of intellectuals involved themselves in trying to contribute to the solution of the human life puzzle. They are led by the idea that each newborn child will only reach its full potential if its development in utero is free from any adverse influence, providing the best possible environment for the embryo/fetus. Considering the embryo/fetus, it should be always kept in mind the amazing aspect of these parts of human life in which the pregnant woman and the embryo/fetus, although locked in the most intimate of relationships, are at all times two separate individuals. Accepting the embryo/fetus as a person opens a new set of questions about its personality and human rights.

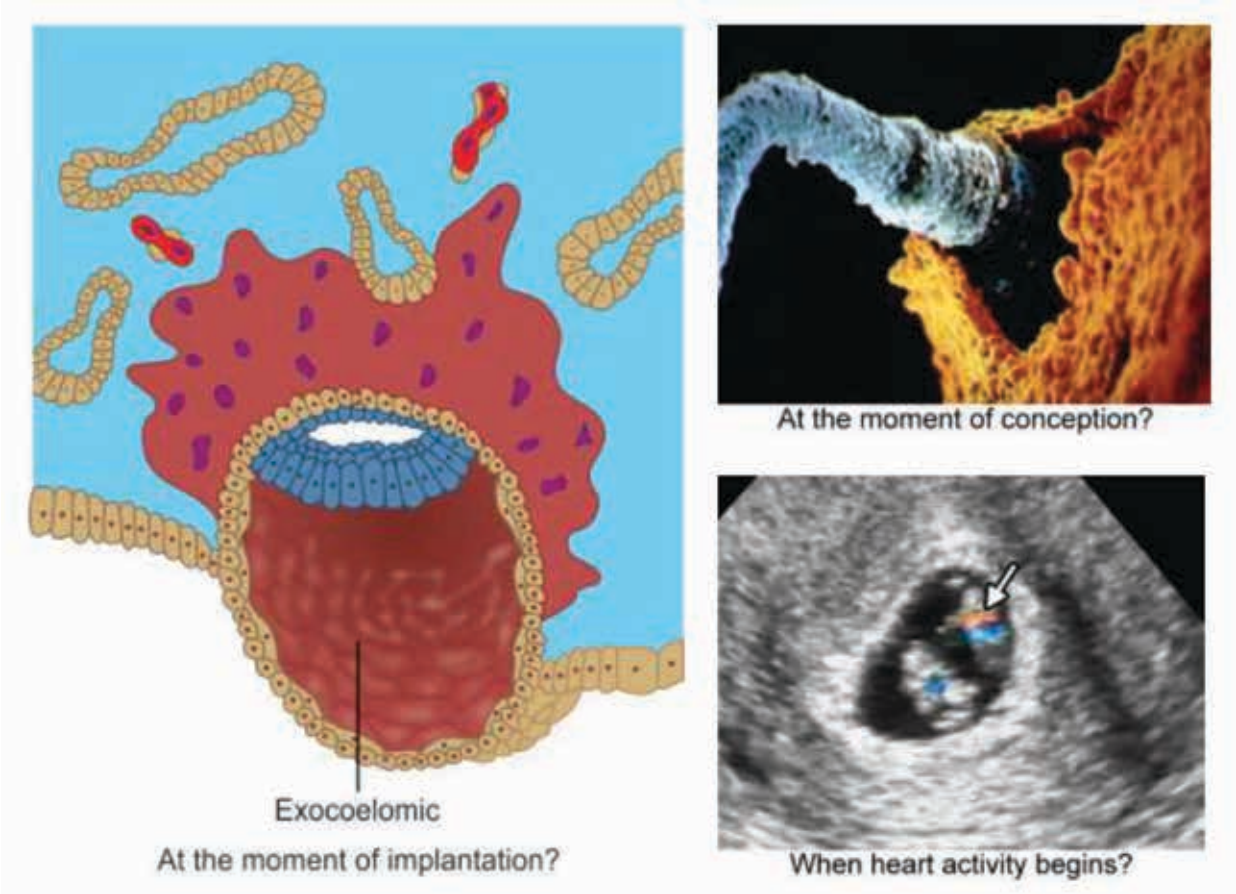


Figure 2. Some possible questions on the beginning of human life

THE DEFINITION OF LIFE

Proper answers to the question of how to define human life are complicated. Nowadays, dilemmas consider the respect of human life from the birth to death involving not just biology, but other sciences also. Philosophy, theology, psychology, sociology, law and politics evaluate this topic from different point of views. Integration of all could result in a useful answer.

Some authors say that that life as such does not exist – No one has ever seen it. Szent-Gyorgy says that the noun "life" has no significance because there is no such thing as "life." Le Dantez holds that the expression "to live" is too general, and that it is better to say a dog "dogs" or a fish "fishes" than a dog or a fish lives (Kurjak 1992a).

When defining life, it should be considered not just as it is today, but as it might have been in its primordial form and as it will be in the future. All present forms of life appear as something completely new. Life, then, is transferred and not conceived in each new generation. Furthermore, the phenomenon of life has existed on Earth for approximately 3.5 billion years. Consequently, although the genome of a new embryo is unique, the make-up of an embryo is not new. If life is observed through the cell, then every life (and human also) is considered as a continuum. Human cells and mankind have existed on Earth continuously since the appearance of the first man. However, if the definition refers to a single human being or the present population, the statement that "human life is a continuum" is not acceptable (Godfrey 1995, Liggins 1992).

Life, in a true sense of the word, begins when the chemical matter gives rise, in a specific way, to an autonomous, self-regulating, and self-reproducing system. Life is connected with a living being, and it creates its own system as an indivisible whole – It forms its individuality. One of the most important characteristics of living beings is reproduction. Reproduction is a means of creating new life by transferring forms of an old one into newly formed human being. Therefore, variability, individual development, and harmony characterize human beings. Individuality

is the most essential characteristic of human beings consisting of new life, but also all human life forms through evolution, characterized by phenotype, behavior and the capability to recognize and adapt. Human embryo and fetus gradually develop into these characteristics.

"Human life" poses a semantic problem. The placenta is "human life," as is every individual cell or organ of the human body, but "human life" is clearly not equivalent to "human being." It is, therefore, mandatory to differentiate between organic or vegetative human life and "potential personal human life." The latter term allows various groups to identify a point of the continuum between abortion and birth to which they can ascribe appropriate values and rights (Beller & Zlatnik 1995).

Although we should not forget that in the same way today's research is tomorrow's benefit (Kurjak 1992), concerning human life, conclusions should not be treated one-sidedly from one perspective. This reality should be regarded in all its richness: the embryo gives the biologist and geneticist substance for consideration, but talking about the beginning of a human life requires philosophical/anthropological consideration, as well as theological and social sciences. In its protection, we have to include ethics and law. This approach leads to the conclusion that it is necessary to reject reductionism as well as integrism, and to find a „golden middle" between these two methodologies (Serra & Colombo 1998).

WHAT DOES BIOLOGY SAY?

Biology characterizes human beings by the dynamics of the system and its self-control (homeostasis), excitability (response to stimuli of different nature and origins), self-reproducibility, the heredity of the characters, and the evolutionary trend (Serra & Colombo 1998). For biologists, it is important to specify which form of life phenomena we are referring to: cell, organism population, or species. The basic level of organization and the simplest form of life is the cell. Biologically speaking, human cellular life never stops or if it did, the extinction of the human species would result and is passed on from one generation to another. Human individual organismic life is defined within its life cycle, which is temporarily limited, i.e. it has a beginning and an end (Gilbert 1991). It is obvious that life is a highly dynamic phenomenon that could be described and explained through the careful study of life processes and interactions by interdisciplinary approach. In human spermatozoa and oocyte are two essential cells involved in creating human life. (Figs 1 and 2) It is clear that biologists are most qualified to render judg-

Figure 3. Some questions about the definition of a person

Figure 4. Different behavioral patterns of the fetuses in second half of pregnancy. Are they different personalities?

ment on the structure and function of cells. To quote Scarpelli (Scarpelli 2003), the very broad scope of biological science (from molecular to behavioral biology, and from unicellular to multisystem forms) brings with it the justifiable understanding that the biological scientist knows and is able to define the state of being alive or "life." If not, the science fails.

The biological scientist, who may specialize within one or another domain of the broad scope, has particular and definitive knowledge and understanding of the living individual that is his specialty. If not, disorder will rise above failure.

Understanding of the beginning of human life and development of the embryo/fetus could provide definitive resolution. However, with the recent possibility of visualizing early human development virtually from conception, perinatologists should be those who by study, training, practice and research are singularly qualified (Scarpelli 2001).

While science provides us data about physical development of the human being, it does not provide information about its personality and personhood. These are philosophical, rather than scientific topics.

HUMAN EMBRYOGENESIS

Only proper understanding of the process of human embryogenesis enables answering scientifically the question of when the life cycle of a human individual starts. Therefore, in the following text the main steps of the human developmental process are going to be briefly described, primarily during the first 15 days following fertilization.

A human being originates from two living cells: the oocyte and the spermatozoon, transmitting the torch of life to the next generation. The oocyte is a cell approximately 120 μm in diameter with a thick membrane, known as the zona pellucida. The spermatozoon moves, using the flagellum or tail, and the total length of the spermatozoon including the tail is 60 μm (Jirasek 2001).

After syngamy, the zygote undergoes mitotic cell division as it moves down the fallopian tube toward the uterus. A series of mitotic divisions then leads to the development of the preembryo. The newly divided cells are called blastomeres. From one to three days after syngamy, there is a division into two cells, then four cells. Blastomeres form cellular aggregates of distinct, totipotent, undifferentiated cells that, during several early cell divisions, retain the capacity to develop independently into normal preembryos. As the blastocyst is in the process of attaching to the uterine wall, the cells increase in number and organize into two layers of cells. Implantation progresses as the outer cell layer of the blastocyst, the trophectoderm, invades the uterine wall and erodes blood vessels and glands. Having begun five or more days after fertilization with the attachment of the blastocyst to the endometrial lining of the uterus, implantation is completed when the blastocyst is fully embedded in the endometrium several days later. Even during these 5–6 days, modern medicine introduces the possibility of making preimplantation genetic diagnosis.

However, at this time, these cells are not yet totally differentiated in terms of their determination to specific cells or organs of the embryo. The term pre-embryo, then, includes the developmental stages from the first cell division of the zygote through the morula and the blastocyst. By approximately the 14th day after the end of the process of fertilization, all cells, depending on their position, will have become parts of the placenta and membranes or the embryo. The embryo stage, therefore, begins approximately 16 days after the beginning of the fertilization process and continues until the end of 8 weeks after fertilization, when organogenesis is complete (ACOG Committee 1994).

The pre-embryo is the structure that exists from the end of the process of fertilization until the appearance of a single primitive streak. Until the completion of implantation, the preembryo is capable of dividing into multiple entities, but does not contain enough genetic information to develop into an embryo, it lacks of genetic material from maternal mitochondria and of maternal and parental genetic messages in the form of messenger RNA or proteins. Therefore, during the preembryonic period, it has not yet been determined with certainty that a biological individual will result, or would be one or more (identical twins forming), so that the assignment of the full rights of an individual human person is inconsistent with biological reality.

One conclusion from this is that the preembryo requires the establishment of special rules in the society: it cannot claim absolute protection based on claims of personhood; although meriting respect, it does not have the same moral value that a human person has. Today, one largely accepted opinion is that until the 14th day from fertilization or at least, until implantation – the human embryo may not be considered, from the ontological point of view, as an individual.

Genetic uniqueness and singleness coincide only after implantation and restriction have completed, which is about 3 weeks after fertilization. Until that period, the zygote and its sequelae are in a fluid pro-

Figure 5. Transvaginal sonography of the 8 weeks embryo with yolk sac

Figure 6. Color Doppler visualization of entire embryonic circulation

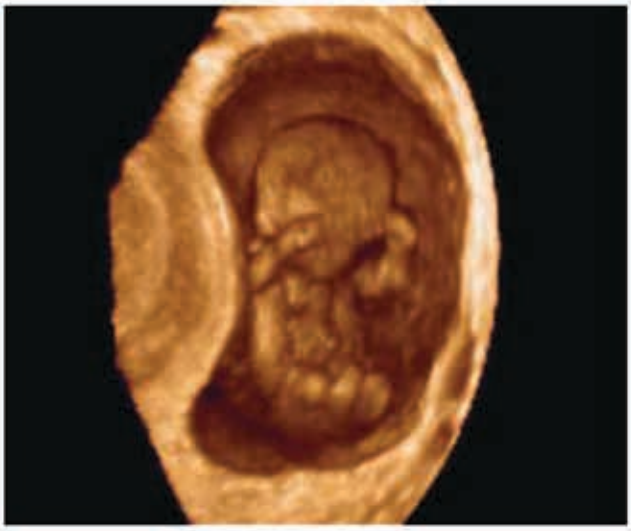


Figure 7. Ten weeks gestation. Intrauterine content with early fetus. Many anatomical landmarks are visible.

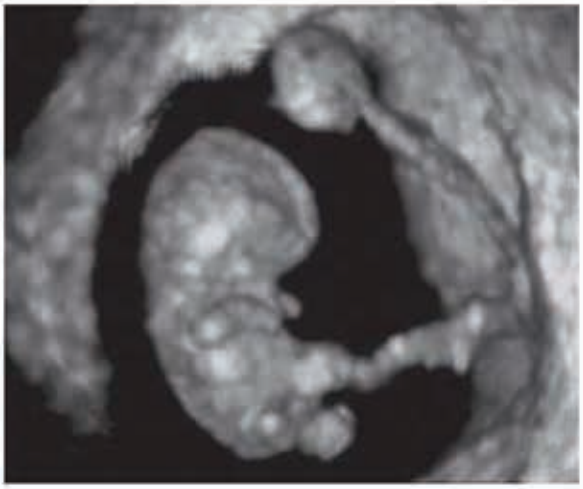


Figure 8. Nine weeks embryo with vitelline duct and yolk sac seen in three dimensions.

cess, are not physical individual, and therefore, cannot be a person.

It is well-known that high percentages of oocytes which have been penetrated never proceed on to further development, and that many oocytes which do, are thwarted so early in their development that their presence is not even recognized. It is suggested that 30% of conceptions detected by positive reactions to human chorionic gonadotropin (HCG) tests abort spontaneously before these pregnancies are clinically verified.

The newly conceived preembryo presents itself as a biologically defined reality. However, the status of the preembryo as an individual remains a great mystery. In the present scientific scene especially with the progress of ultrasound technologies, prenatal psychology and therapeutics opened a window into prenatal life of embryo and fetus confirming the evidence that the embryo/fetus is a true subject itself (Declaration 2004, Kurjak et al. 2005).

PERSONALITY

Defining personality is very complex. There is still no clear definition of personality. One dictionary offers "what constitutes an individual as distinct person," but does not define what the "what" is. Another dictionary asserts "the state of existing as a thinking intelligent being." This definition might lead to the inference that personality increases pro rata with intelligence, or that some people may not have a personality at all if we followed Bertrand Russell's dictum that "most people would rather die than think and many, in fact, do!" Kenneth Stallworthy's Manual of Psychiatry is more help with the definition that "personality is the individual as a whole with everything about him which makes him different from other people," because we can certainly distinguish fetuses from each other and from other people. With the next sentence – "personality is determined by what is born in the individual in the first place and by everything which subsequently happens to him in the second"—We are really in the field (Serra & Colombo 1998, Beller & Zlatnik 1995).

Viewpoints on the nature of "personhood" and what it means ethically and legally vary widely. In his proposed Life Protection Act, Sass acknowledges that a fetus with formed synapses is not a "person" in the usual sense of the word, connoting consciousness and self-consciousness (Sass 1989). Veatch sees the problem as defining the life that has full moral standing (Veatch 1994), while Knutson (Knutson 1967) has noted that "those who employ spiritual or religious definitions of when life begins tend to place the beginning of life earlier than those who employ psychological, sociological, or cultural definitions."

Led by the truism, "No insignificant person was ever born," human beings should be valued from birth to natural death. It is hard to establish proper values and exact definitions. This becomes especially problematic when prenatal life is considered. The above stated truism opens an important question: "Is the person-unborn a person in the first place and, if so, is the person-unborn a 'significant' person?" (Serra & Colombo 1998)

Let us evaluate further present controversies. There is no doubt that the embryo and fetus in utero are biologically human individuals prior to birth. The child who is born is the same developing human individual that was in the mother's womb. Birth alone cannot confer natural personhood or human individuality. This is confirmed by preterm deliveries of babies who are as truly human and almost as viable as those whose gestation goes to full term. All the known evidence supports the human fetus being a true ontological human individual and consequently a human person in fact, if not in law. A human person cannot begin before the appropriate brain structures are developed that are capable of sustaining awareness. The same applies to a grossly malformed fetus. It would still be a human individual even if its human nature was not perfect or its functions quite normal. Nobody questions the humanity of a Down's syndrome fetus or child. A fetus or child with severe open spina bifida is not less of a human being. The same should be said for the live anencephalic fetus or infant with only brainstem functions. It is a human individual even if it lacks a complete brain and usually survives birth by only a few hours or a day.

"Person" and "personhood" are the legally operational terms in the United States and many other countries. Alternatively, "person" and "personhood" are replaced by terms such as "viable outside the uterus," "a woman's right to privacy," and "a woman's right to choose." In each case, viable, privacy and choice, the life-support provider may legally order transfer of the dependent individual into a morbid environment. For this group, dilemma (which includes the stem cell, abortion and cloning debates) is abated, but not resolved (Kurjak 1992).

Human society created several standards in defining "person" or "human being" based on what is familiar and easy recognizable (Serra & Colombo 1998). For example, a human speaks, understands, and laughs. Absence of these characteristics (mutism, autism, and stoicism) does not disqualify. To the contrary, the conclusion is that the characteristics we have come to associate with being a person may not be applicable to each individual person. Therefore, it is necessary to establish criteria for a definition of "person" in society and in time (Figs 3 and 4). Some prominent Italian professors (Declaration 2004) committed themselves to caring for the embryo in such a way; giving the same dignity to every patient, and the human conditions to grow and develop, to educate

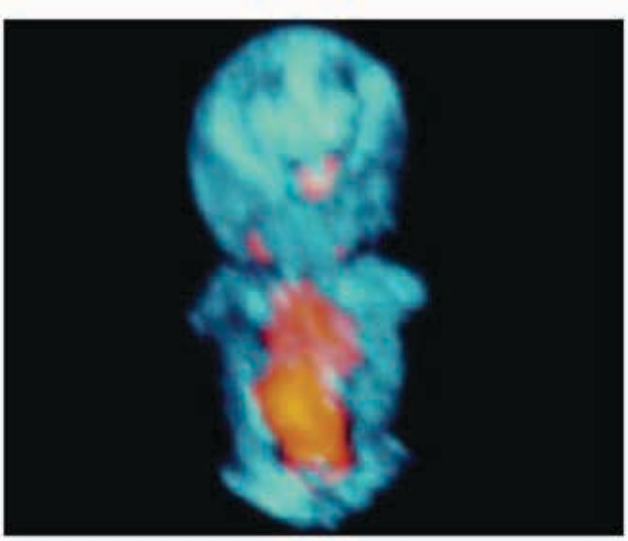


Figure 9. Eleven weeks embryo with entire peripheral and central vascularization visualized by three-dimensional power Doppler.

Figure 10. The earliest detection of brain circulation at 7 weeks and 4 days of gestation.

others inside and outside the specialty, and to carry out research involving all the components of society.

EMBRYO AS A PATIENT: BIOETHICAL ASPECTS

The idea of the embryo/fetus as a miniaturized infant or adult is true to the extent that the embryonic/fetal physiologist must be able to apply knowledge of every system after birth, yet quite untrue in failing to recognize the many ways in which life before birth differs fundamentally from life after birth. The newly conceived form presents itself as the biologically defined reality: it is an individual that

Figure 11. Another possible question about the beginning of human life.

Figure 12. Hand near face movement of the fetus at 16 weeks of gestation, as seen by three-dimensional ultrasound.

is completely human in development that autonomously, moment by moment without any discontinuity, actualizes its proper form in order to realize through intrinsic activity, a design present in its own genome (Figs 5 to 10) (Declaration 2004). The embryo as a patient is best understood as the subset of the concept of the fetus as the patient. These two concepts opened a whole set of questions regarding ethical problems. The embryo as the patient is indivisible from its mother. However, balance is needed in protecting the interests of the embryo/fetus and the mother. One prominent approach to understanding the concept of the embryo/fetus as a patient has involved attempts to show whether or not the embryo/fetus has independent moral status, or personhood (Engelhardt 1986, Dunstan 1984, Chervenak et al. 2001). Independent moral status for the fetus would mean that one or more of the characteristics possessed either in, or of the embryo/fetus itself, and therefore independently of the pregnant woman or any other factor, generate, and therefore ground obligations to the embryo/fetus on the part of the pregnant woman and her physician.

A wide range of intrinsic characteristics has been considered for this role, e.g. moment of conception, implantation, central nervous system development, quickening, and the moment of birth (Curran 1978). Given the variability of proposed characteristics, there are many views about when the embryo/fetus does or does not acquire independent moral status. Some take the view that the embryo/fetus possesses independent moral status from the moment of conception or implantation. Others believe that the embryo/fetus acquires independent moral status in degrees, thus resulting in "graded" moral status. Still others hold, at least implicitly, that the embryo/fetus never has independent moral status so long as it is in utero (Chervenak et al. 2001).

Being a patient does not require that one possesses independent moral status (Ruddick & Wilcox 1982). Being a patient means that one can benefit from the application of the clinical skills of the physician (McCullough & Chervenak 1994). Put more precisely, a human being without independent moral status is properly regarded as a patient when the following conditions are met: that a human being is presented to the physician for the purpose of applying clinical interventions that are reliably expected to be efficacious, in that they are reliably expected to result in a greater balance of goods over harms in the future of the human being in question (Curran 1978). In other words, an individual is considered a patient when a physician has beneficence-based ethical obligations to that individual.

To clarify the concept of the embryo/fetus as the patient, beneficence-based obligation is necessary to be provided. Beneficence-based obligations to the fetus and embryo exist when the fetus can later achieve independent moral status (McCullough & Chervenak 1994). This leads to the conclusion that ethical significance of the unborn child is in direct link with the child to be born – the child, it can become.

LEGAL STATUS OF THE EMBRYO

When discussing law, it should be always kept in mind that medicine is international, but law is not. Before the era of Aristotle, who taught that human life begins when the fetus is formed, human life was

considered to begin at birth. Prior to birth, the fetus was not an independent human being but, like an organ, part of the mother (Connery 1987). Thus the birth of a full-term infant has been used in the laws of various countries to signify the beginning of the human life that is to be protected.

Indeed, the status of the human embryo is not juridically defined and relies on the political, social, and religious influences in each country. Interestingly, nearly all countries of the Western world use the twelfth week of pregnancy as the limit for legal abortion. It is not the end of the first trimester, which is 13.3 weeks, and there is no other particular biological event to justify this limit.

It is hard to answer the question when human life should be legally protected. At the time of conception? At the time of implantation? At the time of birth? (Fig. 11) In all countries (except Ireland and Liechtenstein), juridical considerations are based on Roman law. Roman civil law says that the fetus has rights when it is born or if it is born-nasciterus.

Few countries agree with the definition of the beginning of human personality at the time of conception. The majority does not grant legal status to the human embryo in vitro (i.e. during the 14 days after fertilization). Thus, even in the absence of legal rights, there is no denying that the embryo constitutes the beginning of human life, a member of the human family. Therefore, whatever the attitude, every country has to examine which practices are compatible with the respect of that dignity and the security of human genetic material (Pierre & Soutoul 1994).

ARGUMENTS FOR BEGINNING OF HUMAN LIFE AND HUMAN PERSON AT FERTILIZATION

The fundamental approaches of biomedical and social (secular) practice must begin with the understanding that the subject before birth is a person and that "personhood" is conferred by successful fertilization of the egg. To hide from this in silence or ignorance should be unacceptable to all, as stressed by Scarpelli (Scarpelli 2003).

The view that human life begins when sperm and eggs fuse to give rise to a single cell human zygote, whose genetic individuality and uniqueness remain unchanged during normal development, is widely supported. Because the zygote has the capacity to become an adult human individual, it is thought it must be one already. The same zygote organizes itself into an embryo, a fetus, a child and an adult. By this account, the zygote is an actual human individual and not simply a potential one, in much the same way as an infant is an actual human person with potential to develop to maturity and not just a potential person. As Scarpelli pointed out, outside the realm of religious dogma, there has been no one whose existence can be traced back to any entity other than the fertilized egg. The biological line of existence of each individual, without exception, begins precisely when fertilization of the egg is successful (Scarpelli 2003).

The process of fertilization actually begins with conditioning of the spermatozoon in the male and

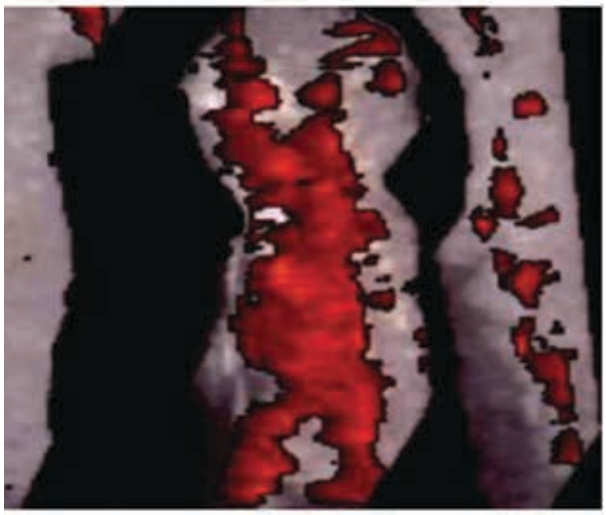


Figure 13. Early triplets clearly visualized by three-dimensional sonography.

Figure 14. Illustrative example of the complex fetal movements recorded by 4D sonography at 12 weeks' gestation.

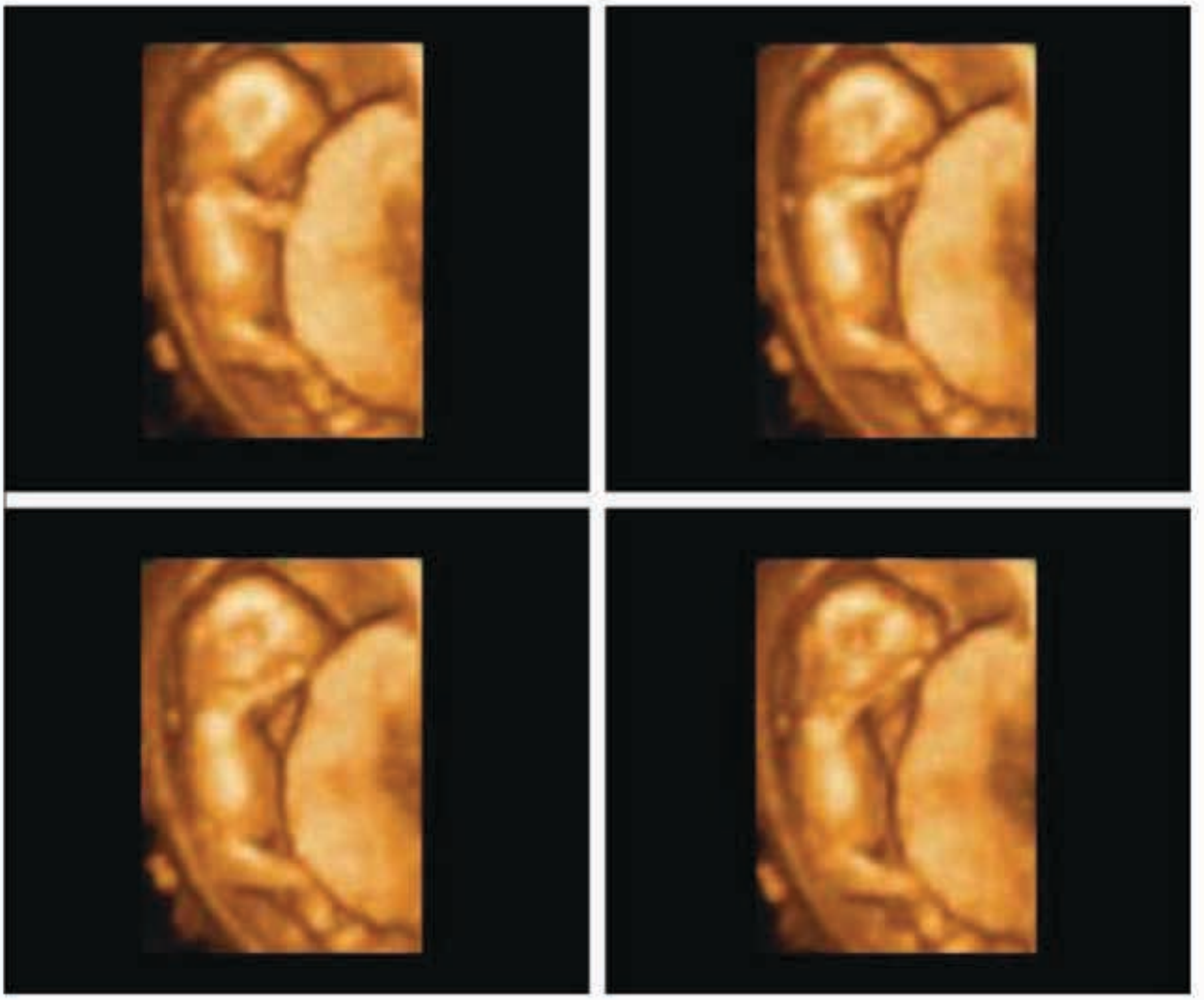


Figure 15. Fourteen-week fetus. Complete vascular anatomy of fetal and placental circulation shown by three-dimensional power Doppler.

female reproductive tracts. Thereafter, fertilization involves not only the egg itself, but also the various investments which surround the egg at the time it is released from the ovary follicle. Fertilization, therefore, is not an event, but a complex biochemical process requiring a minimum of 24 hours to complete syngamy, that is the formation of a diploid set of chromosomes. During this process, there is no commingling of maternal and paternal chromosomes within a single nuclear membrane (prezygote); after this process, the parental chromosomes material is commingled (zygote).

Among the many other activities of this new cell, most important is the recognition of the new genome, which represents the principal information center for the development of the new human being and for all its further activities. For the better understanding of the very nature of the zygote, two main features are to be at least mentioned here. The first feature is that the zygote exists and operates from syngamy on as a being, ontologically one, and with a precise identity. The second feature is that the zygote is intrinsically oriented and determined to a definite development. Both identity and orientation are due essentially to the genetic information with which it is endowed. That is why many do believe that this cell represents the exact point in time and space where a new human individual organism initiates its own life cycle (Serra & Colombo 1998).

ARGUMENTS AGAINST THE BEGINNING OF HUMAN LIFE AT FERTILIZATION

Today, one largely accepted opinion is that until the 14th day from fertilization or at least, until implan-

tation – the human embryo may not be considered, from the ontological point of view, as an individual. There are at least five main reasons in favor of this opinion:

1. Before the formation of the embryonic disc, the embryo is "a mass of cells, genetically human," "a cluster of distinct individual cells," which are each "distinct ontological entities in simple contact with the others" (Ford 1991). The genetically unique, newly developed DNA, a genome, is not established until 48 hours after sperm penetration. The ovum and sperm lie side by side for more than 48 hours before they finally merge. In biological terms, this renders conception as a process that occurs overtime and not a specific point in time (Beller & Zlatnik 1995).

2. Until approximately the 14th day after fertilization, all that happens is simply a preparation of the protective and nutritional systems required for the future needs of the embryo. Only when the entity called embryonic disc is formed, can the embryo develop into a fetus (McLaren 1986).

3. The monozygotic twins phenomenon or chimeras can occur. In fact, this seems to be the strongest reason why the embryo is denied the quality of individuality, and as a proof that the zygote cannot be an ontologically human being. In approximately one-third of cases the embryo divides at about the two cells stage, and in the other two-thirds, the inner cell mass divides within the blastocyst from day 38. Occasionally, the division takes place from day 8–12, but usually it is not complete, thereby forming conjoined identical twins or two-headed individuals. The chimera, resulting from the recombination of two individual to become one individuum (and detectable through genetic testing), provides another argument against the equivalence of conception and the beginning of human life: no individuum has died, yet one has ceased to exist.

4. Co-existence of the embryo with its mother is a necessary condition for an embryo belonging to the human species, and this condition can be obtained only at implantation (Chervenak et al. 2001). However, there is evidence that development of a human embryo in vitro can continue well beyond the stage of implantation, and that mouse embryos implanted under the male renal capsule can reach the fetal stage. It is also argued, or at least implied, that so many human embryos die before or after implantation that it would be lacking in realism to accept that the human individual begins before implantation.

It is well-known that high percentages of oocytes which have been penetrated never proceed on to further development, and that many oocytes which do, are thwarted so early in their development that their presence is not even recognized. Up to 50% of ovulated eggs and zygotes recovered after operations were found so grossly abnormal that it would be very unlikely that they would result in viable pregnancies. It is also suggested that 30% of conceptions detected by positive reactions to human chorionic gonadotropin (HCG) tests abort spontaneously before these pregnancies are clinically verified. The scientific literature is not unanimous on the incidence of natural wastage prior to, and during, implantation in humans, varying from 15% to as much as 50%. The vast majority of these losses are due to chromosomal defects caused during gametogenesis and fertilization (Abel 1993).

Genetic uniqueness and singleness coincide only after implantation and restriction have completed, which is about 3 weeks after fertilization. Until that period, the zygote and its sequelae are in a fluid process and are not a physical individual, and therefore cannot be a person. Although in a set of twins one individuum can disappear, genetic and individual identities are now more or less equivalent. Many eminent Catholic writers, among them the Australian priest Norman Ford, author of When Did I Begin? consider implantation to mark the beginning of human life; they maintain that the preembryo has only intrinsic potential and must be protected only from the time of implantation (McCormick 1991).

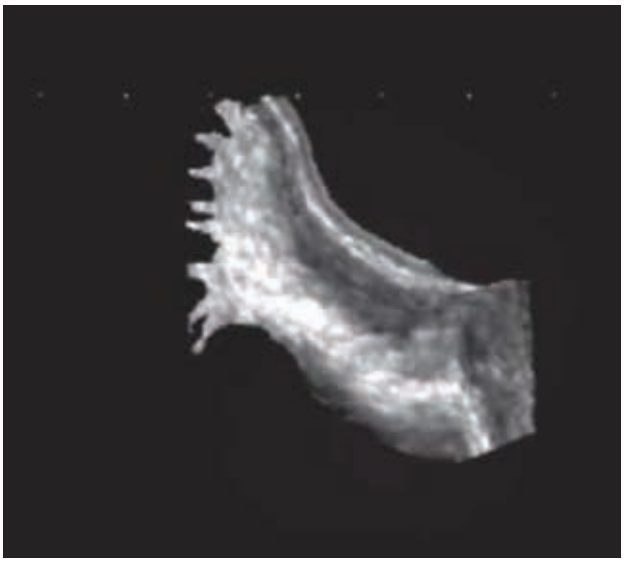


Figure 16. Three-dimensional sonography visualization of the part of fallopian tube.

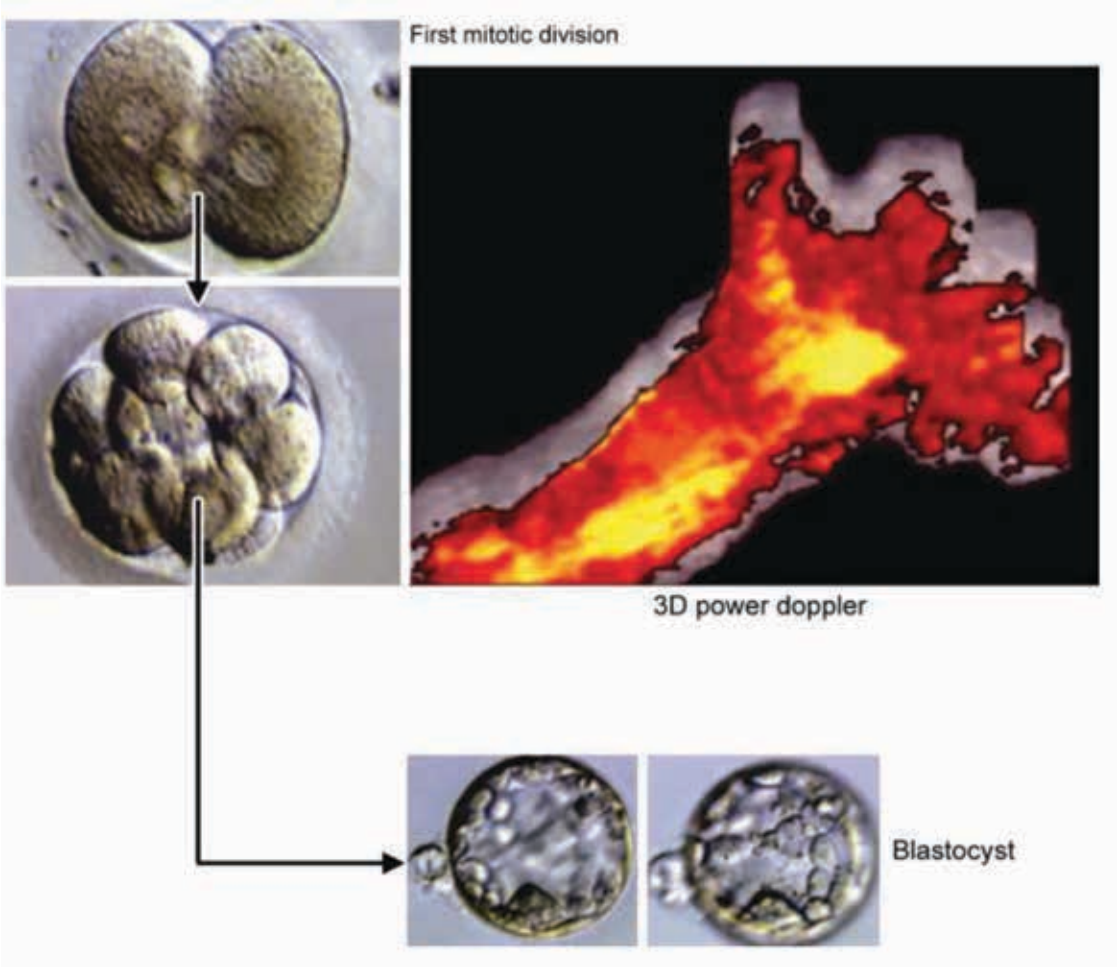


Figure 17. Visualization of the patency of fallopian tube by three-dimensional power Doppler sonography, important for successful first mitotic division and transfer of early embryo to uterus.

5. The product of fertilization may be a tumor, a hydatidiform mole, or chorioepithelioma. Though the mole is alive and of human origin, it is definitely not a human individual or human being. It lacks a true human nature from the start and has no natural potential to begin human development.

A teratoma is another clear instance of cells developing abnormally that results from the product of fertilization, but which could not be considered to be a true human individual with a human nature. It has no potential to develop into an entire fetus or infant. Clearly, the fetus with the teratoma would be a human individual, but not the attached teratoma itself. Obviously, not all the living cells that develop from the conceptus, the early embryo, or the fetus form an integral part of a developing human individual (Serra & Colombo 1998).

DIFFERENT RELIGIOUS TEACHINGS AND HISTORICAL ASPECTS

The Catholic Church's teachings are clearly described in the Introduction Donum Vitae: "A human creature is to be respected and treated as a person from conception and therefore from that same time his (her) rights as a person must be recognized, among which in the first place is the invaluable right to life of each innocent human creature."

In 1997, the Third Assembly of the Pontifical Academy for Life was held in Vatican City. It has been concluded that "at the fusion of two gametes, a new real human individual initiates its own existence, or life cycle, during which – given all the necessary and sufficient conditions – it will autonomously realize

all the potentialities with which he is intrinsically endowed." The embryo, therefore, from the time the gametes fuse, is a real human individual, not a potential human individual. It was even added that recent findings of human biological science recognize that in zygotes resulting from fertilization, the biological identity of a new human individual is already constituted (Mahoney 1984, Johnson 1995).

In Western Europe and in North and South America these opinions are mostly based on Judeo-Christian theology, in Arabian Countries, in Africa, and in Asia prevail the influences of the Islamic and Buddhist religions. Although their approach to the beginning of human life is impressively similar, each of these religions has different attitudes to the problem of embryo research, infertility and its therapy. In a fact, while the Jewish attitude towards infertility is expressed in the Talmud sayings and in the Bible (synthesized in the first commandment of God to Adam "Be fruitful and multiply"), the Christian point of view establishes no absolute right to parenthood. According to the Islamic views, attempts to cure infertility are not only permissible, but also a duty.

Islamic teaching is based on prophet Mohammed description: "The creation of each of you in his mother's abdomen assumes a "nufta" (male and female semen drops) for 40 days, then becomes "alaga" for the same (duration), then a "mudgha" (like a chewed peace of meat) for the same, then God sends an angel to it with instructions. The angel is ordered to write the Sustenance, life span, deeds and whether eventually his lot is happiness or misery, then to blow the Spirit into him" (Human developments as described in Khur'an and Sunnah; Moore, et al. In: Some evidence for the truth of Islam, 1981). The summary of this poetic and sacred description is: Soul breathing "ensoulment" occurs at 120 days of gestation from conception.

To make this religious principle applicable to the practice, the Islamic Jurisprudence Council wrote a Fatwa in 1990 that said: "Abortion is allowed in the first 120 days of conception if it is proven beyond doubt that the fetus is affected with a severe malformation that is not amenable to therapy, and if his life, after being born, will be a means of misery to both him and his family, and his parents agree." so that there is no difficulty for either the prenatal diagnosis, or for the possible termination of pregnancy within the exposed limits.

Buddhism has imposed strict ethics on priests, but it has relatively lenient attitudes toward lay people, so if medical treatment for infertility is available, people should make use of it.

For about two thousand years, the opinions of Aristotle, the great Greek philosopher and naturalist, on the beginning of the human being were commonly held. He argued that the male semen had a special power residing in it, pneuma, to transform the menstrual blood, first into a living being with a vegetative soul after seven days, and subsequently into one with a sensitive soul 40 days after contact with the male semen (Congregation 1988).

Aquinas adopted Aristotle's theory, but specified that rational ensolement took place through the creative act of God to transform the living creature into a human being once it had acquired a sensitive soul. The first conception took place over seven days, while the second conception, or complete formation of the living individual with a complete human nature, lasted 40 days (Ford 1991).

Hippocrates believed that entrance of the soul into the male embryo occurred on the thirtieth day of intrauterine life. It entered into the female embryo on the fortieth day. Actually, this idea was a considerable improvement on the scheme found in the Book of Leviticus, where it is suggested that the soul does not enter the female until forty days after the conception (Beazley 1980).

In short, the rational soul enables the matter to become a human being, an animated body, an embodied soul, a human person.

Harvey's experiments with deer in 1633 proved Aristotle's theory of human reproduction wrong, without himself finding a satisfactory explanation of human conception. After modern scientists discovered the process of fertilization, most people took for granted that human beings, complete with a rational soul, began once fertilization had taken place.

It is clear that the answer to the question "When has the human being actually come to life?" could only be given by combining the cognition of different religions, philosophies and various biological scientific disciplines. There is a very fine line between the competence of science and the one of metaphysics, and it greatly depends on the individual's philosophical principles. Those two, more or less autonomous intellectual disciplines have very often tried dominating one another, or ignoring each other. It is only recently that the majority of scientists and some

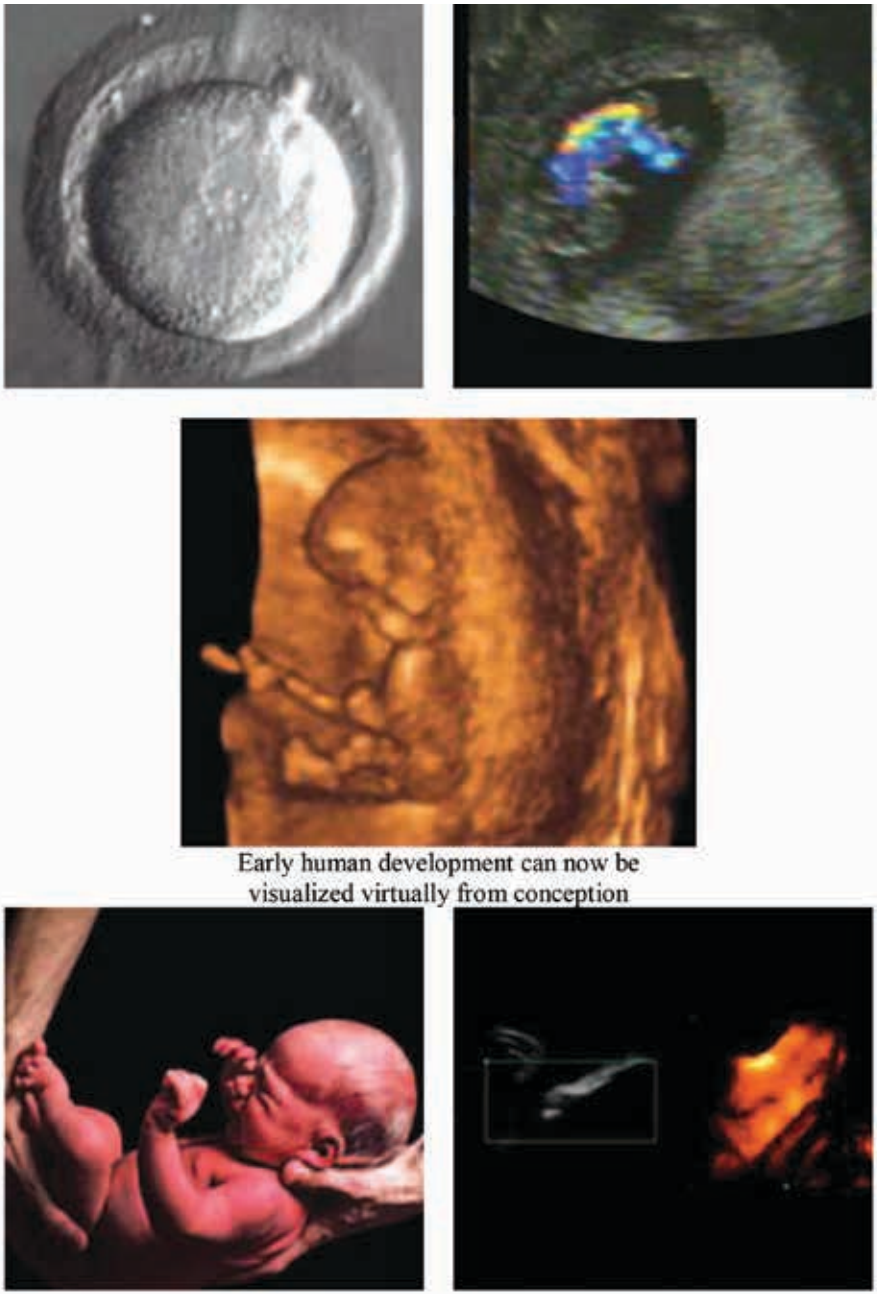


Figure 18. Illustrative example of the use of different medical methods to assess early human development.

theologians have come to realize that the separate meanings of scientific and religious "truths" complement each other, thus representing methodologically independent entities. Current science is not interested in what Nature is, but in the facts that could be stated regarding it, thus trying to explain the term, rather then inventing it. The main difference between science and religion can be seen in the fact that scientific "truths," unlike religious postulates, can and must be experimentally verified and the methods of scientific cognition can be easily explained and learnt. Whereas religion favors irrationality, science prefers an entirely rational approach to matters of importance. Intellectual cognition, when scientifically expressed, usually is in a form of mathematical formulas and presented quantitatively. Contrarily, religion tends to keep its truths in a form of metaphoric expressions, preferring qualitative. Today, there is a tendency, on a higher level, to reopen the dialogue between the science and religion, which was present

at the very beginning of our culture. Religion had existed long before science came to life, but science is not to be thought of as a continuation of the religion. Each discipline should preserve its principles, its separate interpretations and its own conclusions. In the end, both of them represent different components of the one and indivisible culture of mankind.

CLINICAL CONTROVERSIES

There are some clinical controversies pertinent in any discussion of when life begins. Spermatozoa are living cells. They present evidence that they are living by their motility. They are equipped with an effective mechanism for movement in the form of a tail that beats under the control of the cytoplasmic droplets within the head. These living cells, which have been manufactured in the testes, are released into the environment provided by the male reproductive tract. They are not yet capable of fertilization. The spermatozoon must first come under the influence of the male reproductive tract, where it acquires the ability to function in fertilization. Even after ejaculation, it is capable of penetrating the egg, and it is modified further by exposure to the female reproductive tract, taking on the ability or capacity to fertilize. The decision must be made as to whether the spermatozoon is a being (i.e., living and human with the potential for continued life once fertilization has occurred); albeit in another form, it is entitled to the right of protection as a person. Those who deny right for life to the spermatozoon might argue that it is not a complete human cell chromosomally—it contains only the haploid number of chromosomes. Paradoxically, those who take that point of view would insist that an individual born with fewer or more chromosomes

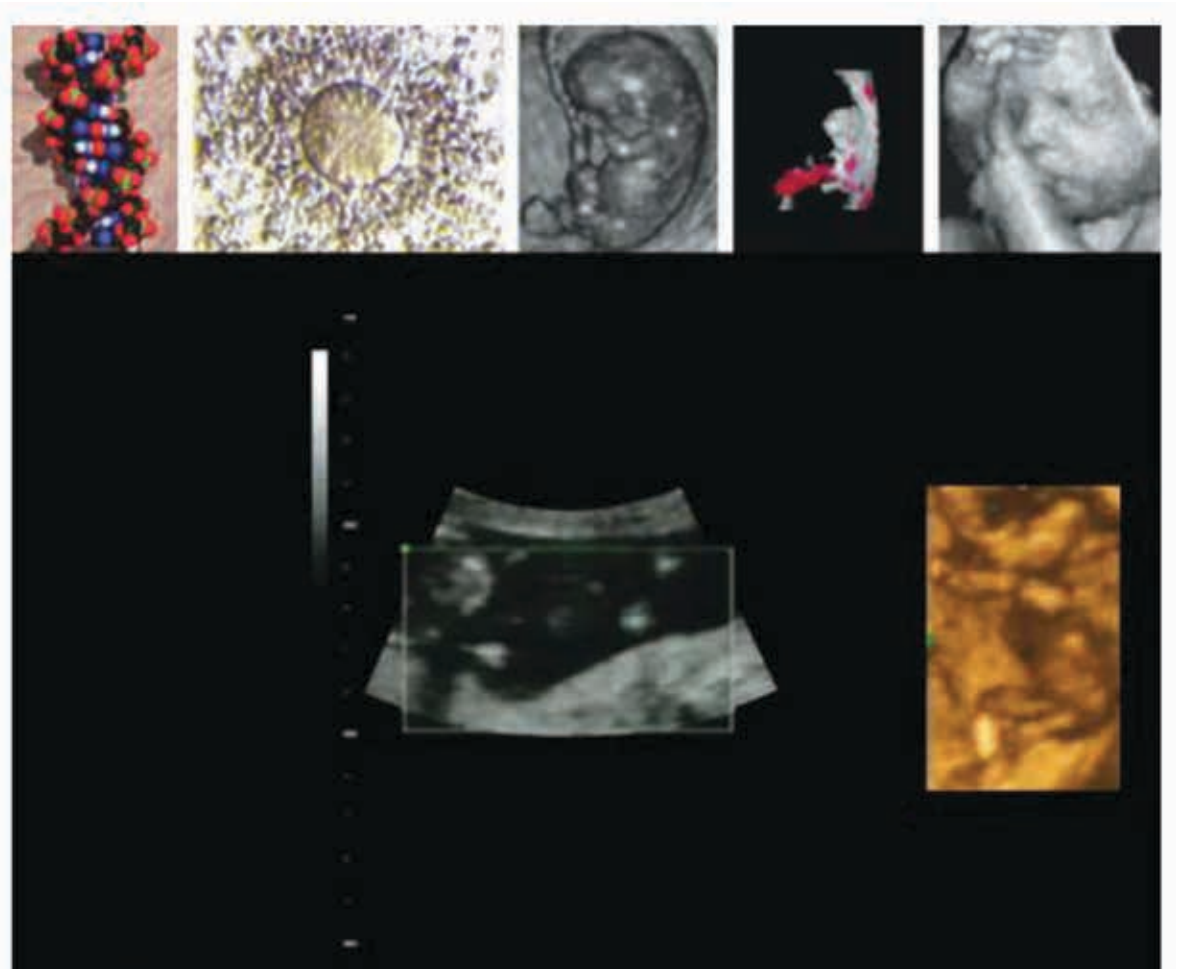


Figure 19. Integrated slide showing continuity of scientific visualization of the beginning of early human development from genetic material to oocyte, morphology of embryo, its vascularization, and fetal behavioral pattern assessed by 4D sonography.

than normal is human and entitled to all the rights of "personhood." As Mastroianni stressed, the decision to base the definition of "human life" solely on the number of chromosomes in a given cell has far-reaching implications (Kurjak 1987).

Furthermore, life has been defined as being terminated when brain activity ends. If we were to say that life begins when brain activity starts, we would be admitting that the definition of the beginning of life is dependent upon technology and not upon ethics or morality.

Some suggested that the beginning of human life requires the neural fusion of the periphery with the center, as well as sufficient development of the brain itself (Mastroianni 1986). Brody formulated the so-called symmetry concept: if the death of a human being requires the death of the brain, the beginning of human life shall correspond with the beginning of the life of the brain, considered to be at day 32 pc (Beller & Reeve 1989). However, Sass has correctly pointed out that fusion is not established anatomically without neurons which form synapses, which would be expected from embryological development at 70 days (8 weeks) pc (Brody 1975).

In this light, let us take for example the accepted definition of birth, which some years ago was described as the complete expulsion of a fetus of 1000 g or 28 weeks of pregnancy. With advances in perinatal and neonatal intensive care, the line was drawn at 500 g, or approximately or 22 weeks of gestation, some years later. This meant that a 20-week-old fetus was not born by definition, even if it was viable. This concept has changed. The same logic applies to a live fetus being accorded the term "life," if we use such definitions as the beginning of brain activity or ultrasonic proof of heartbeat and movement. The establishment of each of these parameters is shifted to an earlier stage year by year by improving technological refinements in electronic and ultrasonic equipment. This leads us to the conclusion that to follow this line of reasoning means to give life, birth, and viability definitions determined by technology. The more advanced the technology, the earlier life begins.

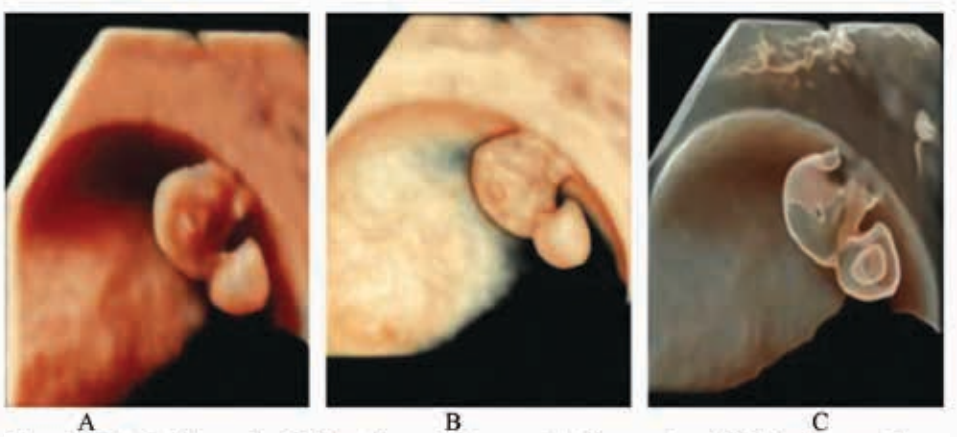
In any consideration of the beginning of human life, it helps to think about when life ends. Let us consider the following: A 2-week-old newborn is hospitalized with massive brain injury suffered in an automobile accident. Despite all measures, no electrical or other brain activity can be detected during the next two days and the child is pronounced dead. Its body parts may survive after its death, as after the death of every person of whatever age. Hair and nails grow for days. Kidneys, heart, liver and other organs may go on living for years if transplanted into another individual. Cells taken soon after death and cultured in a laboratory might live well beyond the 72 or more years this child might have lived, although the life of the infant has ended. The conclusion reached in this case that death of the brain means the end of life, is generally accepted by physicians, courts, and the public (Kurjak 1992).

Returning to the question of when life begins, it is true that the DNA of the fertilized egg has the information necessary to form an individual, but so does virtually every other cell in the body. Nobody would claim full rights for the living cells of the infant killed in the accident, although each has a complete library of DNA. Nor would they for thousands of living skin cells, we loose every time we wash our hands and faces. Is there some stage in the development of the brain that is critical? Or is it the time at which the fetus can survive outside the womb, with or without the support of medical technology? Should we revert to a criterion used for many years, the time of quickening, when one can feel the fetus moving? These are questions still to be answered.

VISUALIZATION OF EARLY HUMAN DEVELOPMENT

Significant advances have been made in recent years in visualizing and analyzing the earliest human development. Most of them have been done by introduction of three-dimensional static and color Doppler and 4D sonography. Many new parameters about early human development are now studied directly by new ultrasound techniques.

Considerable number of biochemical, morphological and vascular changes occur within the follicle during the process of ovulation and luteinization and most of them can be studied by transvaginal ultrasound with color Doppler and 3D facilities (Sass 1994). If the oocyte is fertilized, the embryo is transported into the uterus where under favorable hormonal and environmental conditions, it will implant and develop into a new and unique individual. The introduction of transvaginal color Doppler improved the recognition of blood vessels enabling detailed ex-



Figures 20 A-C. Six weeks HDlive silhouette images. (A) Conventional HDlive image of embryo and yolk sac. (B and C) With gradual increase of silhouette.

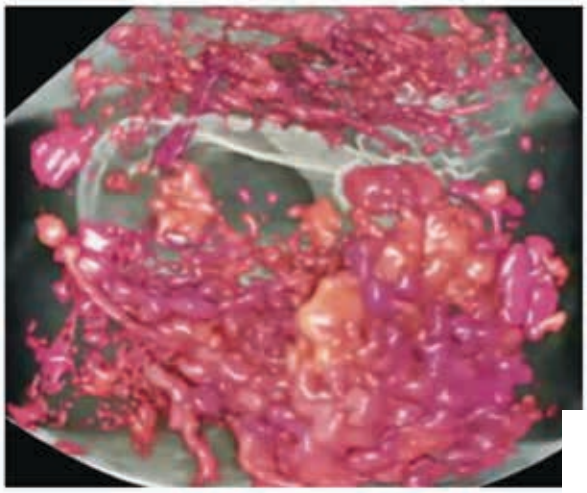


Figure 21. Six weeks HDlive flow image of maternal-embryonal circulation.

amination of small vessels such as arteries supplying preovulatory follicle, corpus luteum and endometrium (McLaren 1986).

Perifollicular vascularization can help in identification of follicles containing high quality oocytes, with a high probability of recuperating, fertilizing, cleaving and implanting, while 3D ultrasound enables accurate morphological inspection and detection of cumulus oophorus. Follicles without visualization of the cumulus by multiplanar imaging are not likely to contain fertilizable oocytes. This information is especially useful in patients undergoing ovulation induction.

Following ovulation, the corpus luteum is formed as the result of many structural, functional and vascular changes in the former follicular wall. Color Doppler studies of the luteal blood flow velocities enable evaluation of the corpus luteum function in second phase of menstrual cycle and early pregnancy. When the placenta takes over the role of production of progesterone, the corpus luteum starts regressing.

After ovulation there is a short period during which the endometrial receptivity is maximal. During these few days, a blastocyst can attach to the endometrium and provoke increased vascular permeability and vasodilatation at the implantation site. Trophoblast-produced proteolytic enzymes cause the penetration of the uterine mucosa and erode adjacent maternal capillaries. This results in formation of the intercommunicating lacunar network – the intervillous space of the placenta. A small intradecidual gestational sac can be visualized by transvaginal sonography between 32 and 34 days (Kupesic 1996).

The secondary yolk sac is the earliest extraembryonic structure normally seen within the gestational sac in the beginning of the 5th gestational week. The yolk sac volume was found to increase from 5 to 10 weeks' gestation. When the yolk sac reaches its maximum volume at around 10 weeks, it has already started to degenerate, which can be indirectly proved by a significant reduction in visualization rates of the yolk sac vascularity (Ford 1991). Therefore, a combination of functional and volumetric studies by 3D power Doppler helps to identify some of the most important moments in early human development.

The embryonic heart begins beating on about day 22–23, accepting blood components from the yolk sac and pushing blood into the circulation. The em-

Figure 22. Ten weeks HDlive silhouette image of embryo and amnion.

bryonic blood begins circulating at the end of the 4th week of development. The start of the embryo-chorionic circulation changes the source of nourishment to all intraembryonic tissues. The survival and further development of the embryo become dependent on the circulation of embryonic/fetal blood. If the embryo-chorionic circulation does not develop, or fails, the conceptus is aborted. The embryo cannot survive without the chorion (placenta) and the chorion will not survive without the embryo. Avascular degenerated chorionic villi constitute the hydatidiform mole.

Within the embryo, there are three distinct blood circulatory systems (Jirasek 2001):

1. Vitelline circulation (from yolk sac to embryo)
2. Intraembryonic circulation
3. Two umbilical arteries (from embryo to placenta -fetoplacental circulation).

It is possible to visualize and assess them virtually from conception (Kupesic et al. 1999, Kurjak et al 1992b, Kurjak & Kupesic 1997, Kurjak et al. 1998, Kurjak & Kupesic 1999a).

At 5 weeks from the maternal side of placenta, it is possible to obtain simultaneous three-dimensional imaging of the developing intervillous circulation during the first trimester of pregnancy. Three-dimensional power Doppler reveals intensive vascular activity surrounding the chorionic shell starting from the first sonographic evidence of the developing pregnancy during the 5th week of gestation.

At 7 weeks, three-dimensional power Doppler images depict aortic and umbilical blood flow. Initial branches of umbilical vessels are visible at the placental umbilical insertion.

During the 8th—9th week, developing intestine is being herniated into the proximal umbilical cord.

At 9 to 10 weeks, herniation of the mid-gut is present. The arms with elbow and legs with knee are clearly visible, while feet can be seen approaching the midline.

At eleven weeks, three-dimensional power Doppler imaging allows visualization of the entire fetal and placental circulation (Figs 6, 9, 10 and 12).

During the 11th-12th week of pregnancy development of the head and neck continues. Facial details such as nose, orbits, maxilla and mandibles are often visible. Herniated mid-gut returns into the abdominal cavity.

NEW POSSIBILITIES FOR STUDYING EMBRYONIC MOVEMENTS AND BEHAVIOR

The latest development of 3D and 4D sonography enables precise study of embryonic and fetal activity and behavior (Fig. 13) (Kurjak et al. 1999b). With four-dimensional ultrasound, movements of head, body, and all four limbs and extremities can be seen simultaneously in three dimensions (Lee 2001). Therefore, the earliest phases of the human anatomical and motor development can be visualized and studied simultaneously (Figs 13, 14, 18 and 19). It is clear that neurologic development – early fetal motor activity

and behavior needs to be re-evaluated by this new technique (Campbell 2002, de Vries et al. 1982, de Vrie et al. 1985). Our group studied the development of the complexity of spontaneous embryonic and fetal movements (Kurjak et al. 2002). With the advancing of the gestational age, the movements become more and more complex. The increase in the number of axodendritic and axosomatic synapses between 8 and 10, and again between 12 and 15 weeks (Kurjak et al. 2003b, Okado & Kojima 1984) correlates with the periods of fetal movement differentiation and with the onset of general movements and complex activity patterns, such as swallowing, stretching and yawning, seen easily by 4D technique. By 7–8 weeks of pregnancy, gross body movements appear. They consist of changing the position of the head towards the body. By 9–10 weeks of pregnancy, limb movements appear. They consist of changing the position of the extremities towards the body without the extension or flexion in elbow and knee. At 10–12 weeks of pregnancy, complex limb movements appear. They consist of changes in the position of limb segments towards each other, such as extension and flexion in elbow and knee (Fig. 14).

Between 12–15 weeks of pregnancy, swallowing, stretching and yawning activities appear. In addition to these activities, it is now feasible to study by 4D ultrasound a full range of facial expression including smiling, crying and eyelid movement (Fig. 15).

It is hoped that the new 4D technique will help us have a better understanding of both the somatic and motoric development of the early embryo. It will also enable the reliable study of fetal and even parental behavior (Lee 2001).

There were recently number of papers on new attractive techniques for visualization of early human development (Kurjak et al. 2007a, Kurjak et al. 2007b, Kurjak et al. 2008, Pooh & Kurjak 2009, Pooh et al. 2011, Pooh & Kurjak 2012, Kurjak et al. 2016a, Kurjak et al. 2016b, Kurjak 2017, Pooh & Kurjak 2015, Kurjak et al. 2018).

CONCLUSION

The question of when a human life begins and how to define it, could be answered only through the interconnecting pathways of history, philosophy, medical science and religion (Fig. 16 to 19). It has not been easy to determine where to draw the fine line between the competence of science and metaphysics in this delicate philosophical field. To a large extent the drawing of this line depends on one's fundamental philosophical outlook. To quote Beller: "The point at which human life begins will always be seen differently by different individuals, groups, cultures, and religious faiths. In democracy, there are always at least two sides, and the center holds only when the majority realizes that without a minority, democracy itself is lost. The minority in turn must realize its best chance lies in persuasion by reason and thoughtfulness rather than fanaticism." (Beller & Zlatnik 1995).

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SAŽETAK

Kontroverza početka ljudskog života – znanost i vjera su sve bliže

Jedna od najkontroverznijih tema u suvremenoj bioetici, znanosti i filozofiji je početak pojedinačnog ljudskog života. U ovoj naizgled beskonačnoj debati, koju snažno potiče nedavni tehnološki napredak u polju ljudske reprodukcije, postalo je nužno iznaći sintezu između znanstvenih podataka i hipoteza, filozofske misli te pitanja društvenih znanosti kako bi se riješili etički, pravni i društveni problemi. Nadalje, u ovom polju postoji snažno iskušenje da od znanosti traži da odabere između mišljenja i uvjerenja, koja se međusobno poništavaju. Pitanje kada ljudski život počinje traži nužnu pomoć drugačijih oblika znanja. Nalazimo se na raskršću između znanosti i religije koje je potrebno pažljivo istražiti.

Suvremena bioetika i znanost snažno su zainteresirane za ljudski život na oba kraja njegova postojanja (rođenje i smrt), no druge znanosti (npr. Filozofija, tehnologija, psihologija, sociologija, pravo i politika) gledaju na početak ljudskog života s drugih gledišta. No, bioetičke teme poput ove se ne mogu sagledavati samo iz jedne perspektive (npr. Biološke, filozofske ili vjerske) jer dobiveni zaključci neće biti zadovoljavajući ili reduktivni. Ovu stvarnost bi trebalo sagledati u punini: embrij biologu i genetičaru pruža obilje materijala za razmišljanje, no budući da govorimo o početku ljudskog života, potreban je filozofsko antropološki pristup i sukob s teologijom; kako bi ga zaštitili moramo uključiti etiku i pravo, a kako bi iskusili i istraživali društveno ponašanje potrebno je sudjelovanje drugih disciplina kao što su povijest medicine i sociologija.

Teško je odgovoriti na pitanje od kada bi trebalo pravno zaštititi ljudski život. Od trenutka začeća? Od trenutka usađivanja? Od rođenja? U svim zemljama (uz izuzetak Irske i Lihtenštajna) pravna razmatranja počivaju na Rimskom pravu. Rimsko građansko pravo kaže da fetus stječe prava kad se rodi ili ako će se roditi – nasciterus.

Mali broj zemalja se slaže s definicijom da ljudska osobnost nastaje u trenutku začeća. Većina ljudskom embriju in vitro (tj. U 14 dana nakon oplodnje) ne daje legalni status. No, usprkos odsustvu legalnih prava, nema poricanja da embrij predstavlja početak ljudskog života, da je član ljudske obitelji. Stoga, koji je god prevladavajući stav, svaka zemlja mora preispitati koje su prakse spojive s poštivanjem tog dostojanstva i zaštitom ljudskog genetskog materijala.

Pitanje kad započinje ljudski život i kako ga definirati može dobiti odgovor jedino kroz među povezane puteve povijesti, filozofije, medicine i religije. Nije lako odrediti gdje povući osjetljivu granicu između kompetencije znanosti i metafizike u ovom osjetljivom filozofskom pitanju. Povlačenje te granice u velikoj mjeri ovisi o temeljnom filozofskom gledištu pojedinca. Različiti pojedinci, grupe, kulture i religije će na trenutak u kojem počinje ljudski život uvijek različito gledati. U demokraciji uvijek postoje barem dvije suprotstavljene strane, a opstanak centra je moguć tek kad većina shvati da bez postojanja manjine nestaje i sama demokracija. Manjina pak mora shvatiti da razumno i pažljivo uvjeravanje donosi više koristi od fanatizma.

Ključne riječi: 4D sonografija, znanstvene i religiozne proturječnosti, etika, legalni status nerođenih

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LIMITS OF VIABILITY: SHOULD WE PLAY GOD?

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SUMMARY

Aim is to show that the definition of the infants born at the limits of viability within the countries is dependent on the social and medical conditions in which the infant is born, and even in one country in which neonatal intensive care is available, it depends on the place of birth and organization of perinatal care.

With decreasing gestational age mortality, short- and long-term morbidity of preterm infants are increasing while their survival to discharge is decreasing. It is questionable how to define viability and where the limit of viability can be set. The definition of the limits of viability is not quite clear. There are at least two ways of understanding it: the first, defining the gestational age and/or birth weight at which human fetus has the capability of survival outside the uterus; and the second, gestational age and/or birth weight at which more than 50% of infants survive to discharge home from the hospital. While in developing countries infants of less than 28 weeks of gestation without neonatal intensive care have 95% probability of dying, survival of infants between 22 and 25 gestational weeks in developed countries is reaching 90%.

Up to now the definition of the limits of viability has not be established, and precise definition of viability scientifically has not been produced yet. Currently, the World Health Organization sets lower limit of viability at 22 weeks of gestation, or 500 g birth weight, or 25 cm of birth length. The universal definition of the limit of viability is probably not possible, because of its variability from one individual to the other, from one setting to the other and from one community to the other.

Key words: fetus, viability, survival, neonatal intensive care, morbidity, mortality

INTRODUCTION

Preterm birth is any birth occurring before 37 weeks of gestation or 259 days of pregnancy with the global rate of 10.6% with lowest rate in Europe (8.7%) and highest in North Africa (13.4%) (Chawanpaiboon et al. 2014, Vogel et al. 2018). The country with more than 3.5 million of premature babies in a year is India, followed by China with 1.5 million out of 14.8 million of premature babies born every year in the world (Chawanpaiboon et al. 2014, Vogel et al. 2018). The baby can be born between 32 and <37 gestational weeks (GW) (accounting for 84.7% of entire population of premature babies), 28 and <32 GW (accounting for 11.3% of premature babies), and <28 GW (accounting for 4.1% of premature babies) (Chawanpaiboon et al. 2014, Vogel et al. 2018). The categories of premature and term infants are given in the table 1 for better understanding (Glass et al. 2015). Extremely preterm infant account for less then 1% of all births and moderate preterm babies account for more then 60% of infant mortality (Glass et al. 2015).

With decreasing gestational age mortality, survival to discharge, short- and long-term morbidity of preterm infants are increasing. It is questionable how to define viability and where the limit of viability can be set. The definition of the limits of viability is not quite clear. There are at least two ways of

Label	Definition (completed gestation in weeks)
Extremely Preterm	< 28
Very Preterm	28 to <32
Moderate Preterm	32 to <34
Late Preterm	34 to <37
Early-Term	37 to <39
Term	38 to <41
Late-Term	41 to <42
Post-Term	>42
Small for gestational age (SGA)	Weight less than 10th percentile for gestational age
Large for gestational age (LGA)	Weight greater than 90th percentile for gestational age
Very low birth weight (VLBW)	Less than 1500 g
Extremely low birth weight (ELBW)	Less than 1000 g

Table 1. Terminology of prematurity (Glass et al. 2015)

understanding it: the first, defining the gestational age and/or birth weight at which human fetus has the capability of survival outside the uterus; and the second, gestational age and/or birth weight at which more than 50% of infants survive to discharge home from the hospital (El-Metwally et al. 2000, Seri & Evans 2008, Mercurio & Drago 2019). Historically, limits of viability dropped from 2200 g in 1900s to 600 g in 2000s (Obladen 2011, Stanojevic 2018). World Health Organization (WHO) set the limit of viability in 1993 at 500 g, 25 cm of the birth length, and/or 22 gestational weeks (GW) and above, with the obligation to register these newborns as infants not abortions (Obladen 2011, WHO 2011, Stanojevic 2018). Historically, the registration of infants born at the limits of viability was not universal and many of them were not registered (Tzoumaka-Bakoula 1987, Obladen 2011, WHO 2011, Stanojevic 2018). On the other hand, in the developed countries if the infant is born at 28 GW, it has 95% of the probability to dye if neonatal intensive care is not available (Blencowe et al. 2012). Only 1% of infants born at 28 GW in the world have access to the neonatal intensive care (Blencowe et al. 2012). Without any doubt, the treatment of infants at 28 GW without lethal congenital malformations in developed counties is obligatory, with survival to discharge of more than 90% (Stoll et al. 2015 Lemos A, et al. 2020 Rysavy et al. 2021).

The aim of the paper is to show that the definition of the infants born at the limits of viability within the countries is dependent on the social and medical conditions in which the infant is born, and even in one country in which neonatal intensive care is available, it depends on the place of birth and organization of perinatal care.

DEFINITION OF THE LIMITS OF VIABILITY

Certain gestational age or certain birth weight at which the survival to discharge is above 50% could be one of the definitions of the limits of viability (El-Metwally et al. 2000). At the beginning of 20th century, it was concluded that defining limits of viability using gestation and body measures should be avoided, because it could encourage withholding life-saving support to infants believed to be unviable (Obladen 2011). Introduction of the brain development and consciousness to the definition of the limits of viability made even more confusion because it was not easy to define the consciousness and to set the limit when the brain development has achieved a minimum level of consciousness (Obladen 2011). It could be concluded that up to the present days the definition of the limits of viability has not be established, and that precise definition

of viability scientifically has not been produced yet (Obladen 2011). Currently, the WHO sets lower limit of viability at 22 weeks of gestation, or 500 g birth weight, or 25 cm of birth length, at least for perinatal statistics. The 10th revision of the International Classification of Diseases describes perinatal period as starting at 22 completed weeks (WHO 2011) The concept of viability is variable, sometimes meaning the gestational age, weight, or length at which the smallest known infant survived, while sometimes meaning the stage at which specified percentage of infants survived with the assistance of given technological and other therapeutic means (Pignotti 2010, Obladen 2011). Technological and therapeutic resources essential for the survival of infants at the limits of viability are not available equally in the world, so viability involves social and economic issues as well (Pignoti 2010, Obladen 2011). Sometimes to be viable means to be discharged alive from the hospital regardless of the quality of life which, is important at least for the survivors and their parents (Pignoti et al. 2021). The universal definition of the limit of viability is probably not possible, because of its variability from one individual to the other, from one setting to the other and from one community to the other (Pignoti 2010, Obladen 211). Therefore, it should be described statistically as a survival curve for specific gestation or birthweight for certain institution or other location for the specified period (Pignoti 2010, Obladen 2011, Chow et al. 2015). Human viability, defined as gestational age at which the chance of survival is 50%, is currently approximately 23 to 25 weeks in developed countries. Infant girls, on average, have better outcomes than infant boys (Glass et al. 2015 Brumbaugh et al. 2019). From the neonatologist point of view, viable infants are those whom most of the clinicians would treat, while nonviable are those whom most of the clinicians would not treat, and those in between are so called gray zone (Bucher et al. 2018 Silberberg et al. 2018). In so called gray zone the treatment of infants is optional and has been set at 22-23 weeks (Japan, Germany, Sweden), 23-24 weeks (United Kingdom, USA, Canada), 24-26 weeks (France, Netherlands, Switzerland), at 25 weeks in Argentina, and at 23 weeks in the Czech Republic (Obladen 2011, Domellöf & Jonsson 2018, Silberberg et al. 2018 Šimják et al. 2018). Recently in the USA recommendation on resuscitation, the limit at which it should be initiated was set at 22 GW (American College of Obstetricians and Gynecologists & Society for Maternal-Fetal Medicine 2017, Chen et al. 2021). There were substantial differences in terms of the initiation of intensive care and/or resuscitation of the infants at the limits of viability between neonatologists, neonatal nurses, and obstetricians (Geurtzen et al. 2016, Bucher et al. 2018). The differences between obstetricians and neonatologists were investigated when counselling the parents on the issue of the limits of viability, with heterogeneity in prenatal counselling, the differences between preferred counseling and actual practice (Geurtzen et al. 2017, Geurtzen et al. 2018a Geurtzen et al. 2018b, Reed et al. 2020).

LIMITS OF VIABILITY: HISTORICAL AND CONTEMPORARY PERSPECTIVE

Although fetal viability should be considered as the intrinsic probability of the fetus to survive outside the uterus, nowadays it is still only the function of the technological and biomedical capabilities which are different in different parts of the world, meaning that understanding of the viability is not universal (Breborowicz 2010). As it was already pointed out, in the period of 130 years (from 1876 to 2006) the limit of viability dropped from the birth weight of 2200 g to 600 g (Obladen 2011). In the period of 30 years, survival of infants at the limits of viability in Sweden has changed considerably, as shown in the Figure 1 (Domellöf & Jonsson 2018). Neonatal survival above 50% at 26 GW was reached in 1985, while nowadays more than 90% of that infants survive (Domellöf & Jonsson 2018). Survival of more than 50% of infants born after 25 GW was reached in the years 1991-1992 while for 24 GW survival above 50% was observed in the years 1995-1996 (Domellöf & Jonsson 2018). In the period from 2004 to 2007 infants of 23 weeks reached the survival above 50%, while at 22 GW survival of more than 50% was observed in the period 2013-2014 (Domellöf & Jonsson 2018). Similar data have been published for the period of 25 years in industrialized countries (Glass et al. 2015). It is obvious from the Figure 1 that infants at 22 GW were not followed and registered systematically till the period 2004 to 2007 (Domellöf & Jonsson 2018).

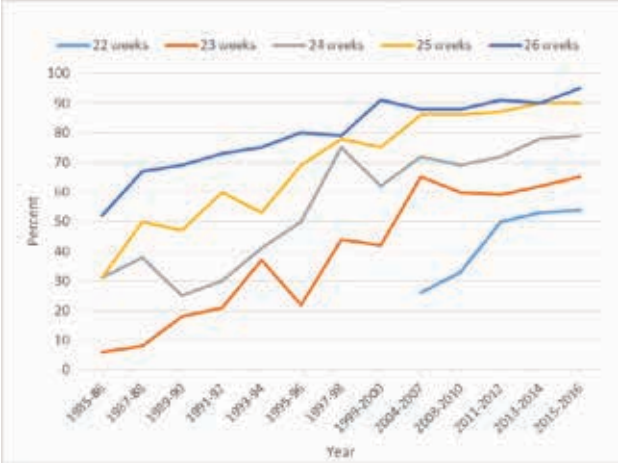

Figure 1. Neonatal survival of extremely preterm, live-born infants at 22 to 26 completed weeks' gestation in Sweden between 1985 and 2016 by gestational age and year of birth. Data are from the Swedish Birth Registry (1985–2000), the Extremely Preterm Infants in Sweden Study (EXPRESS) (2004–2007), and the Swedish Neonatal Quality Register (SNQ) (2008–2016). Data from the EXPRESS and SNQ are based on infants who were admitted to the neonatal unit (Domellöf & Jonsson 2018)

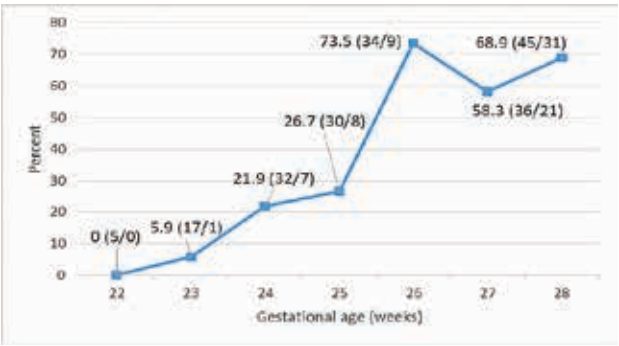

Figure 2. Survival to discharge of infants born at the Neonatal Unit Department of Obstetrics and Gynecology Medical School University of Zagreb, Clinica Hospital "Sveti Duh", Zagreb, Croatia in the years 2003 to 2017 (numbers in brackets: number of liveborns / survivors to discharge)

Figure 2 is showing the data on survival to discharge of inborn infants treated at the Neonatal Unit, Department of Obstetrics and Gynecology Medical School University of Zagreb, Clinical Hospital "Sveti Duh", Zagreb, Croatia in the years 2003 to 2017. The number of liveborn infants in the 15 year period are presented as the first number in the brackets, while the number after slash presents te infants who survived to discharge. Numbers are small and it is possible that some liveborn infants from 22 to 24 weeks of gestation were not registered. If the data are compared with the data from the Figure 1, the results in Zagreb are worse: the same as they were 30 years ago in Sweden for all infants born at the limits of viability. Croatian national data on the survival of infants born at the limits of viability regarding their gestational age are not available, which is the reason why the data from one center are presented. From the national Croatian data for the year 2018, there were no survivors to discharge with the birthweight below 500 g (all 13 liveborns died in the early neonatal period), while for the infants between 500 g and 999 g 52.3% (69 out of 132 liveborn) survived to discharge, and for the group between 1000 g and 1499g survival to discharge was 93% (Filipović-Grčić et al. 2019).

If we look at the data from developing countries, then in one center in the ten-year period (from 2005 to 2014) the survival rate of infants with birth weight of less than 1500 g was only 18%, while no survivors were found in the group below 750 g at birth (Abdulkadir et al. 2015). In Ghana, the mortality rate of extreme preterm infants (below 26 weeks of gestation) in the period from 2011 to 2015 was 80.2% (survival to discharge 19.8%), while for the infants of gestational age from 26 to 27 weeks it was 68.9% (survival to discharge 31.1%) (Sackey & Tagoe 2019,). In recently published Ethiopian study (covering period from 2014 to 2017) mortality rate of premature infants above 28 weeks of gestation was 50.8% (Seid et al. 2019). In the study of the literature on the mortality rates at the limits of viability in developed and developing countries, it was concluded that the mortality rates ranged from 4 to 46% in developed countries and 0.2 to 64.4% in developing countries, meaning that they remain high in developing and in developed countries (Chow et al. 2015).

DEVELOPMENT OF THE CARE FOR INFANTS AT THE LIMITS OF VIABILITY

It is obvious that development of medical and perinatal care in particular enabled better survival of the infants at the limits of viability (Glass et al. 2015). Antenatal use of corticosteroids and magnesium sulphate improved the survival of those infants sub-

stantially (Shepherd et al. 2018, Wolf et al. 2020). Development of artificial ventilation and oxygen use, exogenous surfactant, targeted oxygen therapy, prophylactic methylxanthines and some other therapeutic modalities influenced positively outcome of those tiny infants, while postnatal corticosteroid use in the first week of life, ethamsylate versus placebo for prevention of morbidity and mortality in preterm or very low birthweight infants, volume expansion versus no treatment, gelatin versus fresh frozen plasma for prevention of morbidity and mortality in very preterm infants, prophylactic indomethacin versus placebo for preventing mortality and morbidity in preterm infants did prove to be effective based on evidence (Shepherd et al. 2018, Wolf et al. 2020). There are some experimental trials on the use of new promissing therapeutic modalities for infants at limits of viability like artificial uterus or placenta (Charest-Pekeski et al. 2021). Historical perspective of the therapeutic modalities for care of infants at the limits of viability in developed countries is shown in the Table 2 (Glass et al. 2015, Charest-Pekeski et al. 2021).

Short and long-term outcome of infants at the limits of viability

In developed countries we are witnessing lowering the gestational age at which neonates at the limits of viability are surviving, while in developed world infants below 28 GW are not counted at all in perinatal statistics, because the probability of their survival without neonatal intensive care is virtually not possible (Blencowe et al. 2012, Ceriani Cernadas 2018). These data are the result of huge inequity between developed and developing world, which can be illustrated by the fact that time for developing countries to reach the same chance of neonatal survival as in 2012 for newborn babies in high-income countries, based on average annual rate of reduction from 2000–12 was 110 years for sub-Saharan Africa (Lawn et al. 2014).

For the purposes of counselling the parents of those infants in developed world, it is important to have the information on the short- and long-term outcome of the infants at the limits of viability (Geurtzen et al. 2018). Short- and long-term adverse outcome, postnatal growth restriction and increased prevalence of cardiovascular diseases in adulthood of infants born at the limits of viability remained unsolved, raising many medical, legal, and ethical issues (Farooqi et al. 2006, Jarjour 2015, Källén et al. 2015, Stoll et al. 2015). The most important for those surviving infants and their families and for the entire society is the issue of the quality of life without major disability and significant health problems later in life. Although ethical principles are universal, they could not be applied to the same way in all neonatal intensive care units (NICUs) within one country, while the variations are even more emphasized in developed and developing world (Chow et al. 2014, Owens et al. 2015). Survival to discharge without major morbidity in one recent study did not changed in the 22 years, and the change for the entire group of infants from 22 to 28 GW was 21% in the year 1990 and 29% in the year 2012, but if we look at the group of infants between 22 and 25 GW, then the percentages of infants without major morbidity are decreasing (Stoll et al. 2015). In recently published Swedish study, they concluded that the Swedish proactive approach to care at the border of viability has not resulted in an increased

Treatment method	Year of development
CPAP, Mechanical Ventilation	1980s
Exogenous Surfactant	Early 1990s
Antenatal Steroids	Mid/Late 1990s
Avoiding Postnatal Steroids	Early2000s
Targeted Oxygen Therapy	Mid 2000s
Artificial uterus and/or placenta	Experimental only on animal models

Table 2. Historical perspective of the therapeutic modalities for care of infants at the limits of viability in developed countries (Glass et al. 2015, Charest-Pekeski et al. 2021)
CPAP = Continuous positive airway pressure

proportion of functional impairment among survivors (Domellöf & Jonsson 2018).

In the review of literature on the neurodevelopmental outcome of infants at the limits of viability, the rates of surviving unimpaired or minimally impaired are 6% to 20% for live-born infants at ≤25 weeks' gestation and <5% for infants born at 22 and 23 weeks' gestation (Jarjour 2015). Figure 3 shows that in different studies from three developed countries (USA, Sweden and Unitd Kingdom), the data on the mild, moderate and severe disability are very similar, and they are dependent on gestational age. With decreasing gestational age number of infants with the disabilities is increasing (Moore et al. 2012, Serenius et al. 2013, Rysavy et al. 2015, Patel 2016).

Long-term disability like intellectual disability (5% to 36%), cerebral palsy (9% to 18%), blindness (0.7% to 9%), and deafness (2% to 4%) occurring later in life of the infants at the limits of viability are influencing their quality of life (Jarjour 2015). Milder degrees of disability involving cognition, behavior, and learning are increasingly recognized among older preterm children, teens, and young adults (Jarjour 2015). Besides neurodevelopmental disability, there is also the problem of postnatal growth restriction affecting at least in the first 12 years of life weight, height, and particularly head growth with significant growth delay expressed as 20% of children throughout the whole period of 12 years having smaller head circumference compared to their term born counterparts (Farooqi et al. 2006). It has been published that the percentage of infants with special educational needs is increasing with decreasing gestational age, which is shown in the Figure 4 (MacKay et al. 2010). The highest rates are for infants at the lower limit of viability from 22 to 25 gestational weeks (MacKay et al. 2010).

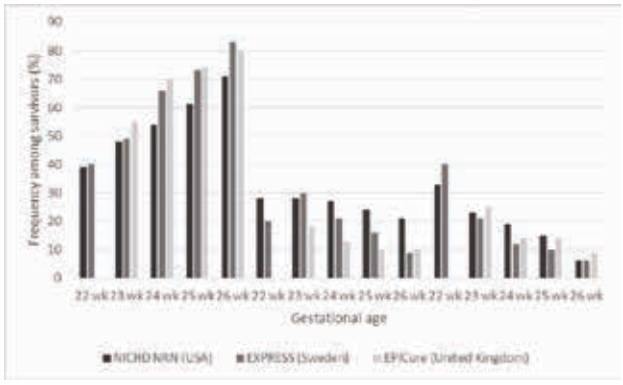

Figure 3. The spectrum of disability among surviving exremely preterm infants (NICHD, National Institute of Child Health and Human Development; NRN, Neonatal Research; EXPRESS, Extremely Preterm Infants in Sweden Study;) (Moore et al. 2012, Serenius et al. 2013, Rysavy et al. 2015, Patel 2016)

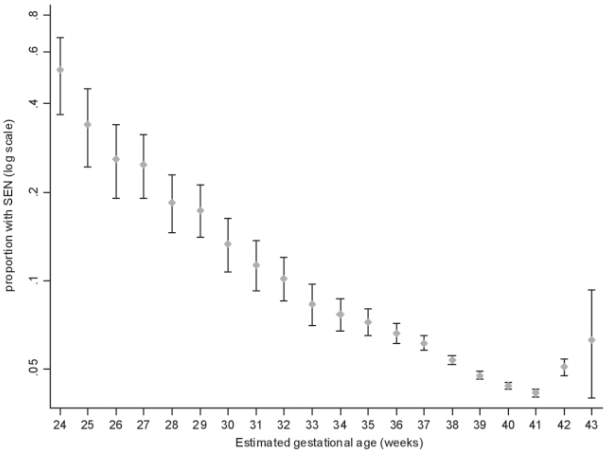

Figure 4. Special educational needs (SEN) of infants at the lower limit of viability (MacKay et al. 2010)

ETHICAL DILEMMAS IN THE CARE FOR INFANTS AT THE LIMITS OF VIABILITY

If there is a threatened preterm labor at the limits of viability either due to the maternal or fetal conditions, many ethical dilemmas arise even prenatally (van Eerden et al. 2014, Källén et al. 2015, Ceriani Cernadas 2018). In the Dutch study the termination of pregnancy due to the maternal indications occurred at the average gestational age of 24 weeks and 3 days in 1 per 1000 pregnancies in the ten-year period, with the overall perinatal mortality of 99.4% (van Eerden et al. 2014). In the Swedish study several obstetric factors influenced the outcome of infants at the limits of viability like delivery by the Cesarean Section lowering the risk of death in the first day of life but not later, prenatal corticosteroid decreasing the risk of death in the first 365 days of life, while the risk of mental developmental delay was increased after vaginal breach delivery (Källén et al, 2015). Interventions for extremely preterm infants bring up many ethical

questions: to resuscitate or not to resuscitate, to treat or not to treat, is intensive care indicated, how to prevent severe morbidity, and many others. If guidelines for intervention in the "periviable" period are available, then infants are categorized using predefined categories, such as "futile," "beneficial," and "gray zone" based on completed 7-day periods of gestation; however, such definitions often differ among countries (Dupont-Thibodeau et al. 2014). As emphasized before, it is questionable to use the gestational age as the criterion for the definition of viability, which should be more thoroughly discussed from the ethical point of view (Dupont-Thibodeau et al. 2014). If some decision like life-sustaining treatment is to be made, then prognostic information should be as precise as possible. While trying to define prognosis, we will face other very severe obstacles like how to define severe disability and how to accurately predict late outcome (Dupont-Thibodeau et al. 2019). This may prevent professionals from producing precise guidelines for the care of infants at the limits of viability, because they are based on imprecise data (Dupont-Thibodeau et al. 2019). These data are expressing the inability of healthcare professional to make precise, accurate and practically applicable guidelines from the ethical point of view, while the situation is even worse when trying to perceive the decisions from the parental point of view (Stanak & Hawlik 2019). For the doctors it is always very important to give the information, which is empathetic, sincere, and as accurate as possible, and not influenced by medical providers believes (non-directive counselling) (Geurtzen et al. 2018b). That kind of counselling or decision making is not easy at all, because it is connected with many dilemmas: do we try to save these babies knowing that our procedures are likely to be unsuccessful, or do we provide just a comfort care for them with the consciousness that we may allow some babies to die who might have been saved (Brunkhorst et al. 2014). Proposed by Brunkkhorst et al. ten suggestions for the doctors caring for the babies at the limits of viability seem practically applicable, accurate and to the point (Brunkkhorst et al. 2014):

(1) accept that there is a 'gray zone' during which decisions are not black and white;
(2) do not place too much emphasis on gestational age;
(3) dying is generally not in an infant's best interest;
(4) impairment does not necessarily equal poor quality of life;
(5) just because the train has left the station doesn't mean you can't get off;
(6) respect powerful emotions;
(7) be aware of the self-fulfilling prophecies;
(8) time lag likely skews all outcome data;
(9) statistics can be both confused and confusing;
(10) never abandon parents.

Although it is expected from medical professionals to be objective and to make counselling without emotions, sometimes it is not likely to be achieved. On the other hand, the parents are using probabilities and medical data, which are not the main decision-making tool, because emotions like fear, concern, regret, hope, quality of life, personalized and individualized approach are essential (Janvier et al. 2014). The example of the end-of life decision making process for the infants at the limits of viability can be given as useful for the communication with parents, including the following issues according to Janvier et al. (Janvier et al. 2014):

(1) What is the Situation? Is the baby imminently dying? Should withholding or withdrawing life-sustaining interventions be considered?
(2) Opinions and options: personal biases of healthcare professionals and alternatives for patients.
(3) Basic human interactions.
(4) Parents: their story, their concerns, their needs, and their goals.
(5) Information: meeting parental informational needs and providing balanced information.
(6) Emotions: relational aspects of decision making which include the following: emotions, social supports, coping with uncertainty, adaptation, and resilience.

The situation concerning the education of trainees in neonatology on the issues of counseling patients at the limits of viability in Europe is worrisome, because only 7% of them got some education, while the others are not aware even of the mortality data (Geurtzen et al. 2016).

RIGHT OF THE NEWBORN TO BE BORN IN THE BEST POSSIBLE CONDITIONS

According to the articles 6 and 24 of the Convention on the Rights of the Child, every child has the inherent right to life and to the enjoyment of the highest attainable standard of health (WHO 1989, Eidelman

2005, Yu 2005). Twenty five years ago in the developed countries there was a tendency for both obstetricians and pediatricians to underestimate the potential for survival and to overestimate the risks for disability for infants at the limits of viability (Eidelman 2005, Yu 2005). In accordance with the principles from the Convention, the practice of conservative approach of withholding neonatal resuscitation or delaying intensive care should be changed to a proactive approach that results in early intensive care becoming more available to a larger proportion of these preterm infants, because, according to the recent data, more proactive treatment is not increasing the proportion of functional impairment among survivors (Silberberg et al. 2018, Domellöf & Jonsson 2018). To realize this principal, more infants at the limits of viability should be born at institutions with the possibility of the delivery of appropriate neonatal intensive care. Changes in the organization of health care system influenced survival and mortality rate of the infants born at the limits of viability. Although prematurity rate is globally increasing with expectedly increasing morbidity, the mortality rate has decreasing tendency (Yu 2005). Therefore, any effort should be made to organize the best perinatal care in order to improve survival and decrease possible consequences of intensive care in developed and in developing countries (Owens et al. 2015). The Declaration on the Rights of the Child is universal and applies to any newborn child on Earth, but we should be aware of the strikingly different chances of survival and outcomes depending on the place of birth and social origin (WHO 1989).

CONCLUSION

At the moment we have reached the plateau of the survival of the infants at the limits of viability. From the historical perspective it could be considered a big achievement of medical science, but still there is a place for improvement. Defining limit of viability is gestational age and birth weight sensitive and is dependent on the biological capability of the infant to survive in certain society which is dependent on development and wealth of the country. That is why the definition of the limits of viability is not universal and should rely on the local statistical data on the survival, short- and long-term outcome of the babies born at the threshold of viability. Availability and the organization of medical care, technology, and approach of medical professionals and parents are influencing survival and early and late outcome of the infants at the limits of viability. Lack of capability to cope with the issues connected with the care of the infants at the limits of viability is creating some ethical and emotional dilemmas for parents and for medical professionals. As medicine and technology are developing and improving, new ethical issues are arising, which should be solved by availability of appropriate medical care for every child born at the limits of viability. This will change the definition of the limit of viability in accordance with the biological potential of the individual infant, while the issues of inequity and poverty which are now importantly affecting survival of those infants should be solved, in order to make the proclamations from the Convention on the Rights of the Child a reality. In this way the circle of the care of infants at the limits of viability would be closed in the universal and timeless manner. Further development of care for infants at the limits of viability is shown in the Figure 5. When counselling the parents, healthcare providers should always bear on mind the best interest of the child and the family to provide them with the best possible care in existing conditions. They are not expected to play God, but to do no harm.

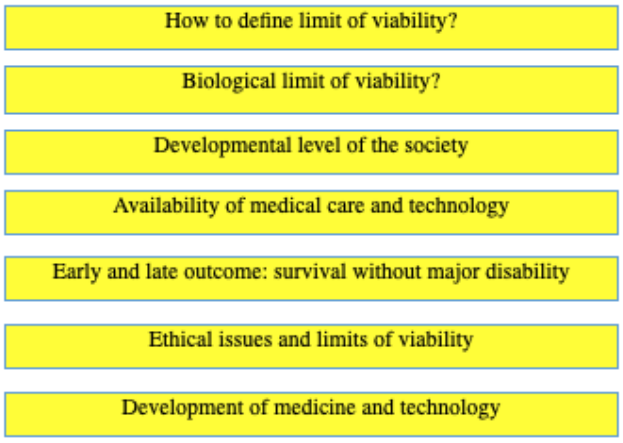

Figure 5. Past, present, and future of the care for the infants at the limits of viability

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SAŽETAK

Granice preživljavanja: trebamo li se igrati Boga?

Cilj je prikazati da definicija novorođenčadi rođene na granici preživljavanja u svim državama ovisi o socijalnim i medicinskim uvjetima u kojima se dijete rađa, a čak i u jednoj zemlji u kojoj je dostupna neonatalna intenzivna skrb ovisi o mjestu rođenja i organizaciji perinatalne skrbi.

Smanjenjem gestacijske dobi nedonoščadi povećava se njihova smrtnost, kratkotrajni i dugoročni morbiditet, a smanjuje se preživljavanje do otpusta iz bolnice. Upitno je kako definirati granice preživljavanja i gdje se one mogu postaviti. Definicija granica preživljavanja nedonoščadi nije sasvim jasna. Postoje najmanje dva načina na koje se granice preživljavanja mogu razumjeti: prvi, definiranje gestacijske dobi i/ili porođajne mase pri kojoj ljudski fetus ima sposobnost preživljavanja izvan maternice; i druga, gestacijska dob i/ili porođajna masa pri kojoj više od 50% novorođenčadi preživi do otpusta iz bolnice. Dok u zemljama u razvoju dojenčad mlađa od 28 tjedana gestacije bez dostupne intenzivne skrbi ima vjerojatnost umiranja od 95%, dotle u razvijenim zemljama preživljavanje nedonoščadi između 22 i 25 tjedana gestacije doseže 90%. Prema sadašnjim spoznajama definicija granica preživljavanja nije znanstveno precizno i nedvojbeno utvrđena i određena. Trenutno Svjetska zdravstvena organizacija postavlja donju granicu preživljavanja na 22 tjedna gestacije, i/ili porođajnu masu od 500g i/ili porodnu dužinu od 25 cm. Univerzalna definicija granica preživljavanja vjerojatno nije moguća zbog individualnih razlika od jednog nedonoščeta do drugog, od jedne zdravstvene ustanove do druge kao i od jedne društvene zajednice do druge.

Ključne riječi: plod, preživljavanje, novorođenačka intenzivna skrb, pobol, pomor

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THE PROFESSION OF MEDICINE IS SECULAR: AN EIGHTEENTH-CENTURY IDEA WITH IMPLICATIONS FOR THE BOUNDARY BETWEEN MEDICINE AND RELIGION

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SUMMARY

The aim of this paper is to draw on John Gregory's (1724-1773) professional ethics in medicine to provide guidance to physicians for the responsible management of the potentially contested boundary between medicine and religion. The paper provides a philosophical and clinical interpretation of Gregory's method of argument by persuasion: setting out complementary considerations that together invite agreement. The cumulative effect of this argument by persuasion is that a contested boundary between medicine and religion is not required by the commitment to the evidence-based, scientific practice of medicine. Gregory's legacy to us is the concept of the profession of medicine as secular, in two senses. As scientific, medicine draws on evidence and not on divinity, transcendent reality, or sacred texts and practices. There is no necessary hostility of evidence-based medicine toward religion and faith communities.

Key words: medicine - professional ethics- Gregory's method – interpretations – EBM (Evidence Based Medicine)

INTRODUCTION: *UBI TRES MEDICI, IBI DUO ATHEII*.

With the emergence of scientific medicine in Renaissance Europe and, especially, during the Enlightenment, the boundary between medicine and religion became contested. In part, this was owed to competing explanations of the phenomena of health and disease. As the success of medical explanations and clinical management based on them increased, the authority of religion to explain health and disease was directly challenged. The threat of medicine to religion was expressed by people of the Christian faiths in the phrase, Ubi tres medici, duo atheii, or, wherever there are three doctors there are two atheists (McCullough 1998). In this paper we present an eighteenth-century response to this challenge and invite the reader to assess its utility for today.

JOHN GREGORY RESPONSE TO *UBI TRES MEDICE, IBI DUO ATHEII*.

On the most important – but still neglected – responses to this accusation was mounted by the Scottish physician-ethicist, John Gregory (1724-1773). As a young man, Gregory would have been well aware of religious persecution of atheists. In 1767 became Professor of Medicine at the University of Edinburgh, a position he held in alternating years with William Cullen (1710-1790). Cullen was revered as the best teacher of clinical medicine at the University of Edinburgh, based on the Baconian science of rigorous

observation of signs and symptoms and sorting them into patterns that made causal sense. Cullen was also a suspected atheist. At that time, professors at the University of Edinburgh were appointed by the Town Council and there was no tenure. There was a movement afoot to have Cullen dismissed from his faculty position, to prevent an atheist from infecting the students with heresy (McCullough 1998).

Gregory gave a series of ethics lectures before students transitioned from the lecture hall to the wards of the Royal Infirmary of Edinburgh for their clinical training. As was then common, Gregory permitted his lectures to be published anonymously, to test reception of them by the medical and learned communities. Probably edited by his son, James Gregory, the lectures appeared in 1770 as *Observations on the Duties and Qualifications of a Physician, and on the Method of Prosecuting Enquiries in Philosophy* (Gregory 1770). This book was very well received, leading Gregory to revise and publish it under his own name as *Lectures on the Duties and Qualifications of a Physician* in 1772 (Gregory 1772). This book is remarkable for the scope of ethical challenges that Gregory addressed and that remain current, including confidentiality, the right of patients to express their views about treatment, patients with "nervous ailments" now known as the "worried well," and end-of-life care, including what appears to be an endorsement of physician-assisted suicide (McCullough 1998).

Gregory addresses two contested boundaries. The first was between physician and surgeons. Using the example of a gangrenous limb, Greogry makes the case for the physician taking the lead in making the diagnosis and devising a treatment plan. If that plan included surgery, the physician should turn the case over to the surgeon who then would take responsibility for the surgery. No one had ever made such a proposal for the management of the contested boundary between medicine and surgery. The basis for Gregory's proposal was the commitment of clinicians to the scientific practice of medicine directed to the patient's health-related interests, keeping all forms of self-interest systematically secondary (Gregory 1770, 1772, McCullough 1998).

The second contested boundary was that between medicine and religion. Gregory almost certainly had in mind the political and personal peril that his colleague Cullen faced as well as the history of persecution of heretics. We know that this topic was of major importance to Gregory – and therefore for this intended audience – because he devoted more words to it than any of the many other ethical challenges he addressed (McCullough 1998).

I shall make no apology for going a little out of my way in treating of so serious a subject. In an enquiry into the office and duties of a physician, I deemed it necessary to attempt to wipe off a reflection so derogatory to our profession; and, at the same time, to caution you against that petulance and vanity in conversation, which may occasion imputations of bad principles, equally dangerous to society, and to your own interest and honour (Gregory 1772, p. 70).

In this paper, we will explain Gregory's response to the contested boundary between medicine and religion and show how this remarkable text from the history of medical ethics can provide reliable guidance to the Academy today.

A METHODOLOGICAL NOTE

Gregory's style of reasoning was common in his day. It can best be described as argument by persuasion. One sets out a number of considerations in support of a position with the goal of persuading the reader to agree on the basis of the accumulated persuasive power of all of the considerations considered together. This can also be called complementary reasoning: each successive consideration adds something not contained in its predecessor, creating a coherence among them. No one consideration, therefore, should be considered persuasive by itself (McCullough 1998). We now invite the reader to experience Gregory's method of argument by persuasion by presenting in sequence each of the considerations that Gregory advances with an update of each.

GREGORY'S ARGUMENT BY PERSUASION

Scientifically Eminent Physicians of Piety

Gregory first points out that there have been many scientifically eminent physicians who were noted for their piety. Their examples are meant to refute Ubi tres medici, duo atheii, or the claim that becoming a scientific physician entails a commitment to atheism:

I shall conclude this subject with some observations on a charge of a heinous nature, which has been

often urged against our profession; I mean that of infidelity, and contempt of religion. I think the charge ill-founded; and will venture to say, that the most eminent of our faculty have been distinguished for real piety. I shall only mention, as examples, Harvey, Sydenham, Arbuthnot, Boerhaave, Stahl, and Hoffman (Gregory, 1772, pp. 63-64).

His students and contemporaries would have instantly recognized men who were then regarded as scientific giants. William Harvey (1578-1657) discovered circulation. Thomas Sydenham (1624-1689) authored a textbook in medicine that remained in use for two centuries, earning him the sobriquet, "The English Hippocrates." Hermann Boerhaave (1668-1738) the founder of modern physiology and renowned teacher at the medical school at Leiden, where Gregory and other of "Boerhaave's men" at the University of Edinburgh studied. Georg Ernst Stahl (1659-1734) posited the *anima* to distinguish between living and non-living things. While this concept did not survive, the wholistic approach to patient care, which Gregory embraced and taught, was very influential at Edinburgh. Friedrich Hoffmann (1660-1742) who took the lead in preparing physicians to serve as municipal physicians, forerunners of public health physicians. Hoffmann also published *Medicus Politicus*, a very influential text in the history of medical ethics (McCullough 1998).

Today, there are eminent physicians noted for their piety, i.e., their serious commitment to religious beliefs and practice. The most prominent such physician in the United States, and perhaps in the world, is Francis Collins, the Director of the National Institutes of Health and renowned scientific investigator (U.S. Public Broadcasting System (PBS) 2004, Collins 2006). In the PBS interview, Collins made the following claim and offered himself as an example of a scientific physician who has a serious faith commitment:

So where, then, is the discordancy that causes so many people to see these views of science and of spirit as being incompatible? In me, they both exist. They both exist at the same moment in the day. They're not compartmentalized. They are entirely compatible. And they're part of who I am (U.S. Public Broadcasting System (PBS) 2004, Collins 2006).

Contempt for Religion does not Apply to all Forms of Religion

Gregory turns to the origins of contempt for religion in the scientific mind set:

It is easy, however, to see whence this calumny has arisen. Men whose minds have been enlarged by knowledge, who have been accustomed to think, and to reason upon all subjects with a generous freedom, are not apt to become bigots to any particular sect or system. They can be steady to their own principles without thinking ill of those who differ from them; but they are impatient of the authority and controul of men, who would lord it over their consciences, and dictate to them what they are to believe (Gregory 1772, p. 64).

Gregory's point is subtle: It is correct for the scientific physician to be "impatient with the authority and controul of men." He may have had in mind the rigid orthodoxy of the Church of Scotland and, as would be typical at the time, Roman Catholicism. But it is not correct for the scientific physician to reject religion that is compatible with conscience. There were at the time religious communities based on the sovereignty of conscience, especially the various Dissenters. Scientific medicine is therefore not incompatible with religion in all of its various forms but only in those forms incompatible with the sovereignty of conscience.

The Perils of Unguarded Expressions

Scientific physicians can sometimes abandon the discipline of evidence-based reasoning and become enthusiasts in the sense that they make claims for which they do not have warrant. In this passage Gregory invokes the distinctive commitment of the University of Edinburgh, *Lehrenfreiheit* or the freedom to teach, which, in turn, is based on freedom of inquiry.

This freedom of spirit, this moderation and charity for those of different sentiments, have frequently been ascribed, by narrow-minded people, to secret infidelity, scepticism, or, at least, to lukewarmness in religion; while some who were sincere Christians, exasperated by such reproaches, have sometimes expressed themselves unguardedly, and thereby afforded their enemies a handle to calumniate them. This, I imagine, has been the real source of that charge of infidelity so often and so unjustly brought against physicians (Gregory 1772, pp. 64-65).

Freedom of inquiry, Gregory insists, must be rigorous, in which intellectual endeavor there is no place for unguarded statements. Unguarded statements make one a target for the accusation of infidelity, not rigorous scientific thinking.

Newly Won Liberty

Gregory then makes a related, more general point: unbridled freedom can result in atheism:

In a neighboring nation, where few people have been used to think or to reason with freedom on religion, and where, till of late, no man durst express himself freely on the subject, some ingenious and lively writers have, within these few years appeared, who, impatient to display their newly-acquired liberty, have attempted to shake the foundations of all religion, natural as well as revealed. Lately emancipated from the lowest superstition, by a transition not unnatural, they have plunged at once into Atheism. It is perhaps for the better, that these gentlemen have carried matters so far; because it is to be hoped the evil will soon cure itself (Gregory 1772, pp. 65-66).

Here he emphasizes that unbridled freedom is not what freedom truly concerns. There is a distinctive, traditional, conservative bent to Gregory's thinking here, with deep roots in the Stoic tradition. Freedom must be exercise under the constraint of values and institutions worth preserving. These include religion based on conscience.

Religion is Natural to the Human Mind

Gregory then makes the point that we are naturally inclined to be religious:

Mankind may have their religious opinions disfigured by various superstitions: but still religion is natural to the human mind, and every attempt to eradicate it, will be found as impotent as it is wicked (Gregory 1772, p. 66).

This idea retains its currency. Stempsey has recently argued, for example, that we are not only "Homo sapiens" but also "Homo religious" (Stempsey 2021). Evidence-based, scientific thinking inclines toward and not away from religion (Collins 2006).

Socially Deleterious Consequences of Atheism

Gregory then invokes a time-honored argument form in philosophical reasoning: Grant, for the sake of argument, an opponent's position and then show that this position has implications that anyone, including one's opponent, should reject.

But, supposing that Atheism came universally to prevail, together with the disbelief of the immortality of the soul, the duration of such sentiments would necessarily be very short; because they would at once unhinge all the bonds of society, and produce a continued scene of anarchy and wickedness (Gregory 1772, p. 66).

These words would have had a powerful resonance for Scotsmen, who were only a quarter century from the doomed Stuart rebellion of 1746-1747. Gregory had been recruited to fight by the legendary Rob Roy but Gregory's father forbade him to enlist, thus saving him from the slaughter that befell the Scottish rebels at the battle of Culloden (McCullough 1998). Gregory knew firsthand of what he writes: social bonds should never be taken for granted and, when they fail, catastrophe usually follows.

Weak Arguments for Atheism

Gregory next pulls together the elements of his argument by persuasion. He has shown that becoming a scientific physician does not commit one to becoming an atheist, quite the opposite. Moreover, making atheism universal would result in societal calamity. Taken together the previous complementary considerations lay bare the weak arguments for atheism.

Divested of that uncouth, metaphysical dress, under which they long lay concealed, the gloomy speculation of a few recluse men, they are now produced to the world, adorned with what passes among many for wit and humour, and adapted to every capacity. So far as they contain any argument, their weakness has been often demonstrated (Gregory 1772, p. 66).

Attacking Youth on the Weak Side

Gregory was a dedicated medical educator. He lent students his lecture notes and even, sometimes, money (McCullough 1998). He was concerned that young students might not have the maturity of thought that he has displayed in the above, complementary considerations, and, as a consequence, become disrespectful of religion. Recall that medical students in Scotland, then and now, start after secondary school. Gregory was but 19 years of age when he left Aberdeen to follow his father and older brother to study medicine in Edinburgh (McCullough 1998).

One method taken by the present patrons of infidelity to propagate their opinions is somewhat dan-

gerous. With much assurance, they insinuate, that all who avow their belief in natural or revealed religion, are either hypocrites or fools. This is attacking youth on their weak side. A young man, of a liberal spirit, naturally disdains the idea of hypocrisy; and, from an ill-judged pride, is afraid of whatever may subject him to so mean an imputation. Vanity, again, is their most ruling passion, as they commonly dread contempt above everything, and resent reflections on the weakness and narrowness of their understanding, more than any charge against their principles or morals (Gregory 1772, pp. 66-67).

Gregory was well aware that, with rare exceptions, young men (and now young women) do not enter their late teens or early twenties intellectually fully formed. Making the case for atheism when a student does not have the intellectual tools on display in the considerations above is impermissible pedagogically. Moreover, should a medical student embrace atheism, the origin of this change is not in scientific medicine but in less-than-mature intellectual development and lack of clinical experience (see below). In this passage, we add, Gregory is role-modeling for students the protection of the vulnerable that students were about to begin to learn in the wards of the Royal Infirmary of Edinburgh.

Useful and Amiable Men are Friends of Religion

Gregory next offers a virtues-based consideration. To become a man of virtue, especially mastery of the professional virtues of tenderness and steadiness (engaging directly in the affective experience of patient in a self-disciplined way) and candor (the commitment to being open to evidence from whatever source), is at the heart of *Lectures*. Here Gregory makes the more general point that persons of virtue have social worth and earned moral standing for the rest of us.

But I will venture to say, that men of the most enlarged, clear, and solid understandings, who have acted with the greatest spirit, dignity, and propriety, and who have been regarded as the most useful and amiable members of society, have never openly insulted, or insidiously attempted to ridicule the principles of religion; but, on the contrary, have been its best and warmest friends (Gregory 1772, pp. 67-68).

These persons of virtue are not hostile to religion but its "best and warmest friends." This complements his opening consideration. Scientific physicians, admirable for their intellectual virtues, were men of piety. So are persons who are admirable for their moral virtues.

The Study of Medicine does not Lead to Impiety

Gregory next makes an argument based on the "works of nature." This is known as the argument for the existence of the god of deism (there is a creator and designer god who is the author of the patterns of nature and has ordained those patterns to human and animal good). The evidence of transcendent design is available to every scientific physician.

The study of medicine, of all others, should be the least suspected of leading to impiety. An intimate acquaintance with the works of Nature, raises the mind to the most sublime conceptions of the Supreme Being, and at the same time dilates the heart with the most pleasing views of Providence. The difficulties that necessarily attend all deep enquiries into a subject so disproportionate to the human faculties, should not be suspected to surprize a physician, who, in his practice, is often involved in perplexity, even

in subjects exposed to the examination of his senses (Gregory 1772, p. 68).

The complexity of clinical practice prepares physicians especially well for the task of gathering the evidence for deism.

Clinical Experience Naturally Inclines the Physician to Religion

Daily experience with the pain, distress, and suffering of patients complements the results of the work of nature with the results of tender and steady engagement with patients.

There are, besides, some peculiar circumstances in the profession of a physician, which should naturally dispose him to look beyond the present scene of things, and engage his heart on the side of religion. He has many opportunities of seeing people, once the gay and the happy, sunk in deep distress; sometimes devoted to a painful and lingering death; and sometimes struggling with the tortures of a distracted mind. Such afflictive scenes, one should imagine, might soften any heart not dead to every feeling of humanity, and make it reverence that religion which alone can support the soul in the most complicated distresses; that religion, which teaches to enjoy life with cheerfulness, and to resign it with dignity (Gregory 1772, pp. 68-69).

Religion based on freedom of conscience permits the believer to sustain meaning in his or her life, right up to its final days. Gregory thus anticipates the death with dignity movement in many countries in the last century and underscores the essential role that religious belief can play for the maintenance of dignity as one dies.

The Sensitive Physician Keeps his Atheism to Himself

Gregory makes one final point to the atheist whom he has not been able to persuade: a physician committed to the compassionate care of patients, but is also an atheist, should remain systematically silent about his commitment.

A physician, who has the misfortune to disbelieve in a future state, will, if he have common good-nature, conceal his sentiments from those under his charge, with as much care as he would preserve them from the infection of a mortal disease. With a mind unfeeling, or occupied in various pursuits, he may not be aware of his own unhappy situation; yet it is barbarous to deprive expiring nature of its last support, and to blast the only surviving comfort of those who have taken a last farewell of every sublunary pleasure. But, if motives of humanity, and a regard to the peace and happiness of society cannot restrain a physician from expressing sentiments destructive of religion or morals, it is vain to urge the decency of the profession. The most favourable construction we can put on such conduct, is to suppose that it proceeds from an ungovernable levity, or a criminal vanity, that forgets all the ties of morals, decency, and good manners (Gregory 1772, pp. 69-70).

For the physician who fails to maintain compassionate, respectful silence about his or her atheism, Gregory reserves some of the strongest language in *Lectures*. The final sentence is written in what Gregory himself would have described as "warm" terms. Another way to put it is that in this sentence Gregory is in high dudgeon, which his students and readers would have immediately recognized as such. This sentence can be restated in contemporary terms: No physician should want to become despicable.

CONCLUSION: MEDICINE IS A SECULAR PROFESSION

The reader now has been introduced to Gregory's argument by persuasion against the view that becoming a scientific physician commits one to atheism. No one consideration is sufficient to make this case, but together, Gregory believes, his students and readers should accept this conclusion. Gregory's pioneering work on professional medical ethics from the eighteenth-century thus provides guidance for the management of the potentially contested boundary between medicine and religion. The boundary between medicine and religion is not necessarily, but only potentially, contested.

The key to this conclusion is based on a theme that is implicit in the texts from his *Lectures* that we have analyzed here. While Gregory did not use the word "secular" he put in place the concept of medicine as a secular profession that can guide the Academy. The meaning of "secular" has two components. First, medicine is a secular profession is evidence-based. Evidence-based clinical reasoning draws of science, which creates intellectual tools that do not make – and need not make -- reference to divinity, transcendent reality, or sacred texts and prac-

tices. The medical profession is therefore open to all, with no religious – or *anti-religious* – test. Second, inasmuch as there is no requirement that being a physician means that one becomes an atheist. There is therefore no necessary hostility of medicine toward religion and faith communities. Based on these two components of the concept of medicine as secular, the boundary between medicine and religion need not be contested.

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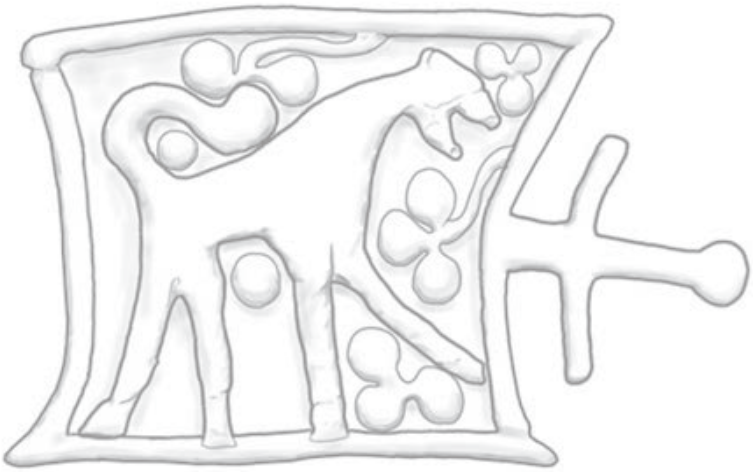
SAŽETAK

Cilj ovog rada je osloniti se na stavove Johna Gregorya (1724-1773) o profesionalnoj etici u medicini kako bi liječnicima pružili smjernice za odgovorno upravljanje potencijalno spornim razgraničenjem između medicine i religije. Ovaj rad donosi filozofsku i kliničku interpretaciju Gregoryeve metode argumenta uvjeravanjem: predstavljanje komplementarnih razmatranja koja zajedno pozivaju na slaganje. Kumulativni rezultat ovog argumenta uvjeravanjem je da znanstvena praksa medicine, temeljena na dokazima, nema potrebu za spornom granicom između medicine i religije. Gregoryevo naslijeđe nama je koncept sekularne medicinske struke, u dva smisla. Kao znanost, medicina se oslanja na dokaze, a ne na božansko, nadiskustvenu stvarnost ili svete spise i prakse. Medicina temeljena na dokazima nema potrebu za antagonizmom prema religiji i vjerskim zajednicama.

Ključne riječi: medicina – profesionalna etika – Gregory-ev metoda – interpretacije – EBM (medicina utemeljena na dokazima)



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Review article

MEDICINE AND PSYCHOLOGY OF IBN SINA (AVICENNA) - A UNIQUE SCIENTIFIC AND RELIGIOUS APPROACH

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SUMMARY

Ibn Sina (Avicenna) is primarily known for his philosophy and medicine, but there is almost no scientific discipline in which this great man didn't leave a significant mark. This paper gives a brief overview of his contribution to medicine and psychology through which his unique scientific and religious approach to the study of the phenomena of human being can be best seen. Medical works of Ibn Sina represent a pinnacle of most important medical achievements of his time. These works contain synthesis of all Greek, Indian and Iranian medical schools, but also new breakthroughs achieved by Muslim scholars through their own experimentation and practice. Although he wrote many medical works, his most important one is *El-Kanun fit-tib,* which can be translated as *The Canon of Medicine.* It's made out of five books which systematically show everything known in the area of medicine up until that point in time. In it, Ibn Sina discusses, among other things, the structure of psychological apparatus of human being and the connection of psychological functions with the brain. He considered psychology to be very important for medicine, so in his psychological works he discusses, in great detail, the essence of human soul, consciousness, intellect and other psychological functions. He observed a man in his entirety, taking into consideration all aspects of his existence, paying special attention to spiritual knowledge and spiritual perfection, religiosity, and methods of achieving inner peace and well-being.

Key words: Ibn Sina – Avicenna – medicine - psychology –spirituality – cognition – well-being - hodegetics

INTRODUCTION

With the arrival of Islam in the 7th century AD, the Arabic world experienced a remarkable transformation. A new, Islamic civilization was developed, which spread to all four sides of the world and became leading in many aspects of human life for centuries to come. In that context, medicine took special place considering the tradition of Prophet Muhammed (PBUH) that God had given a cure for every disease except old age and death and that knowledge is the lost thing of a believer, so that they should seek it „even if they had to do so in China".

After the quick spread of the new Islamic Arabic state and the great blossom of Islamic culture, a need for educating professional medical workers arose as well as the need for improving medical science altogether. Prominent Arabic leaders, especially those from the Abbasid dynasty, invited scientists from all sides of the world to the newly founded capital, Baghdad. Through 150 years (750. - 900. AD) in that new cultural center, all of the most famous works of Greek, Roman, and Indian physicians were translated to Arabic, especially the works of Hippocrates, Galen and Dioscorides. They were translated by expert translators directly from Greek, and partly from translations to Syrian and Persian language. Towards the end of the 7th century, a certain translator school was founded in Baghdad, in which the foundations were set for medieval Arabic (Islamic) medicine. That translator school later became the Academy of sciences. Most deserving of that were the rulers of the Islamic theocratic state, who had open-handedly and tolerantly accepted and helped cooperation between Muslim, Jewish and Christian experts in medicine, philology, and other scientific and philosophical disciplines (Karamehmedović 1961).

However, they weren't only translating medical works, because even in that period we can find original medical works in the Islamic world. The number of medical authors in the classical period of Islamic medicine was huge, but the most significant ones were: Abu Bakr Muhammad ibn Zakariyya al-Razi (in the Western world known as Rhazes) (854-925), Ali ibn Abbas al-Majusi (930-994) and Abu Ali al-Ḥusayn (Ibn Sina) (980-1037). The third one is by far the greatest and the most famous of all physicians of the Islamic world. In the West, they called him Avicenna. During his life, he wrote *The Canon of Medicine*, the book that was the basis for studying medicine in the East and the West for multiple centuries. Aside from somatic diseases, some mental illnesses were described, even in that period of time, with their etiology, symptomatology, diagnostics, and therapy.

SHORT BIOGRAPHY

Ibn Sina, in the West known as Avicenna, also known as The Prince of Physicians, was born near the city of Bukhara (today's Uzbekistan) in the year 980. Even in his early childhood days, he was showing incredible fondness for science. When he was 10 years old he had finished studying Qur'an and grammar and then started studying logic and mathematics. Since he mastered these sciences quickly, he started studying physics, metaphysics, and medicine. At the age of only 16, he had mastered all of the sciences of his time. Ibn Sina's knowledge of medicine contributed to his reputation, so he became sought-after and a favorite of local rulers. Political instability in Central Asia made his life in his birthplace hard, so he had to leave Bukhara and go to Gorgan (Iran). However, when he got there he soon found out that the ruler whose protection he was seeking had passed away. He took it hard, so he spent a few years living alone in some village. Between 1014 and 1015 he goes to Ray (Iran), and from there to Hamadan (Iran) where he meets the ruler of Hamadan. As soon as he arrived in the city he was invited to help the ruler who was sick. When he healed him his reputation had grown so much that he eventually became vizier, a duty he performed for several years, until the death of the ruler. After refusing to keep performing his duties as a vizier, he was arrested. During the siege of Hamadan, he seizes the opportunity, escapes the prison, and leaves Hamadan. When he got out of those troubles, he moved to Isfahan (Iran), a big scientific center of the time. The ruler of Isfahan acknowledged him, and following 15 years he spent in piece in Isfahan. During that time he wrote a couple of significant books. He even started studying astronomy and undertook the building of an observatory. Because of the attack on Isfahan, by the same ruler because of whom he had to leave his birthplace, he went back to Hamadan where he died in the year 1037 aged 57 and where he is buried. During this attack, many of his important works have disappeared. Later, in Hamadan, he was built a mausoleum that exists even to this day. (Khan 2020; Nasr 1991; Corbin 1977)

Ibn Sina had many ups and downs in his life. As a physician, he spent most of his time serving different rulers which got him involved in the matters of state, and for a time, he himself was performing a high state duty. At the same time, he was living a very intense intellectual life, proof of which are numerous works he wrote as well as the quality of his students. Despite being that involved in social life and political problems, he had managed to set the foundation of middle age scholastic philosophy, to synthesize Hippocrates's and Galen's medical tradition, and make a great impact on Islamic science and philosophy as no one before him nor after him had done (Nasr 1991). Husejn (1987) says that he was above other physi-

cians because he was the greatest philosopher of the middle age, and that he was above other philosophers because he was the greatest physician of his time.

MAJOR WORKS

Ibn Sina wrote more than two hundred and twenty works, ranging from the vast book Kitāb al-Shifā ' (The Book of Healing), which is the largest encyclopedia of knowledge compiled by one person, to treatises of several pages. These works encompass almost every branch of knowledge, from metaphysics to medicine, in accordance with the unifying and at the same time encyclopedic genius of Ibn Sina.

*Kitāb al-Shifā '*consists of four books dedicated to logic, natural philosophy (*ṭabī'iyyāt*), mathematics (*riyāḍiyyāt*) and metaphysics (*ilāhiyyāt*). *Kitāb al-najāt* (The Book of Salvation) is a brief summary of *Shifā'*, while *Kitāb al-ishārāt wa-t-tanbīhāt* (The Book of Directives and Remarks) is Ibn Sina's last significant philosophical work and the most personal exposition of his philosophical views. His other important philosophical treatises include *Kitāb al-hidāyah* (The Book of Guidance), 'Uyūn al-ḥikmah (Fountain of Wisdom), Al-Mabda' wa'l-ma'ād (The Beginning and End) and Dānesh-nāme-ye ' alā'ī (The Book of Knowledge for 'Alā' al-Dawlata), and the visionary narrations of Ḥayy ibn Yaqẓān (The Living Son of the Awake), Risālat al-ṭayr (A Treatise on Birds) and Salāmān wa Absāl (Salaman and Absal) which complete a cycle in which the main components of his "eastern philosophy" can be found. Ibn Sina also wrote a series of short treatises on hidden sciences and mystical, theological and religious topics, including interpretations of the Qur'an.

His most important scholarly works are the chapters on natural philosophy and mathematics in the works of *Shifā'* and *Al-Qānūn fī'l-ṭibb* (The Canon of Medicine), which is perhaps the most famous work in the history of medicine in both the East and the West. Ibn Sina also wrote about forty other medical works, including *Al-Urjūzah fī'l-ṭibb* (A Poem on Medicine) which medical students used to memorize the principles of medicine and pharmacology.

Ibn Sina wrote important treatises on language, grammar, and phonetics and devoted many pages of Shifā's work to the study of politics and sociology. He was also a great poet, and many of his poems dealing with philosophical and medical themes in Arabic and Persian have survived to this day. (Nasr 2013; 1991) His works on music are worthy of attention from several aspects. He treated music as a science and paid attention to its theoretical and scientific dimension. The explanations he gave about musical intervals and ratios, as well as his subtlety and precision that he shows in defining basic musical concepts, are a real rarity. Likewise, his discussion of the connection between music and poetry and the comparison of these two sublime arts, may represent a pioneering study of music and poetry. (Bodžnurdi 2011)

Ibn Sina (Avicenna) is primarily known for his philosophy and medicine, but there is almost no scientific discipline in which this great man didn't leave a significant mark. In this paper, we will limit ourselves to a brief overview of his contribution to medicine and psychology through which his unique scientific and religious approach to the study of the human phenomenon can be best seen.

IBN SINA IN MEDICINE

The Canon of Medicine is undoubtedly one of the biggest accomplishments in world history. It represents for medicine what Aristotle's works represent for philosophy, Euclid's works for geometry, Ptolemy's works for astronomy, and Sibawayh's works for grammar, the ultimate reach of scientific thought in a certain scientific branch (Husejn 1987). It's the biggest medical work of Ibn Sina and it's the most suitable source for comprehending the great contribution this author gave to natural sciences using, even in those times, methods of observation and experimentation. The Canon had gone through 15 different editions in Latin and Hebrew and for almost 600 years it was a fundamental medical literature in madrasas in the East, as well as in universities in the West, especially in England and Scotland. The first official recognition of The Canon of Medicine was in the 13th century in Poland (Cerić & Mehić-Basara 1997). That's the work that contains and systematically presents the complete medical science of that time. Ibn Sina in The Canon defines medicine: "Medicine is the science by which we learn the various states of the human body in health and when not in health, and the means by which health is likely to be lost and, when lost, is likely to be restored to health. In other words, it is the art whereby health is conserved and the art whereby it is restored after being lost." (Avicenna 1999). This medical encyclopedic work is made of five books in which the following crucial medical questions are dis-

cussed: description of the human body, constitution of the human body, temperaments, physical capabilities, somatic diseases, hygiene, death, description of diseases that affect the whole body instead of just one organ or location, and then the final chapter is related to pharmacology that is especially important from an experimental point of view. The Canon is the synthesis of teachings and traditions of Hippocrates, Galen, and Dioscorides, however it also contains many things that don't exist in Greek sources. It contains a lot of new discoveries that came as a result of medical experiments and conclusions of Ibn Sina himself, such as the usage of certain herbs, the discovery of antiseptic effects of alcohol, and the discoveries of brain tumors and stomach ulcer. In physiology and anatomy of the eye in his theory of eyesight Ibn Sina states that the light comes into the eye from the outside but at the same time a certain reflex emits from the eye and reaches the object. The Canon, alongside his other works, serves as a witness to Ibn Sina's great knowledge of medicine and as an argument for why he was known as The Prince of Physicians for a period of about a thousand years.

Ibn Sina had shown great skill in observation and experiment. He set the rules for experimenting and therefore was the first one who founded the contemporary scientific method (El-Ehvani 1984). His methods of analysis and observation, with adequate use of logic and reason, his strict determinism and insistence on controlled experiment, had the medicine be recognized as a natural science (Mašić et al. 2010). This is best seen in his medical works where he, while discussing a diagnosis of a disease and the effect of certain pharmaceuticals in its therapy, usually talks about his personal experience in work with patients. With the classification of general and specific diseases, Ibn Sina explained the way of identification of a disease and the way of treating each affected organ. Using his original experimental methods, Ibn Sina had found the cure for many a disease. He was the first one to correctly describe inflammation of meninges, meningitis, and tell the difference between meningitis and other similar diseases. He invented the administration of remedy by injection needle and was the first one to use anesthesia during surgical operations (El-Ehvani 1984). Ibn Sina discussed anesthetic agents as well as the diet for patients needing surgery. He cited 43 plants and their blends as mukhaddar (anesthetics) and taskin (pain relievers) applied before surgery by oral, nasal, or rectal route of administration. Papaver somniferum var. album, Mandragora officinarum, Conium maculatum, Cannabis sativa, Cannabis indica, Lactuca virosa, Solanum nigrum, Fumaria officinalis, Vitex agnuscastus, Lolium persicum, Datura metel, and Commiphora myrrha are some examples. Current findings show that many of his suggested analgesics or anesthetic agents have important pharmacological properties (Ahmed S & Zargaran A 2020). He was one of the first who recognized psychological influence in the origin of somatic diseases. For example, he considered there to be two different causes of dyspepsia. The first one is mental, which leads to certain disorders, and the second one is organic, due to which, the ulcer actually appears on the stomach (Mašić et al. 2010). Besides that, his clinical observations often discuss psychology, which is according to him, and according to other Islamic physicians, tightly connected to medicine (Nasr 1991).

IBN SINA IN PSYCHOLOGY

The main text in which Ibn Sina discusses psychology can be found in the 6th chapter of his Kitab al-Shifa (The Book of Healing) called „Natural sciences". In Kitab al-Najat (The Book of Salvation) and Al-Isharat wal-tanbihat (The Book of Directives and Remarks), as well as in some shorter writings, he discusses psychology in different ways. Ibn Sina's psychology is fundamentally Aristotelian but in his psychology, he surpasses Aristotle's paradigm. The first question that comes to his attention is the question of proving the existence of the soul. We encounter organisms that feed, grow and reproduce. These activities aren't caused by their physicality, so there has to be something else that exists within them. The origin of mentioned activities controlled by willpower is called the soul (nafs). This word isn't just the name for that phenomenon regarding its essence, but regarding its relation to those activities. This clearly shows that the soul isn't the body, but it's that aspect of a being that can be considered its form or perfection (Bodžnurdi 2011).

His evidence of the soul's existence within man Ibn Sina bases on the thesis of man's self-consciousness, therefore he can be considered Descartes's predecessor. We know how this famous French philosopher from the seventeenth century (so 6 centuries later) in his famous statement: „I think, therefore I am/Cogito ergo sum", had in a way summed up Ibn

Sina's demonstration of proof of the human soul's existence. Namely, Ibn Sina had already said that in a somewhat different way: „My awareness of myself is my own being/my own existence." (Bodžnurdi 2011)

The evidence of soul's existence through man's self-consciousness Ibn Sina in a different place gives concisely and clearly: „If you think correctly, you will see that your pointing to yourself when you say 'I' has a different meaning which isn't the same as the meaning when you say 'it' because when you say 'I' you are pointing to your own being, but if you want to point out any of your organs or a part of your body you will say 'it', and by doing that you are pointing at something that is outside of the 'I', it's not the 'I' itself nor a part of it, because the 'I' isn't made of group of identities because the essence of individual parts isn't the same as the essence of the entirety they make. Therefore, when you say 'I' you should be thinking about something that isn't your body nor any of its parts. That something is 'the soul' and the essence of every human is exactly that substance we point to when we say 'I', or what others think of when they say 'you'." (Ibn Sina 2013, Bodžnurdi 2011)

The following thesis Ibn Sina tries to prove is the spirituality of man's soul, or its independence from physical matter. He says: „There is no doubt that there is something within a man, a substance that perceives concepts (intelligible). This substance that perceives concepts isn't the body nor does it depend on it, rather it's the special kind of strength within it. Soul isn't imprinted in the body nor does it exist by it." (Rizvi 2020, Ibn Sina 2013, Bodžnurdi 2011)

Soul is immaterial according to Ibn Sina. His predecessors have been proving the immateriality of the soul by logical evidence. Ibn Sina was the first one who was proving this by mental experience: „Let's imagine a man, created without eyesight, so that he can't see any of his skin; his limbs are separated so none of his body parts touch each other; let's say he is floating in empty space, where there is no air so he can't feel or hear anything. Won't this man be completely unaware of his body? Won't he be able to understand only one thing, and that is the existence of his soul, the existence of 'he'. Therefore, the existence of the soul is immaterial and unrelated to the body." (Rizvi 2020, Handžić 1999)

Ibn Sina dedicated a special chapter to the question of mental faculties (strengths, functions, drives) classifying them based on their qualitative characteristics by which they differ, emphasizing the necessity of a single integrative bond between them. He claims that vegetative and perceptive faculties in a man are specifically different from those in plants and animals considering the fact that man is gifted with reason which permeates and changes the nature of these faculties. Principle that ties all of these faculties he calls the mind.

Animal soul has besides physical senses (five of them: sight, sound, smell, taste, and touch), the interior senses. Some of these perceive shapes, and others perceive meanings of sensations. Among these abilities of perception, there are some that can perceive and act, while some of them can only perceive; some can perceive only shapes, and others can perceive only meanings. The difference between these two is that shape can be perceived by both, interi-

or senses of the soul and external, physical senses. It's first perceived by an external sense which then transfers it to the soul. On the other hand, meaning is something that the soul perceives from the object without it previously being perceived by an external sense. According to Ibn Sina, the most important interior sense is the 'common sense' or the 'composite drive' (his al-muštarak/sensus communis). Within us, there is a power that gathers sensations of external senses, while within the external senses there is no such thing that would gather so many sensations. Sometimes we perceive something yellowish and we can immediately tell that it's honey, which is sweet, of a beautiful smell, and is fluid, without even tasting, smelling, or touching it. We can discern that thanks to the already mentioned faculty (sensus communis – common sense). Therefore, within us, there is an integrative faculty whose function is to gather all of the sensations and make them into one shape, one single image. That is an imaginative faculty, also called common sense, and according to Ibn Sina's classification of interior senses, it is the primary (first), faculty. Its place is in the frontal part of the brain and it perceives all information through the senses. Second, or secondary faculty is pictorial or formative faculty. Its function consists of preserving what was perceived by common sense, sensus communis through external senses. The third faculty with regard to the animal soul is called imaginative, and with regard to the human soul, cogitative. Its function is to select, combine and separate what was kept by formative faculty. Following faculty is a judgment that perceives meanings that cannot be perceived by external senses such as love, hate, usefulness, harmfulness in material objects and it represents the basis of our character, whether it's under the influence of reason or not. The final faculty is memory, which is located in the posterior part of the brain, and its function is to retain what was processed by the faculty of imagination or thinking. These are interior faculties. All of them have their own centers in the brain and with them, they represent a tool, an instrumentarium (organon) which is used to carry out orders of the soul. According to this, all of the faculties perceive through the brain except the rational soul, which is inherent only to man. It perceives without intermediation of the brain, e.g. man's perception of his own existence or the ego feeling. It's done not by the brain rather by direct cognition (Rizvi 2020, Ibn Sina 2013, Bodžnurdi 2011, Eydi 2010, Corbin 2009, Avicenna 2005, Avicenna 1999, Cerić & Mehić-Basara 1997, Rahman 1988; Husejn 1987).

SPIRITUALITY, KNOWLEDGE, WELL-BEING

Ibn Sina was a devout Muslim, of a deeply religious nature, which is manifested not only in his poetry and commentaries on the Qur'an but also in his philosophical works where he tries in every way to reconcile different views with Islamic dogmas and, in fact, in many aspects his beliefs were inspired by the teachings and the meaning of Islam. Whenever he faced difficulties in solving scientific and philosophical problems, Ibn Sina went to the mosque to pray. He wrote several treatises on the benefits of prayer, on the performance of daily religious rites, on pilgrimage, and on other forms of piety. He considered all sacral rites useful because, according to his general view of the world, there is sympathy between different degrees of reality, and especially between human souls, God and heavenly souls, and that sympathy is strengthened by prayerful actions prescribed by different religions. The sympathy that fills the entire universe and that gives meaning to all prayer actions stems from the love that flows through the veins of the cosmos and which is the driving force and cause of the existence of a given order. This love originates from the love towards God who is the most sublime object of love, and also its most sublime subject. In all beings, love is either the cause of their existence or is identical with their existence, which means that there is no being without love (Nasr, 1991).

In the Logic of the Eastern (*Mantiq al Mashriqiyeen*) Ibn Sina gives the following recommendations for attaining sublime spiritual knowledge and states:

"*The Exalted God represents the first and final thought a man should be occupied with, observing Him should strengthen and beautify his gaze and while in a state of humility embark on a mental journey through the sublime Heavenly World, observing God's signs. When such a state is deeply rooted in the devotee of the way, the Heavenly world (Melekut) is outlined in his soul, the Divine world (Lahut) is revealed to him and he acquires intimacy with the Exalted. Then he tastes the sweetness of ultimate pleasure and takes from his soul what is most important to it. He is filled with calmness, and with security inside. He masters The most distant world, i.e. The World of Matter in a way that he is merciful to its inhabitants, facilitates their paths, and with the view of reason sees This World*

as beautiful. His soul is constantly preoccupied with the thought of God. As an attainment of this spiritual journey, he is overtaken by ineffable joy and happiness.

The best act of worship for man is salah (Islamic prayer). The best serenity and relaxation is fasting. The most useful good deed is charity. The purest secret is patience.

The most pointless effort is to discuss untruth. Man, as long as his attention is on what someone has said and his soul is devoted to discussion, cannot get rid of his weaknesses nor can his condition change.

The best deed is one that is done with sincere intent. The most valuable intent is the one that came from the source of knowledge. The root and foundation of every virtue and good is wisdom. The first and foremost is the knowledge of Allah. "(Eydi 2010)

The method proposed by Ibn Sina to attain this sublime spiritual state is the one that is very close to him, the Sufi (Tasawwuf) path of self-knowledge and perfection through self-control and development of moral virtues on the basis of which one should organize one's feelings, thoughts, behavior and lifestyle. It is a complex holistically oriented approach which, from the perspective of modern psychotherapeutic science, contains elements of spiritual, psychoanalytic, existentialist, cognitive-behavioral and gestalt approaches in psychotherapy. Ibn Sina (1999) says:

"Therefore, a reasonable person is obliged to be afraid of shortcomings and flaws, and to be pleased with everything that perfects him. He is obliged to seek everything that will complete him, perfect him, bring him honor, elevate his degree and free him from his restraints in a way that he will be safe from danger, and not in a way that he will be even more restrained, more complicated, and connected. He is obliged to be completely assured that the holy divine substance, when it gets rid of gross bodily substances becoming purer and clearer rather than connected and murky, ascends to the highest world, becomes happy, returns to its kingdom, approaches its Creator. It manages to come into the neighborhood with the Lord of the Universe, mixes with good souls like itself and others similar to it, and saves itself from what is contrary to it. On the basis of this we know that the soul which parts with the body, longing for it and fearing that parting, will be unhappy to the extreme and in great pain in regard to itself and its essence; it will turn to the farthest side of its permanent abode and always seek peace and tranquility there."

To understand this method, it is necessary to understand the concepts of spirit, soul and heart and their mutual relationship in the psychodynamics of spiritual improvement. The spirit is the essence in man and the soul is the appearance of that essence before the mental cognition. A heart, which in addition to signifying the bodily organ, in philosophy and religious psychology, today still represents a symbol of all-perceptibility and sensibility. Understanding and interpretation of these terms in Tasawwuf (Sufism) partly anticipates the psychodynamic understanding of psychic life. According to this understanding, these terms sometimes come in the same sense depending on which properties dominate the human spirit. If the spirit is dominated by bodily desires, instincts, it is denoted by the term *selfish soul* (as a center of passion / sexuality and anger / aggression, which would largely correspond to the psychoanalytic Id, which functions on the principle of pleasure, at the level of the primary process). If the spirit overcomes the instincts and puts them under the control of reason, in the frameworks of reality, it is then called the mind, intellect, reason (the self-critical soul, the closest psychodynamic term is Ego, which functions according to the principle of reality, at the secondary process level). When the spirit is inspired by belief, it is then dominated by religious and moral feelings (*inspired soul*) and is then called *the heart* (the closest psychodynamic term is *Superego*). Usually, the spiritual reality of the heart is veiled by the awareness focused on *the self* (self-preoccupation); which can manifest as either thought or feeling in accordance with the aspirations of a particular being and his personality traits. If these contents sublimate and the aspirations move (relocation) towards the noble spiritual virtues embodied in the divine ideal (somewhat hinted at by the psychodynamic ideal-ego) the spiritual reality of the heart is reached, the true self, the divine in man, which is the very essence of man's individuality. By the true cognizance of God, the soul rejoins the Spirit and finds its peace, serenity (calm soul). This is the point where mental and spiritual meet, where man transcends himself and strives for the divine. The soul that has been reunited with its source (religion from the Latin *religare* - re-establishing a connection with God) enters the spiritual realm and there can further improve and ascend to different degrees, which is described in detail in the mystical teachings of different religious and spiritual tradi-

tions. (Pajević et al. 2021a, 2021b, Pajević 2014, 2010, 2009, El-Gazali 2006a, 2006b, Ibn Sina 2000, Wilcox 1995, Shafii 1985).

HODEGETICS OF IBN SINA: EDUCATION FOR GOOD PHYSICIANS, HUMANISM AND EMPATHIC CIVILIZATION

Digital revolution is changing significantly all fields of society, science, education and medicine and new technologies have a huge potential to change current regimes and methods of knowledge production, publication and education, generally speaking as well as specifically in medicine. Education in medicine faces a number of challenges and dilemmas and the onus is on medical hodegetics, an important but almost forgotten discipline, to address them effectively. Hodegetics (greek hodos – way, guidance, indicator of the way, pointing the way), an important pillar of the triad of medical deontology is closely associated with medical professionalism. Medical deontology (greek deon – duty or obligation; logos – meaning opinion) is a discipline for the study of norms of conduct for the health care professionals, including moral and legal norms as well as those pertaining more strictly to professional performance. In today's culture of narcissism and individualism, many forgot to love one another and they make money instead. According to Pinditrao (2014) the term medical hodegetics refers to the "the guidelines for the study of medicine which cover the ideal principles which students of medicine must learn as were once envisioned by the ancient Fathers of Medicine". Ibn Sina is an excellent hodegetic, he really loved God, people, science, art and medicine. His Canon is the synthesis of teachings and traditions of Hippocrates, Galen, and Dioscorides, but it also contains a lot of new discoveries that came as a result of his own medical experiments and conclusions. He was one of the first who recognized psychological influence in the origin of somatic diseases. Medical hodegetics represents an art and practice of learning organization for developing three core learning capabilities: fostering aspiration (personal mastery, shared vision), promoting reflective conversation (mental models, dialogue) and understanding complexity (systems thinking). Hodegetics supports humans to continually expand their capacity to create the results they truly desire through the mission discovery process, reviewing what they have learned, creating rapport and good and therapeutic relationships, discovering the values of others, understanding self-esteeming and building self-confidence, discovering positive intentions, making creative visualization, utilizing criticism comfortably, securing positive mental attitude, modeling and achieving peak performance. Ibn Sina was a real master of the learning organization and hodegetics in science, art and religion. Through hodegetics learners are supported to grow as persons, psychologically, socially and morally in their role identification. The values/principles that should be respected and practiced in medicine are: 1. Autonomy – "nothing about patients, without patients"; 2. Benevolence – act in the best interest of the patient; 3. Primum non nocere – first, do not harm the patient; 4. Justice - fairness and equality; 5.Dignity involves both the patient and his physician; 6.Truthfulness and honesty; 7. Medical privacy; 8. Confidentiality; 9. Fidelity - being faithful or loyal to their patients; 10.Veracity - truth telling or obligation to full and honest disclosure (Pinditrao 2014). Professional formation in medicine is the process by which some individuals become physicians who serve the calling of medicine by their knowledge, attitudes and skills. Today we can recognize three models of professionalism: 1. the virtues model based on humanism, virtues, and ethics; 2. the behavioral model based on adoption of professional competencies, and 3. the identity formation model based on progressive incorporation of the values, aspirations and missions of the medical profession into the personal identity (see Jakovljevic et al. 2019). Ibn Sina practiced the virtues model based on humanism, spirituality, faith, virtues and universal ethics.

By getting acquainted with Ibn Sina's legacy, we learn, among other things, that man should be observed as a unique divine creation that combines all the wisdom of creation. That all aspects of his existence should be respected and special attention should be paid to spiritual cognitions and spiritual training, religiosity and methods of achieving internal peace and prosperity. That it is necessary for the doctor to have a spiritual background and philosophical basis that will consolidate all the facts related to the patient and based on which they will create their therapeutic approach adapted to patient's needs. That religion, philosophy, science and art are intertwined and that they complete each other. That the acquired knowledge should be applied, systematized

and transferred to others. That one should not be satisfied with superficial knowledge, but strive to reach the very essence of the problem and grasp the basic laws of events. That one should be patient and persistent in research and never give up whether it is a philosophical, scientific or practical problem from everyday life. That one should think, give his best to the limits of his possibilities and then seek help through devotional prayer to the Omniscient Creator. That through belief in God, adherence to religious laws and religious moral and ethical principles, through self-knowledge, one can perfect himself, realize the potentials given to him and rise to unimaginable intellectual and spiritual heights.

CONCLUSION

Ibn Sina's whole scientific and philosophic legacy, especially psychological and medical theory and practice, had had such an impact on the development of medicine in the East and the West for five centuries, that there are theories that even the word medicine was derived from the name Avicenna, the name they called him in the West. Starting from the thesis that psychology and medicine are tightly connected, in his Psychology Ibn Sina discusses the question of man's being, proving the existence of the human soul, describing mental faculties and intellect, and discussing questions of human happiness and longing. He links man's mental faculties to corresponding centers in the brain and notes that emotional states can have a direct impact on somatic functions. He observed man in his entirety taking into consideration all aspects of his existence, paying special attention to spiritual knowledge and spiritual perfection, religiosity and methods of achieving inner peace and well-being, to which modern secularized medicine, psychiatry, psychology and psychotherapy have only gradually returned in recent decades.

Contribution of individual authors:
Ahmed Pajević: conception and design of the manuscript, collecting data and literature searches, analyses and interpretation of literature, manuscript preparation and writing the paper; and gave final approval of the version to be submitted.
Izet Pajević: made substantial contributions to conception and design, analyses and interpretation of data, participated in revising the manuscript and gave final approval of the version to be submitted.
Mevludin Hasanović: made substantial contributions to conception and design, and interpretation of data, participated in revising the manuscript and gave final approval of the version to be submitted.
Miro Jakovljević: made substantial contributions to conception and design, and interpretation of data, manuscript preparation and writing the paper; and gave final approval of the version to be submitted.

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LONG-TERM NEUROPSYCHIATRIC CONSEQUENCES OF SARS-COV INFECTIONS

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SUMMARY

While the COVID-19 pandemic continues to spread globally, with relistic hope that will be solved with adequate vacination, more and more evidences are collected about the presence of psychiatric and neurological manifestations and symptoms associated with this diseas. Neurological manifestations, are part of the COVID-19 clinical picture, but questions remain regarding the frequency and severity of centra nervous system symptoms, the mechanism of action underlying neurological symptoms, and the relationship of symptoms with the course and severity of COVID-19.

The review of the so far published papers shows that although more and more papers are reporting neurological and psyhiatric manifestations associated with COVID-19, many items remain unclear. The long-term psychological implications of this infectious diseases should not be ignored.

In this paper, we aim to present a some of psychological consequences and neurological disorders associated with the SARS-CoV-2 infection, and to emphasize the need a global action that requires close coordination and open-data sharing between hospitals, academic and public health institutions and the fast establishment of harmonised research priorities to face acut and long-term the neurological and psychological consequences

Key words: COVID-19 – Neurological disorders - Psychiatric disorders - Long-term consequences

INTRODUCTION

Infection with the new corona virus (SARS-CoV-2) was first registered in December 2019 in China, and then later spread rapidly to the rest of the world. On December 31, 2019, the World Health Organization (WHO) informed the public for the first time about causes of pneumonnia of unknown origin, in the city of Wuhan (Hubei Province, China), in people who were epidemiologically linked to a seafood and wet animal whole sale local market in Wuhan. Coronavrus disease, called Corona virus disease 2019 (COVID-19), after China quickly spread to most countries in the wold, and the WHO on March 11, 2020 declared a pandmic with this virus. In Bosnia and Herzegovina, the first infected infected person was registered on 5.3.2020 in Banja Luka, and in the Federation of Bosnia and Herzegovina on March 9, 2020 in Konjic (Ghebreyesus 2020; Sinanović et al. 2020). COVID-19 is already affected a remarkably high proportion of the global population, which is unprecedented for a virus with such case fatality and infection rates in modern medicine. The most common presentation are respiratory symptoms ranging from mild flu-like illness to severe pneumonia, but a significant number of patients develop septic shock and multiple organ failure (Sinanović 2020). The most freuqent extrapulmonary manifestations include thrombotic complications, myocardial dysfunction and arrhythmia, acute coronary syndromes, acute kidney injury, gastrointestinal symptoms, hepatocellular injury, hyperglycemia and ketosis, neurologic illnesses, ocular symptoms, and dermatologic complications (Gupta et al. 2020).

By the time I finis this text (April 25, 2021), more than 147.000.000 people worldwide have been confirmed to be infected with SARS-CoV-2, more than 3.100.000 people have died due to COVID-19. Over 84.500.000 recovered were reported. These figures far exceed the SARS and MERS epidemics of 2002 and 2012 respectively.

In this paper, we aim to present a some of psychological consequences and neurological disorders associated with the SARS-CoV-2 infection, and to emphasize the need a global action that requires close coordination and open-data sharing between hospitals, academic and public health institutions and the fast establishment of harmonised research priorities to face acut and long-term the neurological and psychological consequences.

NEUROLOGICAL DISORDERS

The COVID-19, which is not just as a respiratory disease but also affects the cardiovascular, renal, and the nervous system functions (Huang et al. 2020; Yuki et al. 2020). SARS-CoV-2, in a number of patients penetrates the central nervous system (CNS), and apparently could be responsible for fatal outcome in some cases (Gandhi et al. 2020; Sinanović et al. 2020).

The entrry of the virus into the brain can lead to mild and more serious neurological (Neuro-COVID-19) and psychiatric manifestationss, which are not uncommon, including headache, anosmia, ageusia, encephalopathy, encephalitis, paresthesia, myalgia, Guillain-Barre syndrome, impaired consciousness, confusion or delirum and cerebrovascular diseases (Montalavan et al. 2020; Ellul et al. 2020; Sinanovic 2020). Reported neurological findings can be divided into three categories: central (headache (Mao et al. 2020; Wang et al. 2020), dizziness (Mao et al. 2020), impaired consciousness, acute cerebrovascular disease, ataxia and seizures), peripheral (hypogeusia, hyposmia) and musculoskeletal (Table 1) (Huang et al. 2020; Leonardi et al. 2020; Ahmed et al. 2020). Moreover, neurological involvement in COVID-19 corresponds to three situations: (a) neurological manifestations of viral infection, (b) post-infective neurological complications, and (c) infection in patients with neurological co-morbidity (Lahiri et al. 2020).

Table 1. Neurological complications and manifestations of COVID-19

Site	Manifestations
Central Nervous System	Dizziness
	Headache
	Acute cerebrovascular disease
	Impaired consciousness
	Transverse myelitis
	Impaired consciousness
	Transverse myelitis
	Acute hemorrhagic necrotizing encephalopathy
	Encephalopathy
	Encephalitis
	Epilepsy
	Ataxia
Peripheral Nervous System	Hypogeusia
	Hyposmia,
	Neuralgia
	Guillian Barre syndrome
	Skeletal muscle injury

Multiple cross-sectional studies have demonstrated that the incidence rate of olfactory dysfunction in COVID-19 patients varies from 33.9-68% with female dominance (Meng et al. 2020). Myalgia and muscle injury were reported in 10.7% of the cases in Wuhan (Mao et al. 2020) and rhabdomyolysis has been reported in another case from Wuhan (Jin & Tong, 2020). Many patients experienced hyposmia or anosmia, dysgeusia, dysarthria and either allodynia or acroparesthesias (Huang et al. 2020). Several cases of COVID-19 associated GBS have been also observed and published in different countris (Ahmed & Rathore, 2020; Zhao et al. 2020).

In a systematic review and meta-analysis of proportions of Favas et al. (2020) for articles published between 1st December 2019 to 25th June 2020 from: PubMed, MEDLINE, Scopus, EMBASE, Google Scholar, EBSCO, Web of Science, Cochrane Library, WHO database, and ClinicalTrials.gov., pooled prevalence of neurological manifestations were, smell disturbances (35.8%; 95% CI 21.4–50.2), taste disturbances (38.5%; 95%CI 24.0–53.0), myalgia (19.3%; 95%

CI 15.1–23.6), headache (14.7%; 95% CI 10.4–18.9), dizziness (6.1%; 95% CI 3.1–9.2), and syncope (1.8%; 95% CI 0.9–4.6). Pooled prevalence of acute cerebrovascular disease was (2.3%; 95%CI 1.0–3.6), of which majority were ischaemic stroke (2.1%; 95% CI 0.9–3.3), followed by haemorrhagic stroke (0.4%; 95% CI 0.2–0.6), and cerebral venous thrombosis (0.3%; 95% CI 0.1–0.6). They concluded that are common in COVID-19 and are even present as the only symptom without any other manifestation of the respiratory system involvement. Furthermore, they emphesised that some symptoms like smell and taste disturbance can be used as a screening tool for SARS-CoV-2 infection and can help isolate suspected patients earlier to avoid the spread of the disease.

LONG COVID-19 AND LONG-TERM NEUROLOGICAL IMPLICATIONS OF COVID-19

There is increasing awareness of the long-term symptoms and organ damage in patients with confirmed COVID-19 that persist after the acute illness. Although the term "long COVID" is now commonly used for these disorders, there is still no consensus on terminology, which includes chronic COVID syndrome, post-COVID-19 syndrome, post-acute COVID-19, and long-hauler COVID-19 (Del Rio et al. 2020; Anonymous 2020; Stefano 2021; Nalbandian et al. 2021).

Based on relapsing/remitting nature of post-COVID symptoms, the following integrative classification is proposed: potentially infection related-symptoms (up to 4–5 weeks), acute post-COVID symptoms (from week 5 to week 12), long post-COVID symptoms (from week 12 to week 24), and persistent post-COVID symptoms (lasting more than 24 weeks) (Fernández-de-las-Peñas et al. 2020). However, there is much that remains unknown, and the response to long COVID is still in its infancy. What are the diagnoses, definitions, and phenotypes of illness that are grouped under the term long COVID? How long does it last? Who is at risk of serious or prolonged sequelae? What are the underlying causes and mechanisms? How do we prevent or reduce the effects of such sequelae on patient health and wellbeing? Are there any effective treatments to aid patient recovery and the regain of full function? What rehabilitation is needed? (Anonymous 2020). Robust data and scientific evidence are essential to answer these questions. Large and long-term cohort studies are urgently needed to help better understand the trajectory, complications, and biological mechanisms that drive the long-term health consequences of COVID-19. These studies should include diverse populations, with both hospitalised and non-hospitalised patients, patients from primary and secondary care, and patients from a range of high-income, low-income, and middle-income countries. Minority ethnic groups and older people have been disproportionately affected by the pandemic, so ethnic and demographic factors must also be considered during patient recruitment. Patient perspectives regarding terminology of symptoms and recovery should be incorporated into study designs to ensure clinically meaningful research questions and outcomes. Multidisciplinary, multicentre, and multinational collaborations and approaches to data collection are required (Anonymous 2020).

Now it is well known that some patients with COVID-19 may develop various CNS abnormalities of central and peripheral nervous system, with potentially serious and long term consequences, including stroke and isolated psychiatric syndromes (Butler et al. 2020; Butler et al. 2020a). Furthermore, it is known from previous pandemics, such as so-called Spanish flu in 1918 and SARS in 2002, that there are not just acute effects of the viral infection but also long-term sequelae due to disease itself as well as social effects due to governmental measures of containment such as quarantine, social distancing, and lockdown (Kumar et al. 2021). Concerns have also been raised about post-COVID-19 parkinsonian syndromes, driven by the encephalitis lethargica epidemic that followed the 1918 influenza pandemic (Hoffman & Vilensky 2017). Namely, encephalitis lethargica is a neurological syndrome that spread across Europe and then the world beginning in the winter of 1916–17, and continuing into the 1930s. Although the exact number of people afflicted with encephalitis lethargica during the epidemic period is unknown, it is estimated to be more than one million worldwide (Ravenholt & Foege 1982). Those who survived were sometimes left with lingering and permanent neurological sequelae that rendered them nearly akinetic. Although 100 years have passed since the beginning of the epidemic period, many questions remain about this mysterious illness: What causes it? How is it transmitted? Could an epidemic happen again? (Hoffman & Vilensky 2017).

Taquet et al. (2020) emphasise, that their data provide some support for this possibility, although the incidence was low. So, Parkinsonism might be a delayed outcome, and patients after COVID-19 should be monitored longerin which case a clearer signal might emerge with a longer follow-up.

Given the global dimension of the current pandemic and the high transmissibility of the SARS-CoV-2 virus, the evidence that already exists about the association between this virus and the CNS, raises concerns about the potential long-term effects of COVID-19 on the CNS (Sinanović 2020), and strongly suggests that patients surviving COVID-19 are at high risk for subsequent development of neurological disease and in particular Alzheimer's disease (Heneka et al. 2020). Various adverse neurological and psychiatric outcomes occurring after COVID-19 have been predicted and reported (Roger et al. 2020; Ellul et al. 2020; Varathraaj et al. 2020; Taquet et al. 2021a). From the current point of view, it seems that in COVID-19 survivors, in the coming years and decades, the inflammatory systemic process and/or the inflammatory process of the brain could trigger long-term mechanisms that generally lead to an increase of neurological and neurodegenerative disorders (Sinanović et al, 2020; Heneka et al, 2020).

The mechanisms contributing to neuropathology in COVID-19 can be grouped into overlapping categories of direct viral infection, severe systemic inflammation, neuroinflammation, microvascular thrombosis and neurodegeneration (Heneka et al, 2020; Muccioli et al, 2020). While viral parts in the brain have previously been observed with other coronavirus infections (Desforges et al, 2014) there is not yet compelling evidence of SARS-CoV-2 infecting neurons. However, autopsy series have shown that SARS-CoV-2 may cause changes in brain parenchyma and vessels (Romero-Sánchez et al, 2020; Reichard et al, 2020).

In very recently publication (on April 6 2021) of Taquet et al. (2021a) who examined the associations of COVID-19 with neurological and psychiatric outcomes, in the following 6 months, estimation of incidence of a neurological and psychiatric diagnosis among 236 379 patients diagnosed with COVID-19 was done. They concluded that COVID-19 is followed by significant rates of neurological and psychiatric diagnoses over the subsequent 6 months. Namely, in the six months following a COVID-19 diagnosis, about a third of survivors had a neurological or psychiatric disorder and hazard ratios were substantially higher than in influenza (33.62%/95% CI 33.17–34.07) (control cohorts comprised 105 579 patients diagnosed with influenza) for most outcomes. The study replicates earlier findings of an increased risk of stroke (both ischaemic and haemorrhagic) as well as the more novel and concerning finding of an increased risk of incident dementia. Although the estimated incidence was modest in the whole COVID-19 cohort 2.66% of patients older than 65 years 4.72% who had encephalopathy, received a first diagnosis of dementia within 6 months of having COVID-19. The highest hazard ratio compared to influenza is for myoneural junction and muscle disease, but the specific nature and aetiology of this remains rather unclear So, consistent with several other reports (Siow et al., 2020; Hernandez-Fernandez et al. 2020; Xie et al. 2020), in this study, the risk of cerebrovascular events (ischaemic stroke and intracranial haemorrhage) was elevated after COVID-19, with the incidence of ischaemic stroke rising to almost one in ten (or three in 100 for a first stroke) in patients with encephalopathy (Taquet et al. 2021a).

PSYCHIATRIC CONSEQUENCES OF COVID-19

Due to the fact that iformation about the diseas caused by SARS-CoV-2 (COVID-19) spread very quickly, outside China, confirming the remarks that it is very contagious disease, but also a fatal disease, the general public already at the beginning of pandemic become very upset (Dong et al. 2020; Jakovljevic et al. 2020). Apart from respiratory and multiorganic disorders, it was inveitable to expect that such a large pandemic with numerous uncertainities, drastic changes in everyday life among a significant number of inhabitans of the planet, and even our country would lead to psychological difficulties for a significant number of population, including health workers.

Among the first reports is a study by Xiao et al. (2020) who analyzed the presence of stress sympotms, anxiety and sleep quality, and the impact of social support on these symptoms, in 170 residents in central China during the COVID-19. They found a high level of stress and anxiety, as wll as poor sleep quality in most respondents, and a positive correlation in terms of their lower presence with adequate social support. According to a study by Liu et al. (2020) who analyzed 285 respondents over the age of 18 in

Whuan and surroundig cities, where the COVID-19 epidemic started in China, a month after the outbreak, symptoms of post-traumatic stress disorder (PTSD) were present in 7% of subjects. Women had significantly more frequent symptoms of re-experiencing, both repression and arousal, and in the domain of cognition and mood. Subjects who had better sleep quality also had fewer symptoms of PTSD. The authors note that this is the first study on this topic and remind that in earlier study done in Taiwan, after the SARS epidemic, the incidence of depressive symptoms in the sample tested was 3.7% (Ko et al. 2006).

Maunder (2004), studying the psychological consequences of the SARS epidemic in the first half of 2003 in Canada, nots that it was an unpredictable trauamtic event for health workers in Toronto. It is estimated that 29-35% of health workers have experienced a high level of distress. The nurses were in the greatest distress, then those who had contact with SARS patients and those who had children. The lessons they have learned are: efforts are needed to mitigate the psychological impact of actions in controlling infection, especially the interpersonal distance that these actions have promoted; effective risk information and education is a priority in the early stages of the epidemic; health professionals can play a role in influencing good media reporting patterns, that can increase or decrease the general morale of the population; health workers need to have psychological support within the health system as well as cleare practical support that facilities their hard work during an epidemic. High scores on the impact event events in nurses, who had contact with SARS patients, and significant negative impact of social isolation and fear for health, were reported in another study from Toronto (Maunder et al. 2004).

Huang and Zhao (2020) published the results of study, conducted during the COVID-19 epidemic in China, based on an online cross-sectional survey that included 7.236 voluntaries. They determined the overall prevalence of generalized anxiety disorder in 35.1%, depressive symptoms in 20.1%, and sleep quality disorder in 18.2%. Compared to other peofessionals, health workers were more likely to have poorer sleep quality. Age less than 35years and focusing on the COVID-19 pandemic (TV, internet cell phone, thinking about infection and consequences) for more than three hours a day was associated with greater anxiety, and in the case of health workers with poorer sleep quality.

In review article, Röhr et al. (2020) analyzed 13 studies examining the psycchosocial consequences of quarantine measures during the COVID-19 pandemic, noting that these measures were associtaed with negative psychosocial outcomes, including depressive sympotms, anxiety, anger and stress, PTSD, social isolation, loneliness and stigmatization. Based on the analysis, the authors concluded that quarantine isolation measures during the COVID-19 pandemic have huge negative consequences for mental health; and that preventive interventional measures to reduce psychosocial consequences should be an integral part of the crisis response during pandemic conditions. The second review article, which was based on a review of 28 published papers in journal included in PubMed indexing, and which delt with the effects of the COVID-19 pandemic on menal health, it was concluded that symptoms of anxiety and depression (16-28%) and stress (8%) are common psychological reactions to the COVID-19 pandemic and are also associtaed with sleep disorders (Rajkumar 2020).

LONG-TERM PSYCHIATRIC CONSEQUENCES OF COVID-19

Even if patients with COVID-19 recover physically, they are vulnerable to long-lasting mental health problems. Long-term psychological distress with symptoms of anxety and depression, and post-traumatic stress disorder can develop in more than half of patients who survive critical illness. Furthermore, depression following critical illness is associated with an increased mortality risk in the first 2 years following discharge from intensive care unit (ICU) (Hatch et al. 2018). While there is no long-term data on the psychological effects of COVID-19 infection and treatment, an earlier study of patients hospitalized for SARS found that more than one-third had moderate to severe depression and anxiety 1 year after physical recovery (Lee et al. 2007). The mental health effects of surviving COVID-19 may be further compounded by loneliness and isolation, job and economic loss, increased child care and familial responsibilities, and guilt if family members or other contacts contract the virus. Finally, COVID-19 survivors may experience chronic pain, which is commonly reported by ICU survivors (Devine et al. 2019), potentially compounding the epidemic of opioid misuse already affecting many of the same vulnerable populations.

In a recent paper already mentioned above (Taquet et al. 2021a) the estimated incidence of a neurological or psychiatric diagnosis in the following 6 months was 33·62% (95% CI 33·17–34·07), with 12·84% (12·36–13·33) receiving their first such diagnosis. Regarding individual diagnoses of the study outcomes, the whole COVID-19 cohort (236 379 patients) had estimated incidences of 0·67% (0·59–0·75) for dementia, 17·39% (17·04–17·74) for anxiety disorder, and 1·40% (1·30–1·51) for psychotic disorder, among others. In the group with intensive therapy unit admission, estimated incidences were, 1·74% (1·31–2·30) for dementia, 19·15% (17·90–20·48) for anxiety disorder, and 2·77% (2·31–3·33) for psychotic disorder. Most diagnostic categories were more common in patients who had COVID-19 than in those who had influenza (hazard ratio [HR] 1·44, 95% CI 1·40–1·47, for any diagnosis; 1·78, 1·68–1·89, for any first diagnosis). As with incidences, HRs were higher in patients who had more severe COVID-19 (eg, those admitted to ITU compared with those who were not: 1·58, 1·50–1·67, for any diagnosis; 2·87, 2·45–3·35, for any first diagnosis). Unlike the other study, and in line with previous suggestions (Watson et al. 2021), they also observed a significantly increased risk of psychotic disorders, explaning that difference by reflection the larger sample size and longer duration of follow-up in their research. Substance use disorders and insomnia were also more common in COVID-19 survivors than in those who had influenza or other respiratory tract infections (except for the incidence of a first diagnosis of substance use disorder after COVID-19 compared with other respiratory tract infections).

The immediate psychological sequelae SARS-Cov-1 otbreak in 2003 were similar to those reproted in the current COVID-19 pandemic (Chua et al. 2004), as well as one year after the outbreak (Lee et al. 2007). The immediate psychological sequelae of SARS have been included significantly higher stress levels among affected individuals, compared with matched healthy control subjects, as well as poor sleep, depressed mood, weepiness, nightmares, and poor concentration (Chua et al. 2004). Acute psychosis was also observed in a some individuals (Lee et al. 2004). Namely, Lee et al. (2007) found that SARS survivors had higher stress levels during the outbreak, compared with control subjects ($P<0.01$), and this persisted 1 year later ($P<0.01$) without signs of decrease. In 2004, SARS survivors also showed worrying levels of depression, anxiety, and post-traumatic symptoms. During the outbreak, health care worker SARS survivors had stress levels similar to those of non–health care workers, but health care workers showed significantly higher stress levels in 2004 ($P<0.05$) and had higher depression, anxiety, posttraumatic symptoms. So this study shows that, instead of abating with time, stress levels remained persistently elevated one year after the outbreak. Stress levels of health care worker SARS survivors actually increased over the period. As a group, the SARS survivors showed worrying levels of psychological distress one year after the outbreak, as demonstrated by the alarmingly high levels of depression, anxiety, and posttraumatic symptoms, as well as by a high prevalence of potential cases of psychiatric morbidity. Moreover, the strong correlation among the different stress and psychological distress indices means that survivors were affected simultaneously by a multitude of psychological problems and were not merely struggling with isolated problems. Finaly Lee et al. (2007) cocluded that the situation of health care worker SARS survivors is particularly worrying. The long-term psychological implications of infectious diseases should not be ignored. Mental health services could play an important role in rehabilitation.

The long-term psychiatric consequences of COVID-19 likely share similarities with those observed during the SARS outbreak where, following physical recovery, 50% and 20% of survivors continued to exhibit anxiety and depression, respectively, with people treated with antiviral and corticosteroid medications also exhibiting significant memory problems (Tsang et al., 2004). During the convalescence phase, SARS patients also frequently suffered from post-traumatic stress disorder (PTSD), with the lowest level of blood oxygen saturation (SaO_2) during hospitalization being the most significant predictor for intrusion and avoidance symptoms in one study (Wu et al., 2020). The reports on the long-term mental health sequelae in COVID-19 patients confirm some of the above findings. Namely, in one study 12.2% had PTSD symptoms, 26.8% had anxiety and/or depression symptoms. In addition, 53.6% of patients reported chronic fatigue 3 months post-COVID-19 infection (Qi et al., 2020; Mukaetova-Ladinska & Kronenberg, 2020).

While health workers, and a vast army of essential professionals continue to battle COVID-19 on the front lines, policymakers and payers must look to-

ward the future. There needs to be a comprehensive plan for preventing and managing post-COVID-19 complications and supporting patients and families experiencing delayed morbidity and disability as a result. Health protection and policies should extend beyond the present and ensure that COVID-19 kills as few people as possible now and the future (Jing & McCoy, 2020).

CONCLUSION

The consequences of this pandemic on the overall life of people on the planet are significant and unthinkable. COVID-19 is primarily a disease of the respiratory system, but SARS-CoV-2, the RNA virus that causes the disease, in a number of patients also penetrates the CNS, leading to serious neurological disorders, and apparently it is also responsible for mortality.

Furthermore the entrry of the virus into the brain can lead to neurological and psychiatric manifestationss, which are not uncommon inluding headache, anosmia, ageusia, encephalopathy, encephalitis, paresthesia, myalgia, Guillain-Barre syndrome, impaired consciousness, confusion or delirum and cerebrovascular diseases. Psychosocial consequences as well as consequences for mental health are also significant, both for the general population and especially for health workers of all profiles. Many items remain unclear and this uncertainty calls for a global action that requires close coordination and open-data sharing between hospitals, academic and public health institutions and the fast establishment of harmonised research priorities to face acute and long-term post acute COVID-19 complications and psychological consequences. Services need to be configured, and resourced, to deal with this anticipated need. Neurologists, psychiatrists, and caregivers should be alerted to a possible increase in such cases in COVID-19 survivors. Prospective studies are needed to investigate potential correlations between acute and sub-acute COVID-19 infections and long-term neurological sequalae in this patient cohort in spite of relistic hope that this pandemic will be solved with adequate vacination.

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SAŽETAK

Iako se pandemija COVID-19 nastavlja širiti globalno, sa realnom andom da će se to riješiti sa adekvatnom vakcinacijom, prikupja se sve više dokaza o prisustvu psihijatrijskih i neuroloških manifestacija i simptoma sa ovom bolešću. Neurološke manifestacije su dio kliničke slike COVID-19, ali ostaju pitanja u vezi sa učestalošću i težinom simptoma povezanih sa središnjim živčanim susatvom, mehanizmima koji stoje iza neurološkoh simptoma i povezanošću simpotma sa tijekom i težinom COVID-19.

Pregled do sada objavljenih radova pokazuju da, iako je sve više i više saopštenja o neurološkim i psihijatrijskim manifestacijama povezanim sa COVID-19, mnoga pitanja ostaju nejasna. Pored toga, dugoročne psihološke implikacije ove infektivnih bolesti se ne bi trebale ignorirati.

U ovom radu želimo prikazati neke psihološke posljedice i neurološke poremećaje povezane sa SARS-CoV-2 infekcijom i naglasiti potrebu za globalnom akcijom koja zahtijeva blisku koorodinaciju i otovrenu razmjenu podataka između bolnica, akademskih i javnih institucija i brzo uspostavljanje harmoniziranih istraživačkih prioriteta kako bi se suočili sa akutnim i dugoročnim neurološkim i psihološkim posledicama.

Ključne riječi: COVID-19 – Neurološki poremećaji - Psihijatrijski poremećaji - Dugoročne posljedice

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SCHOOL CHILDREN EXPOSURE TO LOW INDOOR AIR QUALITY IN CLASSROOMS DURING COVID-19 PANDEMIC: RESULTS OF A PILOT STUDY

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SUMMARY

Background: Indoor air quality (IAQ) in classrooms affects children's health and academic performance. The aim of this pilot study was to determine IAQ in elementary schools different in their internal and external characteristics, in settings of COVID-19 epidemics.
Methods: IAQ parameters: fine particulate matter ($PM_{2,5}$) mass concentration, CO_2 concentration, temperature and relative humidity were measured in parallel in four elementary schools/classrooms during October (non-heating season) and four months (including holiday in January) of heating season. IAQ parameters were measured in settings of anti-epidemic restrictions (≤13 students in classroom, frequent ventilation).
Results: During October, except in one school, $PM_{2,5}$ concentrations were below the upper recommended value (25μg/m³), but started rising in all schools in the heating season. The highest concentrations of $PM_{2,5}$ were registered in two schools with closed or shortly opened windows. CO_2 concentrations were mostly in the recommended range (up to 1000ppm) except in the school with constantly closed windows and in three schools in February when concentrations were higher. Except in one, the same school, and in January, both temperature and relative humidity were out of the recommended range (24,0–27,0°C in non-heating; 20,0–24,0°C in heating season; and 45–55%), with temperature mainly above and relative humidity mainly below it in three schools. The largest deviation in temperature and relative humidity were registered in urban schools. Registered differences may be explained by different internal and external characteristics.

Conclusion: Despite anti-epidemic restrictions, most of the measured IAQ parameters were out of the recommended values in heating season. In addition, further deterioration of IAQ could be expected if all students had been presented in the classroom. Finally, to assure a healthy school environment in heating season, further optimisation of both indoor and outdoor conditions is needed in both pandemic and non-pandemic settings.

Keywords: Indoor air quality, classroom, green building certification, health, Covid-19

INTRODUCTION

As people spend 80–90% of their lives indoors, it is very important to ensure high indoor air quality (IAQ). This is particularly important in elementary school classrooms because of the vulnerability of school-aged children to poor air (Burtscher & Schüepp 2012). Indeed, school-aged children absorb significantly more air pollutants than adults because of their two times faster breathing cycle, higher air intake as well as higher metabolic rate per unit of body weight (Nam et al. 2015). IAQ in classrooms, which were mainly shown to be crowded, poorly ventilated and overheated, has been repeatedly shown to significantly affect children's health and academic performance, and also to increase the risk of the development of chronic diseases in adulthood (Oliveira et al. 2019).

IAQ in classrooms is affected both by the concentration of indoor air pollutants (IAPs) such as particulate matters (PMs), carbon dioxide (CO_2), carbon monoxide, volatile organic compounds, nitrogen dioxide, radon, airborne microbes, and also by parameters such as temperature and relative humidity.

PMs found in the European classrooms mainly originate from indoor sources, i.e. school children and their playing activities, classroom furnishings (whiteboards, tables, chairs, etc.), consequences of architectural decadence, use of printers and photocopy machines, air-conditioning, heating systems and human activities such as cooking and cleaning (Destaillats et al. 2008; Morawska 2017; EEA 2017; Oliveira et al. 2019). As widespread complex mixtures of solid and liquid particles suspended in air, PMs vary in origin, composition, shape, and size being classified into ≤10 μm (combined fine and coarse fraction, PM_{10}), ≤2,5 μm (fine fraction including the ultrafine particles, $PM_{2.5}$) and ≤0.1 μm (ultrafine particles fraction) (WHO 2012, Zhang et al. 2015). WHO guidelines set $PM_{2.5}$ limits for indoor air at 25 $\mu g/m^3$ for the 8-h period and suggest its indoor concentrations should be as low as possible as it can reach and affect the lowest respiratory tract and even the circulatory system (Kim et al. 2015). Also, a growing evidence on negative health effects following short-term exposure to PMs, their negative effects on cardiorespiratory health and mortality as well as their classification in group I carcinogens (WHO 2016, IARC 2013) put them in the focus of the public health interest.

Concentration of CO_2, a product of human metabolism and respiratory exchange, primarily depends on the number of students in the classroom (Coley & Beisteiner 2002) and was set as a reference for the assessment of IAQ and ventilation control (Persily & Jonge 2017). Indoor CO_2 can also be acquired from outdoor air where concentration reaches around 400 mg/m^3, mainly as a result of fuel combustion from traffic and other human activities. CO_2 limits for safe indoor air are set at 1000 ppm for the 8-h period (ASHRAE 2007), with the higher level considered as both an indicator of unacceptable ventilation as well as with the risk of negative effects on people's perceptions and performance (Fromme et al. 2019).

The wellbeing and respiratory health of school children can also be affected by extreme temperatures and relative humidity (Choo et al. 2015). The recommended temperature range for acceptable IAQ during the heating season is 20,0–24,0°C, while during the non-heating season 24,0–27,0°C (ASHRAE 2007), while recommended relative humidity rate in the classroom is 45–55% (EEA 2017).

Although it is assumed that concentration of IAPs is directly affected by both internal factors such as classroom orientation, classroom ventilation and heating systems and insulation materials, as well as by external factors such as their concentrations outdoors, the vicinity of the road, the farm, or water or sun exposure, the exact data are scarce. Also, the only evidence-based data on IAQ in elementary schools in Bosnia and Herzegovina (BiH) originate from "SEARCH project", an international research on school environment and respiratory health of children that indicated poor IAQ in BiH schools (Cso-

bod et al. 2010). In addition, assessment of IAQ in the settings of COVID-19 epidemic is of additional relevance. Therefore, the aim of this pilot study was to determine IAQ in elementary schools different in their internal and external characteristics potentially affecting IAQ, in the setting of COVID-19 anti-epidemic restrictions.

METHODS

This pilot study was a part of a research of energy efficiency practices in educational institutions of Sarajevo Canton (natural vs artificial construction materials) during the non-heating and heating season. The research was designed and conducted by an interdisciplinary team gathered under the association Green Building Council. It was approved by Cantonal ministry of education.

School selection and characterisation

Out of all schools in Sarajevo Canton, four schools were selected for inclusion in the study. The primary criteria for school selection was different insulation materials presenting a basis for four different scenarios for IAQ assessment.

To identify potential emission sources for IAPs and other factors potentially affecting IAQ, the following data were collected for each school or classroom: number of students in classroom, classroom level, classroom volume, number of m^3/person, flooring, wall covering, material of windows, duration of windows/opening, type of ventilation, classroom orientation, school location (urban/rural), vicinity of the road, classroom orientation to the road, vicinity of the farm or water, sun exposure, type of heating system, type of insulation material, energy efficiency class, etc. School was characterized as being in the vicinity of the road, the farm or water if the distance was equal or less than 50 m. These findings were expressed as school/classroom's characteristics.

IAQ parameters measurements

Following IAQ parameters were measured: $PM_{2,5}$ mass concentration (μg/m^3), CO_2 concentration (ppm), temperature (°C) and relative humidity (%). $PM_{2,5}$ mass concentration was measured by M2000C (Temtop, Elitech, China), CO_2 concentration by HVS-110 (Innen Techsolutions, Zug, Switzerland), and temperature and relative humidity by Testo 174 (Titisee-Neustadt, Germany).

Data collection, analysis and presentation

IAQ parameters were measured and data collected in academic 2020/21, during one month (October) of the non-heating season and four subsequent months (November through February, including winter holiday in January) of the heating season. Parameters were always measured in parallel, i.e. at the end of the third class through subsequent months, or through three school classes in February (six measurements through 100 min-period, i.e. at the beginning and at the end of each of three classes), in the morning shift in four same classrooms, with the same group of students. In February, in addition, outdoor values of all parameters were measured at the end of the third class. Measurements were performed in the settings of Covid-19 anti-epidemic restrictions (≤13 students in the classroom, frequent room ventilation).

RESULTS

School characterization

School/classroom characteristics are presented in Table 1.

IAQ parameters

Median, minimal and maximal values of IAQ parameters measured during the non-heating and the heating season, including holiday period in four schools are shown in Table 2.

$PM_{2,5}$ mass concentrations

Inter-school comparisons through the non-heating, heating season and holiday period (Figure 1a). During October, median $PM_{2,5}$ mass concentrations were mostly below the upper recommended value of 25 μg/m^3 for the 8-h period in all schools except in school 4 where concentration was about 4,3 times higher than recommended. In other three schools concentrations however started rising above recommended value with the beginning of the heating season, so through the non-heating season the concentrations in all schools were far higher than acceptable, up to five

Table 1. School/classroom characteristics

	School			
Characteristics	**School 1**	**School 2**	**School 3**	**School 4**
Nr of students in classroom	8	8	9	8
Grade of children	V	III	IV	II, III
Classroom level	first floor	first floor	first floor	ground floor
Classroom volume (m3)	172,2	181,7	180,8	171,3
m3/person	19,7	20,2	18,1	19,0
Flooring	wooden	vinyl floor	laminate floor	vinyl floor
Wall covering	painted	painted	painted	painted
Type of windows	wooden	plastic	plastic	wooden
Duration of windows/opening	third class	second, third class	all three classes	never
Type of ventilation	natural	natural	natural	natural
Classroom orientation	south	south	south	south
School location	urban	rural	urban	rural
Vicinity of the road	yes	yes	yes	yes
Classroom orientation to the road	direct	indirect	indirect	indirect
Vicinity of the farm	no	no	no	yes
Vicinity of water	yes	yes	no	yes
Sun exposure	direct, high	direct, high	direct, high	indirect, medium
Type of heating	public/natural gas	own/natural gas	own/natural gas	own/fuel oil
Type of insulation materials	none	styrofoam	mineral wool	sheep wool and wood
Energy efficiency class*	D	A	A	C

*Regulation on the implementation of Energy Audit and issuance of Energy Certificate; Official gazzet FBiH No 87/18 file:///Users/Aida/Downloads/EPBD%20implementation%20Report_BiH%20(1).pdf

times higher in schools 1 and 4. Even in the holiday period in January, values were still above 25 μg/m^3.

Comparisons through three school classes in February (Figure 1b). All measured $PM_{2.5}$ mass concentrations were higher than recommended one during the observed 100-min period in February in all schools. The concentrations ranged from a minimal increase of 1,8 times higher in school 2 at the beginning of the first

Table 2. Median (M), minimal (min) and maximal (max) values of IAQ parameters measured during the non-heating and the heating season, including holiday period in four schools

	PM2,5 (µg/m³)			CO2 (ppm)			Temperature (°C)			Relative humidity (%)		
Month	M	Min	Max	M	Min	Max	M	Min	Max	M	Min	Max
October	13	6	108	737	705	1443	28	24	30	40	35	58
November	77	61	119	885	421	1080	25	22	26	45	37	55
December	95	65	131	789	752	1003	24	22	27	39	30	56
January	33	30	36	582	425	657	18	15	18	55	54	60
February	92	55	129	1255	953	2826	25	22	26	29	23	49

class, to the maximal one of 6,1 times higher in school 1 at the end of the second class, and even one of 6,3 times higher in school 4 at the end of the first class. As in the earlier parts of the heating season, these two schools constantly registered the highest $PM_{2,5}$ concentrations. The lowest $PM_{2.5}$ concentration was measured in school 2.

CO_2 concentration

Inter-school comparisons through the non-heating, heating season and holiday period (Figure 2a). CO_2 concentrations were mostly in the recommended range (up to 1000 ppm for the 8-h period) in all schools during all months except in school 4 in October (50% higher than recommended) and in three schools in February, with the highest concentration measured again in school 4. A minor increase, up to 40%, was registered in February in schools 2 and 3 (Figure 2a).

Comparisons through three school classes in February (Figure 2b). CO_2 concentration increased during the observed 100-min period in all schools except school 1 where the concentration started decreasing after the first class. The highest values (up to 3,2 times higher than recommended at the beginning of the third class) and all values higher than recommended were recorded in school 4. Although mainly above the recommended level (up to 40% higher than recommended), CO_2 concentration in school 2 was much lower than in school 4. The lowest CO_2 concentration was registered in school 3 where the windows were continuously open. Still, the value measured at the end of the third class was higher than recommended.

Temperature

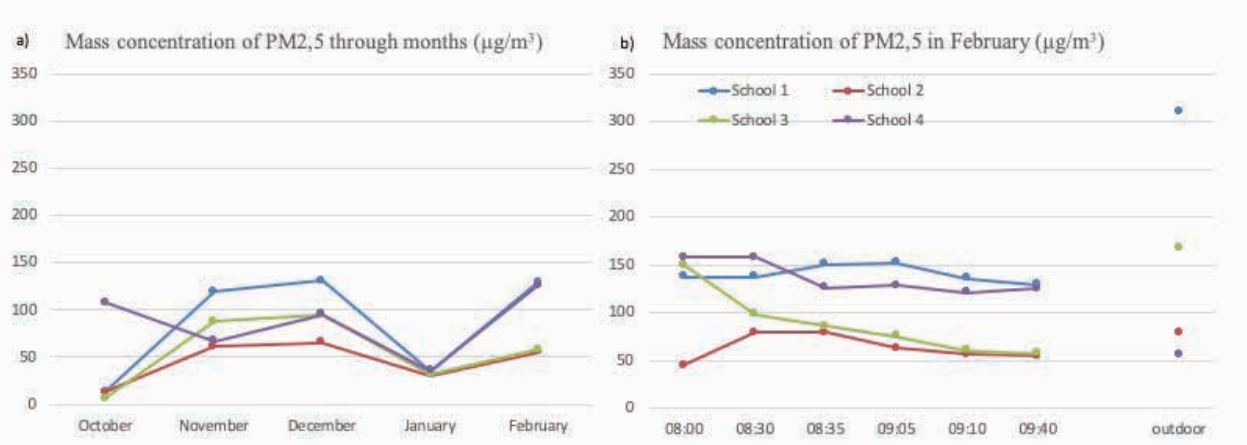
Inter-school comparisons through the non-heating, heating season and holiday period (Figure 3a). Temperature was mostly above the recommended range (24,0–27,0°C in the non-heating; 20,0–24,0°C in the heating season) in all schools through all months except in school 4 and in January (Table 2). The highest temperatures in October were registered in two urban schools (28,8°C in school 1 and 29,5°C in school 3), as well as in the heating season with the highest value of 27°C measured in school 1. The most optimal temperatures in both seasons were registered in school 4.

Comparisons through three school classes in February (Figure 3b). Although at the beginning of the first class in February the temperature was lower than recommended in all schools except school 1, it increased during the first class in all schools. The lowest temperature (12°C) was registered in school 4, but it reached the optimal value by the beginning of the second class. The most optimal temperatures in February were registered in schools 3 and school 4, while in school 1 it was continuously above (up to maximum 28°C) the recommended range.

Relative humidity

Comparisons through the non-heating, heating season and holiday period (Figure 4a). Relative humidity was below the recommended range (45–55%) in all months except January and in all schools except school 4 where the majority of values were in the recommended range and presented always with maxi-

Figure 1. Inter-school comparisons of $PM_{2,5}$ mass concentration a) at the end of the third class through the non-heating, heating season and holiday period in January, b) at the beginning and at the end of each class and outdoor in February, within-day comparison. *Note the difference in the length presented on x axis: class vs break (30 vs 5 min)*



mum value (Table 2). The lowest values, significantly lower than recommended, were mainly measured in school 1.

Comparison through three school classes in February (Figure 4b). Values of relative humidity in February were mostly lower than recommended with the minimum of 23% at the end of the third class in school 3. With the exception at the beginning of the first class when the highest value of 65% was measured, relative humidity was continuously maintained within the recommended range only in school 4.

Closed vs open windows comparisons (Figure 1–4b). Intra-school, closed vs open windows comparison was possible in schools 1 and 2. High $PM_{2,5}$ mass concentration, all above the upper recommended value, started decreasing in both schools after the windows were opened.

Although with closed windows CO_2 concentrations were increasing in both schools, they started decreasing after the windows were opened in school 1, but not in the school 2 where the increase continued even after the windows were opened.

Temperature was increasing with closed windows in both schools but started decreasing (28°C to 24°C) after the windows were opened in school 1, but not in the school 2 where the increase continued even after the windows were opened and despite the outdoor temperature of 7–8°C.

For relative humidity, its decreasing trend related to closed windows, more noticeable in school 2, was continued in the form of slight decrease and then maintenance after the windows were opened in both schools.

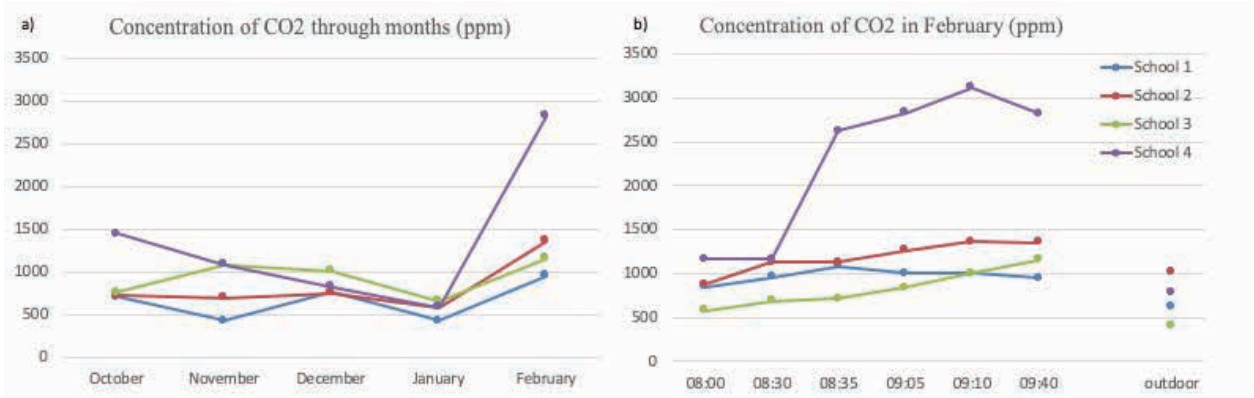
Indoor vs outdoor values comparison (Figure 1-4b, Table 3).

In February, CO_2 concentration and temperature were higher indoors than outdoors in all schools, while $PM_{2,5}$ concentration and relative humidity were lower indoors in all schools except in school 4. Both outdoor $PM_{2,5}$ concentration and relative humidity were higher and CO_2 concentration lower in urban compared to rural schools. The difference between the indoor and outdoor values was the most pronounced for $PM_{2,5}$ concentration.

DISCUSSION

The results of our pilot study showed that, despite anti-epidemic restrictions with frequent ventilation and limited number of students in classrooms, IAQ in classrooms was low, especially during the heating season. The highest concentrations of $PM_{2,5}$ were registered in schools 1 and 4, and the highest concentrations of CO_2 in school 4. However, the most optimal temperature and relative humidity were also registered in school 4, being the most pleasant microenvironment for the students. On the other hand, the largest deviation in temperature, with values mostly above the recommended range, and in relative humidity, with values mostly

Figure 2. Inter-school comparisons of CO_2 concentration a) at the end of the third class through the non-heating, heating season and holiday period in January, b) at the beginning and at the end of each class and outdoor in February, within-day comparison. *Note the difference in the length presented on x axis: class vs break (30 vs 5 min)*



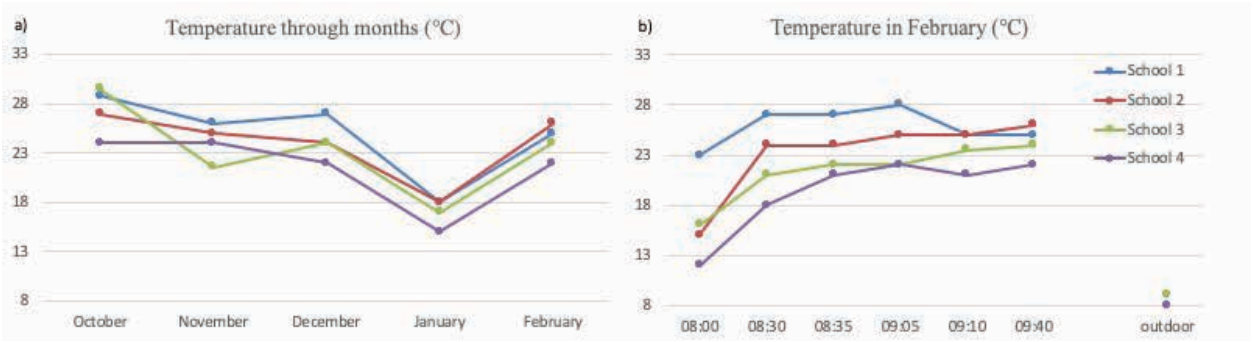
under the recommended range were registered in urban schools.

Although indoor $PM_{2.5}$ concentrations in schools are mainly (34%) a combined mixture of organic (skin flakes, cloth fibers, possible condensation of volatile organic compounds) and particles from chalk and building deterioration, PMs can also originate from outdoor sources (road traffic emissions especially if windows and doors face roads with heavy traffic or industry) and penetrate indoors usually by natural ventilation. Regarding the highest $PM_{2,5}$ concentration registered in schools 1 and 4, these schools shared many characteristics. However, as suggested by our intra-school, closed vs open windows comparison of $PM_{2,5}$ concentrations, the "none windows opening in school 4 or its short duration in school 1" seems to be, next to the number of students in classroom and their activities, a relevant factor that determine high $PM_{2,5}$ concentrations in these two schools. Moreover, $PM_{2,5}$ concentrations in school 4 were even higher indoors than outdoors. In addition, as in school 4 windows were kept closed at all time, its direct orientation to the road and high outdoor $PM_{2,5}$ concentrations did not seem to play a role in high indoor levels of $PM_{2,5}$.

According to "SEARCH project" the highest concentrations of PM_{10} and benzene, and among the highest concentrations of toluene, xylene and NO_2 were measured in BiH schools compared to schools in Albania, Hungary, Italy, Serbia and Slovakia (Csobod et al. 2010). Unlike in our study where $PM_{2,5}$ concentrations declined with natural ventilation, PM_{10} concentrations in SEARCH project were significantly related to frequent window opening, crowdedness and classroom cleaning in the evening. Also, among other factors, heavy traffic and industry in the immediate school neighbourhood were significant determinants of poor IAQ and decreased lung function, while plastic flooring was, besides decreased lung function, also associated with increased prevalence of doctor-diagnosed allergies. The prevalence of children with asthma, asthma-like symptoms and asthma treatment was higher in BiH compared to the average one for all participating children (Csobod et al. 2010).

SInPHONiE study conducted in 2015 across 23 EU countries, 114 primary schools with 5575 students showed that about 85% of students were exposed to $PM_{2.5}$ and PM_{10} concentrations higher than those considered safe for the prevention of cardio-pulmonary diseases (Annesi-Maesano et al. 2013). Also, a recent review showed that median indoor levels of $PM_{2,5}$ exceeded the defined IAQ guidelines [35,0 (5,14–100,0) μg/m^3] in 41 European schools (Oliveira et al. 2019). This range was close to one in our study during the non-heating season [13,0 (6,7–107,7) μg/m^3], but both the median and range were lower compared to ones measured in our heating season (November, December and February) [76,9 (61,0–119,1) μg/m^3 in November; 95,0 (65,0–131,0) μg/m^3 in December; 91,5 (55,0–129,0) μg/m^3 in February].

Figure 3. Inter-school comparisons of temperature a) at the end of the third class through non-heating, heating season and holiday period in January, b) at the beginning and at the end of each class and outdoor in February, within-day comparison. *Note the difference in the length presented on x axis: class vs break (30 vs 5 min)*

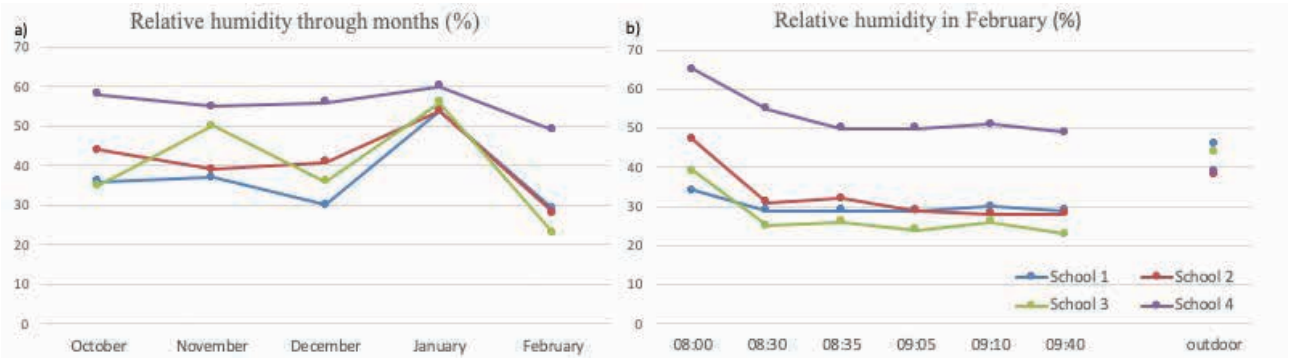


Based on the concentrations of $PM_{2.5}$ reported at European schools, predicted $PM_{2.5}$ short-term health effects on school children were assessed to total of 31 cases of hospital admissions related with respiratory diseases annually (Oliveria et al. 2019), and to a greater use of rescue medication, doctor visits and hospital admissions (Kim et al. 2015; Annesi-Maesano et al. 2013; Brugha & Grigg 2014; Simoni 2010). Also, long-term exposure to $PM_{2,5}$ was directly related with increments of 6–13% in cardiopulmonary mortality (WHO 2012). Furthermore, exposure to $PM_{2,5}$ was responsible for an increase of 20% in human deaths (from 3,5 to 4,2 million deaths till 2015) and is now expected to increase >50% thus reaching 6,6 million deaths in 2050 (Landrigan et al. 2017). Besides health, cognitive development i.e. working memory, attention, learning, school achievement and behaviors are also affected by indoor air pollution in children 7–10 years of age attending schools in high polluted areas (Sunyer et al. 2015).

In Search study, increased levels of CO_2 were significantly associated with classroom level, number of children in the classroom, <2m^2/person in the classroom or <6m^3/person in the classroom, as well as openable windows <2m^2 and less frequent window opening. Our results also suggested an effect of classroom level, but unexpectedly, levels of CO_2 were still above the recommended one despite significantly more space per m^3/person in the classroom (19,0–20,2 m^3/per person) and also did not necessarily decline with windows opening. Moreover, the increase in CO_2 concentration despite the ventilation was registered in schools 2 and 3. High outdoor CO_2 concentrations and/or improper classroom ventilation during heating season generally lead to a serious problem of increase in indoor CO_2 concentration. Furthermore, like with $PM_{2,5}$ concentrations in our study and under the same circumstances, one would expect high CO_2 values in both schools 1 and 4. However, unexpectedly, this was shown only in school 4 while in school 1 high $PM_{2.5}$ concentrations persisted but CO_2 concentrations declined to the lowest ones. This showed that, despite the same "none windows opening in school 4 or its short duration in school 1", the concentrations of $PM_{2,5}$ and CO_2 changed differently suggesting the impact of other factors. Indeed, next to difference in classroom level, also flooring, school location, vicinity of the road or farm, type of heating and fuel, insulation materials, as well as different indoor activities may potentially explain the unexpected dynamics of concentration of $PM_{2.5}$ and CO_2.

CO_2 concentration of above 1000 ppm is related to an increase in absenteeism frequency for approximately 10–20% (Martenies & Batterman 2018). Concentration above 1500 mg/m^3 causes unpleasant air and a negative effect on circulatory, cardiovascular and autonomic nervous systems, including psychomotor and cognitive functions (Gilraine 2020; Roth 2020; Polidori 2013; Shendell 2004). The most common first symptoms are fatigue and headache followed by nausea and dizziness, tachycardia, memory disorder and lack of concentration, blurred sight, sweating, restlessness, vomiting, redness of the skin and even panic attacks (De Giuli 2012). Even though the rise of CO_2 over 1500 mg/m^3 is followed by an unpleasant smell, students in the classroom do not notice it because the sense of smells gets quickly adapted to new odors (Coley 2007).

Figure 4. Inter-school comparisons of relative humidity a) at the end of the third class through non-heating, heating season and holiday period in January, b) at the beginning and at the end of each class and outdoor in February, within-day comparison. *Note the difference in the length presented on x axis: class vs break (30 vs 5 min)*



Besides PMs and CO_2, extreme temperatures and relative humidity can also cause adverse health effects primarily on the human respiratory system (Choo et al. 2015, Wolkoff 2018). While high relative humidity can cause unpleasant smell and the feeling of suffocation, the low one causes desiccation of mucus membranes in upper airways with coughing, epithelial damage and reduced mucociliary clearance making airways more susceptible to viral infection (Wolkoff 2018). The favorable temperature and relative humidity in school 4 compared to urban school 1 could be possibly explained by the difference in the vicinity of water/river and the level of sun exposure, but also in classroom level, type of heating system and fuel, type of insulation and other indoor materials and activities. Our preliminary results showed the urgent need for better temperature and humidity monitoring in schools.

This was the first study of this kind in elementary schools that took into account different internal and external characteristics when assessing IAQ in classrooms, as well as in the setting of Covid-19 restrictions. However, this study had several limitations. As this was a pilot study with a limited number of schools included and limited IAQ parameters measured, the conclusions cannot be generalised nor the causality can be inferred.

Thus, new larger studies through all seasonal and meteorological conditions in more schools measuring more IAPs, especially those with potential or proven long-term adverse health effects, are needed. Further studies should also include analysis of molecular biomarkers, e.g. DNA damage as a reliable biomarker of exposure to various genotoxins that may help to identify individuals at increased risk of IAQ related long term adverse effect. Also, measures included in Green building certification that may affect IAQ such as air conditioning system, sustainable and efficient heating, natural non-toxic materials for construction and indoor finishing, natural materials for furnishing, safe equipment, cleaning and waste management as well as landscape architecture design making optimal barriers to roads, farms, and other pollution sources should be validated.

Finally, it is of utmost importance for the society to assure that children, and especially the most vulnerable ones, breath clean air. This is crucial for their healthy childhood and growing up and successful academic development. Moreover, on such foundations it is more likely to achieve their later productive life and contribution to the society. With the preventable measures and modern technology, ensuring high indoor and outdoor air quality is not an unattainable challenge.

CONCLUSION

Despite the anti-epidemic restrictions with recommended frequent ventilation and limited number of students in the classroom, measured IAQ parameters in the heating season were mainly out of the recommended values. As students and their activities may also be the sources of $PM_{2.5}$ and CO_2, further deterioration of IAQ could be expected if all students had been present in the classroom. Finally, to assure a healthy school environment in the heating season further optimization of both indoor and outdoor conditions is

Table 3. Outdoor values of $PM_{2,5}$ and CO_2 concentrations, temperature and relative humidity measured in February at the end of the third class

	PM2,5 (µg/m³)	CO2 (ppm)	Temperature (°C)	Relative humidity (%)
School 1	311	953	9	46
School 2	79	1356	8	38
School 3	167	1154	9	44
School 4	66	2826	8	39

needed in both pandemic and non-pandemic settings.

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Contribution of individual authors:

Aida Kulo: design of the study, study conduct, literature searches and analyses, interpretation of data, manuscript writing, approval of the final version.

Sanela Klarić: design of the study, study conduct, literature searches and analyses, data interpretation, manuscript writing, approval of the final version.

Asja Ćetković: literature searches and analyses, data interpretation, manuscript writing, approval of the final version.

Amina Blekić: study conduct, data interpretation, manuscript writing, approval of the final version.

Jasna Kusturica: study conduct, data interpretation, approval of the final version.

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Armin Šljivo: study conduct, data interpretation, manuscript writing, approval of the final version.

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SAŽETAK

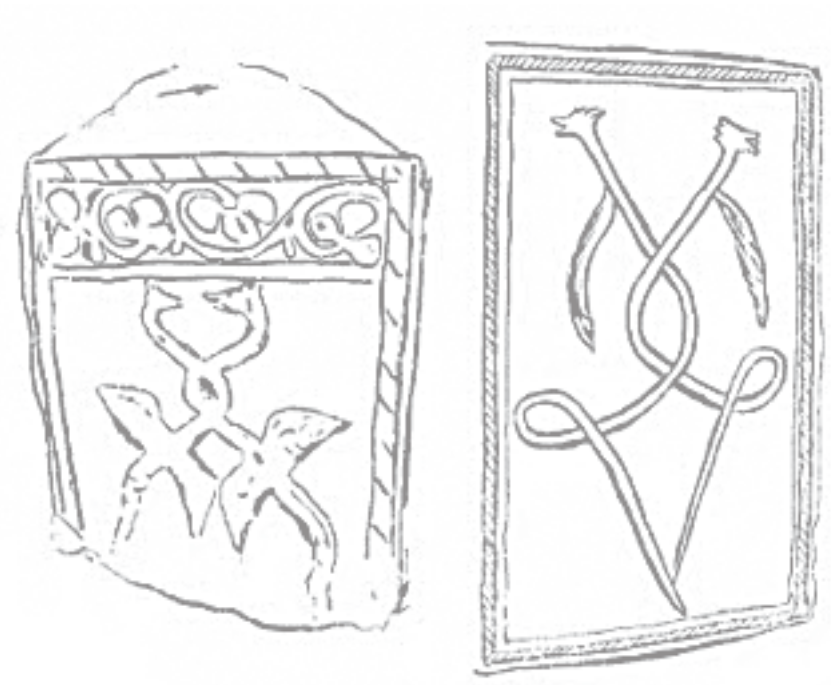
Uvod: Kvaliteta unutarnjeg zraka u učionicama utječe na zdravlje i akademske sposobnosti djece. Cilj ove pilot studije je bio odrediti kvalitet unutarnjeg zraka u osnovnim školama različitih unutrašnjih i vanjskih karakteristika u uslovima COVID-19 epidemije.

Metode: Parametri kvalitete unutarnjeg zraka: masena koncentracija fine čestične tvari ($PM_{2,5}$), koncentracija CO_2, temperatura i relativna vlažnost su mjereni simultano u četiri osnovne škole/učionice tijekom oktobra (sezona bez grijanja) i četiri naredna mjeseca (uključujući raspust u januaru) u sezoni grijanja. Mjerenje je vršeno u vrijeme protuepidemijskih restrikcija (≤13 učenika u učionici, često provjetravanje učionice).

Rezultati: Tokom oktobra, osim u jednoj školi, koncentracije $PM_{2,5}$ su bile ispod gornje preporučene granice (25μg/m³), ali su u svim školama počele rasti u periodu grijanja. Najviše koncentracije $PM_{2,5}$ su registrovane u dvije škole, sa zatvorenim i nakratko otvorenim prozorima. Koncentracije CO_2 su uglavnom bile u preporučenom rasponu (do 1000ppm) osim u školi sa konstantno zatvorenim prozorima, i u tri škole u februaru kada su mjerene više koncentracije. Osim u jednoj istoj školi, i u januaru, i temperatura i relativna vlažnost zraka su bile izvan preporučenog raspona (24,0–27,0°C u sezoni bez grijanja; 20,0–24,0°C u sezoni grijanja; i 45–55%) sa temperaturom uglavnom iznad, a vlažnošću zraka ispod preporučenih vrijednosti u tri škole. Najveće devijacije u temperaturi i relativnoj vlažnosti su zabilježene u školama u urbanoj sredini. Registrovane razlike su najvjerovatnije posljedice različitih unutarnjih i vanjskih karakteristika škola.

Zaključak: Uprkos protuepidemijskim restrikcijama, većina mjerenih parametara su bili van preporučenih vrijednosti u sezoni grijanja. Dodatno opadanje kvalitete unutarnjeg zraka bi se moglo očekivati u prisustvu svih studenata u učionici. Konačno, za stvaranje zdravog školskog okruženja u sezoni grijanja, u pandemijskom ali i u ne-pandemijskom period, potrebna je daljnja optimizacija unutarnjih i vanjskih karakteristika škola.

Ključne riječi: kvalitet unutarnjeg zraka, učionica, certificirana zelena gradnja, zdravlje, COVID-19



INTERNATIONAL ACADEMY OF SCIENCE AND ART IN BOSNIA AND HERZEGOVINA

Key words: Truth - Empathy – Respect - Trust - Partnership - Friendship - Mutuality - Security – Peace

As cultures, nations, societies, and individual human beings we have to learn how to live together in harmony, trust and friendship and resist influences that turn us against each other.

Lord,
Make me an instrument of your peace:
Where there is hatred, let me bring love.
Where there is offence, let me bring pardon.
Where there is discord, let me bring union.
Where there is error, let me bring truth.
Where there is doubt, let me bring faith.
Where there is despair, let me bring hope.
Where there is darkness, let me bring your light.
Where there is sadness, let me bring joy.

O Master,
Let me not seek as much to be consoled as to console,
To be understood as to understand,
To be loved as to love,
For it is in giving that one receives,
It is in self-forgetting that one finds,
It is in pardoning that one is pardoned
It is in dying that one is raised to eternal life

Prayer of Saint Francis
Wikipedia https://en.m.wikipedia.org

"With malice toward none, with charity for all; with firmness in the right, as God gives to see the right, let us strive on to finish the work we are in; to bind up the nation's wounds; to care for him who shall borne the battle, and for his widow and his orphan, to do all which may achieve and cherish a just and lasting peace among ourselves, and with all nations"

– Abraham Lincoln

„We must build a new world, a far better world; one in which the eternal dignity of man is respected"

– Harry S. Truman

„We need to respect our differences and hear them, but it means, instead of having shrill voices of discord, we need a chorus of harmony. In chorus of harmony you know there are lots of differences, but you can hear all the voices"

– Bill Clinton

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Review article

PERSONALIZED NEOANTIGEN VACCINE AGAINST CANCER

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SUMMARY

No significant therapeutic solutions for advanced cancer are available to date. However, an old idea based on usage of tumor-specific antibodies as the basis for a new vaccination form in patients with advanced tumors, has attracted recent research and is possible due to development of personalized neoantigenic vaccines. Each tumour has indeed, its own mutation content, only a small percentage are shared between patients. Technological advances and the established genome databases, allowed for a rapid mapping of mutations in the genome. The latter allows for a rational selection of targets for personalized vaccines and on-demand production of customized therapy according to the patient's individual tumour properties. This article accordingly, summarizes basic principles of vaccines for personalized neoantigens, translational research and clinical studies related to these vaccines. Finally, the future of such therapy with personalized vaccines is discussed.

Key words: personalized vaccines, cancer, mutations, neoantigens, immunity

INTRODUCTION

Vaccines are a hot topic both in science and in the clinical practice. Currently, vaccines are heavily discussed within the public these days as well, primarily as a consequence of the COVID-19. The reason for this is the speed with which products aimed to prevent COVID-19 have stepped into the market. Indeed, these products are supported along with a huge propaganda stating them as 'new types of vaccines' with still unknown effects on human health and not always convincing effects required for the vaccines. Previously, some preventative vaccines like those against childhood diseases have had their ups and downs depending on the target population of users. Cancer vaccines are a therapeutic tool while standard vaccines against, for example, measles and tetanus are preventive products applied in healthy people to incite the immune system to produce antibodies against the particular infection agent. In the case of cancer vaccines, the body helps to fight the disease that is already present. However, such vaccines may also have preventive effects.

Somehow in the shadow of developments of preventive vaccines in the arena of infective disease, personalized vaccines against tumours, especially those based on tumour-specific neoantigenic properties, are highly promising and potentially useful in cancer treatment. The idea of tumour-specific antigens is not new and provides hope for decades in solving the cancer problem. Those expectations were unfortunately unrealistic so far. The main reason was that these previously studied cancer vaccines were not personalized and their development was accordingly hampered by high tumor heterogeneity. In particular, first efforts were based on the wrong assumption that tumour-specific antigens are unique for all patients. Over time, the clinical practice pro-

vided evidence on unique tumour-specific antigens and cancer vaccines should be designed on these personalized properties.

In the 1980s, several laboratories studying cancer immunology began with research based on the idea that proteins encoded by genes mutated in tumours could serve as immune targets on cancer cells. The hypothesis was that such neoantigens, upon binding by the major histocompatibility complex (MHC) protein, would be present on the outer surface of the cancer cell membrane where T cells could detect them with appropriate receptors. This first personalized cancer vaccines grew out of a joint effort in the field of unique tumor mutations identification by use of a computer source aimed to trigger an immune response in cancer patients, helping them fight disease. For many years, Schreiber studied mice that developed sarcomas after exposure to a chemical carcinogen as a model for characterizing interactions between cancer and the immune system. In 2011, he proposed the possibility of sequencing the DNA of these cancer cells to identify unique cancer peptides or neoantigens, in order to stimulate the immune system against cancer. In contrast to the cellular immune therapies, which provide tumor-attacking T cells directly to the patient, the idea was to use such neoantigens to create cancer vaccines that promote differentiation of endogenous T-cells (Schreiber et al. 2011).

This approach finds a strong rationale in the basis of cancer genetics. Cancer is indeed, characterized by accumulation of genetic alterations. Somatic mutations can generate a spectre of cancer neoepitopes that may be then recognized by the autologous T-lymphocyte system. T-cells recognize such antigens as foreign and this fact is in the basis for ideal vaccine development. Each tumour has its own mutation content, of which only a small percentage is shared among patients with same cancer type. The molecular nature of tumor-specific antigens however, remained unknown until the discovery and application of cloning techniques (van der Bruggen et al. 1991). Screening of patient tumor–derived expression libraries with autologous tumor-reactive $CD4^+$ or $CD8^+$ T-cells revealed two categories of spontaneously recognized T cell antigens: (i) nonmutated proteins with tumor-associated expression and (ii) mutated gene products (Coulie et al. 2014). Now the rational selection of targets for vaccines as well as on-demand production of a therapy customized to a patient's individual tumour is possible due to advances in sequencing and genome databases along with immunotherapy (Hundal et al. 2016). Both types of mutations that accumulate in cancer, namely the driver and passenger mutations, can alter sequence proteins and create new epitopes. These new epitopes can be processed and presented on major histocompatibility complex (MHC). Sequence altered complexes are termed neoantigenes. The new mutated epitopes recognized by T-lymphocytes are called neoepitopes (Schumacher & Schreiber 2015). It is important to note that neoepitopes are absent in normal cells but are exclusively present in cancer cells. As the vast majority of mutated antigens detected in these pioneering studies were found to be unique for each individual patient, immunological recognition of neoepitopes was quickly established as clinically highly relevant. Polymerase chain reaction (PCR) sequencing methods prompted the discovery of mutations back in 2008 to identify cancer neoantigens (Segal et al. 2008). A series of 11 breast cancers and 11 colorectal cancers, neoantigens were obtained identifying missense mutations in cancer-related genes from Sanger sequencing data and using available neural networks to evaluate the binding of the encoded proteins to the most common MHC type. Authors predicted that these cancers average between 7 (breast) and 10 (colorectal) novel epitopes per patient. The immune system could, by a variety of approaches including personalized vaccines, be stimulated to respond to these novel peptides (Segal et al. 2008).

CREATION OF CANCER VACCINE

Creation of individualized cancer vaccines require identification of cancer-specific peptides -neoantigens. Afterwards, a platform based on cells, proteins, or nucleic acid should be employed to deliver neoantigens to patients. The patient immune system will then attack the tumor. Antigen-presenting cells, such as dendritic cells, internalize cancer-specific peptides and display them on their surface using major histocompatibility complex (MHC) proteins. This triggers T-cells with receptors that bind these neoantigens to differentiate into effector or killer T cells that mobilize an immune response against cancer cells.

Designing of such vaccines may be based on three options: 1. *a vaccine based on dendritic cells*. In this pro-

cess, monocytes are extracted from patients' blood and cultured with synthetic versions of selected cancer neoantigens. The goal within such approach is creation of mature dendritic cells that carry these neoantigens. These cells are then re-inoculated into the patient; 2. *Long synthetic peptides* - synthetic peptides containing neoantigen sequences are injected into the body, where they are picked up by cells that present the antigen. 3. *DNA and RNA vaccines* - nucleic acids that encode neoantigens are introduced into the body, where they are translated into proteins and collect cells that present the antigen. The cancer vaccine is meant to be inoculated subcutaneously, after which the vaccine travels to the lymph nodes, *i.e.* the immune cells. Once in the area, the vaccine penetrates dendritic cells that present a specific T-cell vaccine antigen. These cells directly fight cancer cells.

One of the problems in cancer vaccines is in the presence of extremely small ingredients. To prevent those small ingredients from being dispersed throughout the body through the bloodstream, a system has been developed that chemically binds together small cancer vaccine particles. Thus, new vaccines called Polycondesate Neoepitope (PNE) have been developed, which consist of a neoantigen that is a mutated specific antigen characteristic of the tumor and of the adjuvant in question. These two ingredients bind together and form a larger entity that the blood vessels cannot absorb. This is how they get to the lymph nodes. Only when they reach the interior of the dendritic cells, the vaccine components separate again allowing the dendritic cells to present T-lymphocyte antigen. An important part of this personalized strategy is a careful analysis of the neoantigens in each individual patient. Such a personally activated immune system enables an effective fight against tumors. It is important to emphasize that neoantigens are not present in normal cells.

For now, all of these vaccine platforms are optional as researchers continue to study the immune system's response to certain neoantigens. Questions include the minimum number and types of neoantigens required to elicit a strong cancer-targeted immune response and whether all neoantigens are encoded by all cancer cells (clonal mutation) or only by a portion of them (sub clonal mutation). Rare types of mutations that dramatically alter protein sequences, such as those resulting from insertion or deletion of frame shifts or fusion peptides due to chromosome structural changes, are likely to yield more potent neoantigens with strong MHC binding potential because they are more obviously selfless to the immune system (Hundal et al. 2018).

TRANSLATIONAL RESEARCH AND CLINICAL STUDIES

Positive results with personalized neoantigenic cancer vaccines have fostered faith in the successful treatment of patients. These vaccines have so far shown highly specific immune responses to cancer cells without serious adverse effects in patients. This initial enthusiasm needs to be confronted with the challenges of clinical trials in order for the concept of personalized vaccines to be routinely applied. (Sahin & Türeci 2018). Dozens of clinical studies with personalized vaccines are currently underway. They are using different vaccine platforms: RNA, DNA, synthetic long peptide, dendritic cells and are mainly in the 1st or 2nd phase of clinical trials. Let us mention just a few of them. One phase 2 clinical trial study is conducted at the National Institute of Health in the United States. The goal is to cure patients with multiple solid tumours using dendritic cells as a vaccine platform (Tral ID NCT03300843). Another study on multiple solid tumours is in Phase 1 clinical trials (NCT03289962) using the RNA vaccine platform. The aim of the study is ambitious and for example aims to collect 567 patients for examination. One study uses the DNA vaccine platform and is also in Phase 1 (NCT02348320) conducted on 30 breast cancer patients (Washington University School of Medicine). A study on follicular lymphomas (NCT03121677) is being conducted at the same University in association with Bristol-Myers Squibb. For this study, a synthetic long peptide is used as the vaccine platform, and the patient growth target is 20.

The choice of the best approach to personalized cancer vaccines will depend on the determined and validated number and types of neoantigens needed to best improve patient outcomes, but also on vaccine platforms that are most measurable, cost-effective, efficient, and rapid to produce. Dendritic cell vaccines seem to be very effective in eliciting an immune response because the role of dendritic cells in the immune system is to present antigens. However, their preparation requires careful cultivation of blood-derived immune cells to mature dendritic cells prior to incubation with selected tumour peptides. Scaling this process would require significant auto-

mation of laboratory steps to produce vaccines for multiple patients simultaneously (Keskin et al. 2019, Ma et al. 2011.).

Another apparently promising approach is based on cocktails made of synthetic long peptides that are injected intramuscularly. Peptides are typically about 20 amino acids in length and each contains a neoantigen sequence of 8 to 11 amino acids. Two safety studies using this approach have been published so far, one in patients with melanoma (Ott et al. 2017) and one in patients with glioblastoma (Keskin et al. 2019). Because they are synthesized, long peptide production is scalable, but their use in human therapy requires specific process controls to ensure good manufacturing practice (GMP). Neoantigen peptides of each patient must be synthesized in isolation to ensure purity, and certain peptide sequences may be challenging to put them in solution before injection. All of these aspects may limit their widespread use in personalized vaccines in the future.

Another way to elicit a neoantigen-induced immune response is by using DNA or RNA vaccines that encode predicted neoantigens. These vaccines have been shown to be effective in preclinical models and in the early stages of human RNA vaccine trials. These vehicles are relatively inexpensive to manufacture. The final sequences of DNA or RNA-encoded neoantigens are easier to confirm after vaccine synthesis than peptide sequences, which require basic sequencing technology instead of less sensitive mass spectrometry. However, one should be very careful while introducing nucleic acids that contain neoantigen coding sequences into cells to enable their conversion into peptides, systemic effects on the genome and the organism remain indeed unknown (Sahin et al. 2017).

In addition, a good clinical example of cancer vaccines in in metastatic melanoma treatment. Until recently, metastatic melanoma was an incurable and deadly disease. New developments in therapy have significantly improved prognosis. For example, personalized melanoma vaccines that elicit a long-lasting antitumor response in patients even 4 years after immunization have been developed. This vaccine was injected into patients on average approximately 18 weeks after vaccination. Four years after vaccination, all 8 patients were alive and 6 showed no signs of active disease. Interestingly, the patient's immune cells did not recognize only specific tumour epitome on which the vaccine was made has already been recognized by other melanoma related epitopes as well. Analysis of two patients in whom the tumour has spread to the lungs showed that they were treated with an immune checkpoint inhibitor (Hu et al. 2021). These are drugs that loosens some of the restrains of immune response to cancer. However, their T cells found ways to fight lethal melanoma cells.

Using the so-called. polymerization technique called polycondensation researchers have addressed one of the key problems of vaccine delivery. In a paper published in ACS Central Science (Wei et al. 2020) the authors show results of a prototype vaccine that can travel automatically to a desired location and activate immune cells at site. Also, the researchers worked in parallel on development of an algorithm for fast and accurate prediction of mutated tumor antigens (Ott et al. 2017). Based on such encouraging results and long-term activity of specific antitumor T lymphocytes, it can be concluded that personalized neoantigen peptide vaccination can help control metastatic tumours, even when combined with specific immune checkpoint inhibition. (Carreno et al. 2015).

INSTEAD OF A CONCLUSION

The results of early preclinical and clinical research on the so-called neoantigen vaccines are extremely encouraging. The end result of this type of therapy will depend on methodological improvements that ensure the reliability of neoantigen prediction and scalability of the vaccine platform. A number of issues remain to be addressed to make personalized neoantigen-based cancer vaccines the ultimate solution. This requires a multidisciplinary approach: specialist in cancer genomics, for cancer immunology, for vaccine development for oncology and diagnostics. One of the limitations in research could be the relatively difficult access of patients for testing given the intensity of new immune treatments and the growing need for randomized clinical trials. This may limit a scrutinized testing of neoantigenic personalized vaccines where preference may be given to therapies that are less personalized and therefore more susceptible to mass production. It will be interesting to see if neoantigen vaccines find their niche and how wide that niche will be. Nonetheless, efforts on this issue will improve our understanding and clarify the next steps towards more effective anti-cancer immunotherapies.

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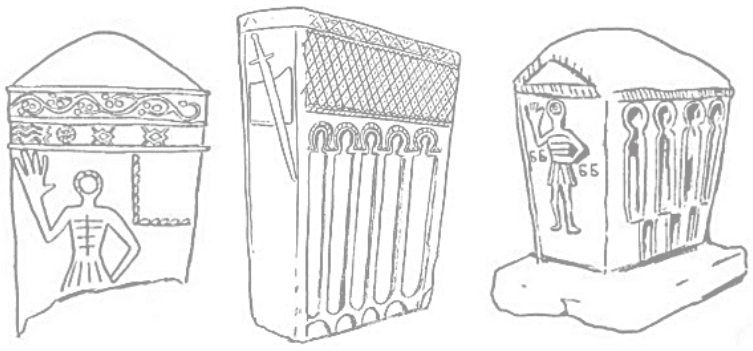
Krešimir Pavelić: Concept and writing of the manuscript

SAŽETAK

Personalizirana neoantigenska cjepiva protiv raka

Do danas nisu bila dostupna značajna terapijska rješenja za uznapredovali rak. Međutim, stara ideja zasnovana na korištenju antitijela specifičnih za tumor, ali koja se temelje na personaliziranim neoantigenskim cjepivima, daje osnovu za novi oblik cijepljenja pacijenata s uznapredovalim tumorima. Svaki tumor sadrži vlastite tipove mutacija, a samo mali postotak tih mutacija zajednički je za tumore ostalih pacijenata. Tehnološki znanstveni napredak i uspostavljene genomske baze podataka omogućili su brzo mapiranje mutacija u genomu što omogućuje racionalan odabir ciljeva za personalizirana cjepiva i njihovu proizvodnju. Takav pristup prilagođene terapije za specifične mutacije u skladu je s individualnim svojstvima tumora pacijenta. U članku se sažeto prikazuju osnovna načela personaliziranih neoantigenskih cjepiva, translacijska istraživanja te kliničke studije povezane s tim cjepivima. Konačno, raspravlja se o budućnosti terapije oboljelih s uznapredovalim tumorima primjenom personaliziranih cjepiva.

Ključne riječi: personalizirana cjepiva, rak, mutacije, neoantigeni, imunitet



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Review article

ARTIFICIAL INTELLIGENCE IN MEDICAL DEVICES: PAST, PRESENT AND FUTURE

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ABSTRACT

Artificial Intelligence (AI) has been drawing attention in the field of medical devices. However, due to system complexity, the variability of their architecture, as well as ethical and regulatory concerns there is an ongoing need to analyze its application and performance.

This study presents a narrative commentary on the applications of artificial neural networks (ANN) and machine learning (ML) algorithms in medical devices, past, current and future perspectives of application. One research focus of this study was on identifying problems and issues related to the implementation of AI in medical devices.

The commentary is based on scientific articles published in PubMed, Scopus ad ScienceDirect databases, official publications of international organizations: European Comission (EC), Food and Drug Administration (FDA), and World Health Organisation (WHO) published in 2009 – 2020 period.

AI is revolutionizing healthcare, from medical applications to clinical engineering. However, before grasping the full potential ethical, legal and social concerns need to be resolved and its application needs to be harmonized and regulated regarding equitable access, privacy, appropriate uses and users, liability and bias and inclusiveness.

Key words: Artificial intelligence; Machine learning; Neural network; Medical devices; prediction; diagnosis;

INTRODUCTION

According to The Business Research Company's research report (Busines Research company, 2020), Global Medical Device (MD) market is increasing due to rising infectious and chronic disease cases, the increase of number of healthcare facilities, healthcare expenditure, technological advancements, and rapid growth of the elderly population. The demand for MDs used in diagnosis, prognosis, and treatment has significantly increased since the emergence of COVID-19 globally (Badnjevic, 2020). Nowadays, it is evident that simply manufacturing a device, and putting it into the use in healthcare sector have been long surpassed. Users are now expecting to have more than a device. Even though there is high demand for healthcare, governments around the world are focused in cost reduction including MDs, but they want to have better patient outcomes. In other words, users of MDs are nowadays expecting more functionality which can be seen in prediction of clinical outcome, advanced classification or other functions which are for which intelligence is required.

Artificial Intelligence (AI), described as the 4th industrial revolution, refers to machines that can simulate human thinking in learning and analysis and

therefore can work in solving the problem (Schwab, 2016). AI covers digital methods, ranging from computer vision to deep learning techniques, which model intelligent behavior without human intervention (Hamet, 2017). It has been applied to many areas of medicine (Long, 2020), especially to aid the detection and prevention of disease (Catic, 2018) (Gurbeta, 2018) (Badnjevic, 2018) (Saric, 2020). In respect to traditional computer programming, AI methods emulate the decision-making process of humans (Deo, 2015).

Nowadays, application of AI in healthcare is one of the strategic pillars for further advancements of the field, offering possibility on increasing efficiency while decreasing costs. Regulators worldwide have recognized (European Council, 2017) (FDA, 2020) recognized the importance of this innovative tools to improve healthcare and move away from hospital-centered systems towards integrated care while strengthening health promotion and disease prevention and implementing personalized medicine. Many countries have formulated or are formulating national AI strategies and policies to promote the research, development and adoption of these methods and technologies (Ravi, 2017) (LeCun, 2015). As a result of integration of AI in MD, variety of MDs for everyday usage in daily life are available, such as remote patient monitoring devices, wearable medical equipment, Electronic Health Records (EHR), etc. Medicine is a huge cognitive process, but it is also to a great extent an Information management task, since decision making is based upon expert knowledge, information of the patient and the doctors experience. Given the growing amount of data generated in healthcare, the potential of AI application is huge from clinical decision-making and public health, to biomedical research and drug development, to health system administration and service redesign.

The usage of AI in medical devices in healthcare is reviewed from the past, the present and future situation. From the perspective of its possible benefits and difficulties, the future applications of artificial intelligence in the medical field, as well as the application in medical devices. New AI functions provide novel solutions for healthcare, and the development of healthcare requires AI skills to reach a new level. The combination of both, demand and the development of AI and healthcare will enable these two fields to develop significantly in the foreseeable future, and ultimately benefit the quality of life of people in need.

METHODS

This paper is presented in the form of narrative commentary based on scientific articles published in PubMed, Scopus ad ScienceDirect databases, official publications of international organizations: European Comission, Food and Drug Administration (FDA) and World Health Organisation (WHO) published in 2009 – 2020 period.

The PubMed, Scopus, and ScienceDirect databases were searched to identify papers published using the search terms “medical device,” “artificial intelligence,” “machine learning”, “artificial neural network”. Papers reporting data on AI applications in medical devices were included. In view of the evolutionary nature of the AI field, both academic literature and grey literature are included in the search.

The following criteria were used to limit the research: papers/materials published from 2009 to 2020); language (English); and full-text publications.

RESULTS AND DISCUSSION

Any instrument, apparatus, appliance, software, material or other article, whether used alone or in combination intended by its manufacturer to be used specifically for diagnostic and/or therapeutic purposes is considered to be medical device. This is definition which is adopted by various regulatory bodies, from European Commission, Food and Drug Administration (FDA), World Health Organisation (WHO) and others. In the 21st century, one of the biggest emerging trends shaping the medical device industry is software as a medical device (SaMD). The category of Software as a Medical Device (SaMD) refers to software products that operate as medical devices independently from any other medical device. They generally run with non-medical technology such as computers, smartphones, tablets, or wearable devices.

Artificial Intelligence in Medical Devices: PAST

The application of AI in medicine is closely linked to development in AI methods. The concept of AI was introduced in medicine in the early 1970s (Patel, 2009) with the aim to improve the efficiency of medical diagnosis and treatment. It took around 30 years from

its introduction to widespread application in healthcare due to several technological limitations which have been overcome by the advent of deep learning.

Artificial Intelligence in Medical Devices: PRESENT

Medical device manufacturers are using these technologies to innovate their products to better help healthcare providers and improve patient care (Flaxman, 2018) (Burki, 2019) (Weungart, 2000).

New AI advances in hardware and software have allowed interpretation of physiological data from sensors which enabled rapid growth of wearables like smart watches, which contain digital health-monitoring applications. This trend in the growing number of wearables entering the market impacts digital health monitoring segment (Jha, 2016). With the continuous development of assistive diagnostic technology, a large amount of data is used in the process of disease detection, diagnosis and treatment (Abernethy, 2010). For clinicians, organizing and analyzing these data in a short period of time is a challenge. Therefore, AI is increasingly used in medicine to help doctors predict diseases and treatment outcomes.

From analysis of medical imaging such as echocardiograms, computed tomography (CT), endoscopy, and skin photographs, to tissue histology and physiological data, such as electrocardiograms (ECG), these technologies have demonstrated enormous potential for health care. They are designed to screen for diseases, classify malignancies, and provide personalized treatment recommendations, among other things, often sooner than has been possible using traditional technologies.

Machine learning is one of the most effective algorithms in machine learning. In recent years, ML have played an important role in medicine, especially in disease prediction. Patients with a history of idiopathic hemorrhagic ulcers may have a higher rate of ulcer recurrence. If serious complications (such as a ruptured ulcer) occur, the safety of the patient is threatened. In 2018, machine learning was used to build a high-precision model to predict the rebleeding of idiopathic peptic ulcer, which is called IPU-ML (Wong, 2019). In another case, enterovirus caused Severe hand, foot and mouth disease rarely causes serious complications in children, such as pulmonary edema and myocarditis (Liu, 2014). In 2019, in order to predict severe hand, foot and mouth disease, the CatBoost model was established, which showed higher specificity and sensitivity than other models (such as decision trees and SVM) (Wang, 2019). In addition, machine learning can predict the effectiveness of radiation therapy.

Combining new imaging technology and an artificial intelligence engine that uses a large number of historical images can improve current detection methods through faster analysis, real-time diagnosis and human error (Graber, 2005). Conditions like epilepsy, Alzheimer's Illness and stroke are a daunting challenge. Current diagnostic technologies (such as MRI, EEG) generate large amounts of data to detect, monitor, and treat neurological diseases. Data analysis is often difficult. It is essential to use intelligent systems that can accumulate, manage, analyze and automatically detect abnormalities in the nervous system. The application of artificial intelligence in this field will improve the consistency of diagnosis and increase the success rate of treatment (Blahuta, 2012). Diabetic retinopathy (DR) is one of the leading causes of preventable blindness worldwide. In a study published by the American Academy of Ophthalmology, a total of 75,137 public fundus images of diabetic patients were used to train and test an artificial intelligence engine to distinguish between healthy fundus and DR. results. The results showed an impressive sensitivity and specificity of 94% and 98%, respectively (Gargeya, 2017). AI is becoming more and more popular in image recognition applications. AI using deep learning algorithms can automatically perform a quantitative and more efficient assessment of complex medical imaging features. One application is to use radiology, ultrasound, and nuclear medicine to image the liver for possible liver disease. In image analysis, artificial intelligence is used to detect and evaluate focal liver lesions, promote treatment, and predict the appropriate response to treatment (Zhou, 2019). AI can be used for in vitro diagnostics, using real-time imaging to capture the fluorescence signal from cells passing up to. Use AI algorithms to distinguish cells by size, shape, and emission wavelength, and classify them as predictors of specific diseases. In addition, combined with other hardware technologies, can be completed in the real world. The integration of AI into the in vitro diagnostic platform can improve device diagnostic performance and accuracy (Smith, 2018).

As for approval of expert systems and medical devices that run on AI / ML statistics show that there is

around 222 devices approved in the United States and 240 devices approved in Europe. (Urs, 2020) Since 2015, the number of approved AI / ML-based devices has increased significantly, many of which have been approved for radiology. However, few qualified devices are high-risk devices. Among the 124 generally recognized AI / ML-based devices in the United States and Europe, 80 were first approved in Europe. One possible reason for the earlier approval in Europe than in the United States may be that the evaluation of medical devices in Europe may be relatively less stringent.

Artificial Intelligence in Medical Devices: FUTURE

The future of AI application in MD can be seen in harmonizing standards and laws that specifically regulate the use of artificial intelligence in medical devices. Some advancements in the filed have already been done by FDA. Unlike the European legislators, the FDA has published its view on artificial intelligence in a document entitled "Proposed Regulatory Framework for Modifications to Artificial Intelligence/Machine Learning (AI/ML)-Based Software as a Medical Device (SaMD)" which was published in April 2019. This document talks about the challenge of continuously learning systems. However, it observes that previously approved medical devices based on AI procedures worked with "locked algorithms".

While regulators are tackling the field, leading manufacturers are changing their business models from conventional manufacturing models into data driven intelligent models. For instance, Medtronic is committed to integrating artificial intelligence into its existing surgical industry, including advanced imaging, robotics and navigation, as well as increasing recruitment for remote patient monitoring. One of the key products Medtronic plans to implement in surgery is a preoperative platform called UNiD ASI, which can use predictive modeling algorithms to reconstruct the spine for digital modeling and perform measurements. UNiD ASI was developed by Medicrea GROUP, a French-based medical device company that provides surgical solutions for neurosurgeons and plastic surgeons.

On the other hand, Philips decided to focus on different market trends, especially AI diagnostics and workflow calculations with enhanced accuracy. In December 2020, Phillips signed a merger agreement to acquire BioTelemetry for US$2.8 billion. Bio Telemetry specializes in cardiac diagnostics, wearable heart monitors, artificial intelligence-based data analysis, and out-of-hospital monitoring positions ("The largest player in the medical technology industry embraces artificial intelligence: ruling on medical devices", 2021). In the world of medical equipment, artificial intelligence is a relatively new field. Unlike many traditional devices usually developed by teams of materials, mechanical, and electrical engineers, artificial intelligence-based medical devices require expertise in software programming and coding.

The future of AI application can be seen not only in increasing accuracy of treatment, but also in preventin injuries and deaths caused by medical devices. As healthcare is generating a lot of data, as in fact every medical device is generating a lot of data, those big data structures can be used to predict safety and performance of medical devices. For instance, the use of smart infusion pump systems has become the preferred method to ensure the safety of intravenous drugs. Most of these systems are based on AI expert systems rather than ML, but the durability and reliability of such devices have led to more comprehensive ML-based applications such as implantable insulin pumps and emerging closed-loop artificial pancreas devices.

Several examples related to healthcare have been cited above, and applications in healthcare are increasing rapidly due to ubiquitous memory and applications and cloud computing resources. For example, most smart infusion pump systems are now designed with ancillary modules and equipment, such as barcodes and radio frequency identification (RFID) readers, to help realize "Five Rights": The right patient, the right drug, the right dose, the right route, and the right time. The MD management strategy is very different from decades ago, so consider how we can contribute to the future.

Inadequate monitoring and improper monitoring of medical devices (MD) will bring a high risk of deviations from accuracy and safety of performance, which will affect clinical accuracy and the efficiency of patient diagnosis and treatment. Even as equipment technology matures, incidents involving defibrillator failure are not uncommon. Articles published in 2019, presents the results of the application of machine learning (ML) technology in the management of infant incubators and defibrillators in medical institutions (Badnjevic 2019, Kovacevic 2019). The

results show that the introduction of machine learning algorithms in Machine learning management strategies can not only improve patient diagnosis and the safety and quality of treatment, and can benefit medical institutions in terms of cost optimization and management.

Such a systems present paradigm change, from reactive management and maintenance to predictive as they can be used to detect hardware deviations, which lead to incorrect diagnosis and incorrect treatment of patients. The results of this study show that clinical engineering and health technology management benefit from the application of machine learning in terms of cost optimization and medical equipment management.

CONCLUSION

The purpose of this study is understanding the availability of technology, appreciate the great potential of AI in healthcare, track new scientific achievement to provide inspiration to researchers in the field. So far, ethical discourses on artificial intelligence and health have occupied privacy and security, trust, prejudice, and accountability and accountability issues, and as the scale of the technology continues to expand, more problems will undoubtedly arise.

When medical devices are concerned, AI is still in its beginnings. It is expected that until 2030 manufacturers of medical devices will shift from traditional business model and incorporate new digital methods of artificial intelligence. In order to place AI based MDs on the martket regulatory framework needs to be developed. Leading regulatory bodies worldwide are still in the beginning of defining AI regulation and policies concerning MDs. To support the uptake of regulatory framework and to harmonize the market international standards concerning AI in MDs are needed. ISO, IEC and IEEE organizations are working on standardizing data quality management and application of AI affecting human wellbeing.

Even with recognized obstacles once can conclude that AI has aalready completely changed the traditional medical model, significantly improved the level of medical services, and ensured health in all aspects. It is yet to be seen how future development prospects of medical AI will impact the human population in tackling the rising challenges such as infectious pandemics, chronic diseases and elderly population.

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STRATEGIC HARMONY – A SOLUTION TO FIXING THE BROKEN WORLD?

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SUMMARY

The article is a review of key ideas and proposals from the book "EmpowerUs: From Crisis to Strategic Harmony" (Kitsap Publishing, 2020). In the preface to the book Philip Kotler, the Father of modern marketing and one of the most influential global management experts points out that there are many „fixing the world books, and this is one of the best". The authors are Ira Kaufman, a transformation strategist and consultant from the USA, and Velimir Srića, a leadership consultant and professor of management information systems from Croatia. Both are well known experts on management of change, digital transformation, and leadership development. The article provides an overview of the Strategic Harmony model and its application. After explaining the key issues of "the broken world", the text focuses on proposed solutions. First, it describes the Change Drivers and their role in initiating necessary transformation. Then, it discusses the importance of mindset change, based on so called TEST values (Trust, Empathy, Sustainability, and Transparency). The article provides a model of transformative leadership enabling leaders in business, government, science, education, culture, medicine, and other human activities to become Catalyzers of change and lead their institutions toward Strategic Harmony.

Key words: The brokec world – strategic harmony model – mindset change –trust - empathy - sustainability - transparency

INTRODUCTION

In early 2020, almost everything stopped. What began in the East as a strange new disease, rapidly spread around the world, forcing the World Health Organization to declare the COVID virus a pandemic. Millions of people became ill and hundreds of thousands died. Entire economies ground to a halt. Health care institutions struggled to cope with an emergency they had not seen since the 1918 influenza. Distraught leaders conducted frantic searches for equipment like masks, gloves, and protective gowns. Millions were told to work from home. Schools shut down, switching to an online format, expecting overwhelmed parents to become "teachers." Colleges and universities switched to online formats, causing chaos and discomfort for both students and faculty. Thousands of seniors died in long-term care homes that were not equipped to withstand a pandemic. Some government leaders played a blame game; others called for collaboration.

Rates of anxiety, addiction, depression, and other mental health conditions began to skyrocket. The world, as we had always known it, suddenly transformed in ways no one ever expected, and psychologists began talking of the pandemic as an international trauma.

The culprit: an unseen aggressor, a microscopic new virus called COVID-19 cut a wide swath of damage and destruction around the globe. It was a Darwinian nightmare—the power of a force of nature that seemingly had us and all our carefully crafted systems in its clutches, threatening our survival and our way of life.

As devastating as this was, the virus also revealed to humanity that all our concepts of "normal" are not working. It showed us the divisions within societies—economic and racial inequality, dysfunctional political systems, preoccupations with violence and power —all of which came into such sharp relief that we could no longer look away or adopt mere Band-

Aid solutions to deeply festering wounds. And for those of us who had been sounding alarm bells about the state of our planet pre-COVID, the irony was not lost on us that as COVID shut us down, the Earth began to heal. Air quality improved, the earth's waters got clearer, you could see the night sky, you could hear the birds. And so we began to ask the questions: Does it take a pandemic to show us this stark truth? Or are there things we should have been doing all along? Were new models of running the world accessible, or do we need to reinvent leadership to catalyze a post-COVID-19 society?

One way or another, our world is broken! It has been broken for a long time. The need for profound systemic change is no longer an option; it is a necessity. If you disagree, and you like the status quo, put this article aside. Otherwise, join us and we can work to transform it!

PROBLEMS OF THE WORLD

Lebanese American scholar, Nassim Nicholas Taleb, noted that *"humanity has never faced such deep social and economic problems, and, at the same time, was equipped with such a low level of understanding of the scope and reach of these problems."* Here are some striking examples of these interrelated, conflicting realities:

Managerial economics, as proposed by Milton Friedman in 1970, is built on maximizing shareholder value. From 1980 to 2013, the global economy, driven by that goal of maximizing profits, tripled in size. However, one result has been the rise of income inequality and a rise in poverty. The most opulent 1% of the population control 90% of private wealth. However, the definition of value may be changing. In the past five years, the long-term value of a company has been redefined by digital technologies and eco-innovation. Eco-innovative companies are growing at a rate of 15% per year, while their respective markets have remained flat. Such a transformative, stakeholder-centric economy, built upon core values, will drive greater inclusivity, equality, and opportunities for sustainable prosperity. Despite the stock market recovery, economic problems are deep-seated in many regions of the world. This has resulted in the collapse of social programs, higher unemployment, and the impoverishment of millions of people. We need a global strategy and programs to address these issues and bridge the fundamental gaps.

Global System Change provides a holistic approach to achieving sustainability and transformation. It is based on Einstein's idea that we must think at a higher level to solve our most complex challenges. All major aspects of human society are interconnected parts of the whole Earth system. We cannot effectively address them in isolation. However, considering all parts of society at once can be extremely complex. To simplify the processes, we often break society into parts and study them without adequate reference to the larger system that contains them. This reductionism ignores relevant factors and produces often unintended consequences, such as widespread environmental and social degradation. And some of the damage is, unfortunately, not unintentional because many companies and governments are aware of the damage caused by some of their practices, but they may opt instead to cover it up, or perhaps they do not care. The solution is to think at a higher, whole-system level. Global System Change integrates all major aspects of society and provides effective, systemic solutions to the major challenges facing humanity.

Political gridlock also inhibits innovative collaborative action. Many of the world's most influential politicians are rightly seen as untrustworthy, corrupt, and unethical. Even though they keep talking about change, they are nothing but bureaucrats fighting for power. To displace these influencers, we need a critical mass of hero-innovators—trustworthy and ethical leaders dedicated to sustainable change. We need persistent idealists ready and able to transform the world into a better place.

Global nutrition or the lack thereof, is a major concern. Many people either starve or practice unhealthy lifestyles. One-fifth of the world population faces obesity while one-fifth suffers from malnutrition. Conversely, a third of all food produced for human consumption—about 1.3 billion tons annually, at a value of more than $1 trillion—is thrown away. Living our core values more consistently, including prioritizing a healthy, less wasteful lifestyle, could potentially allow us to feed all people.

The Global cultural ecosystem has turned into bad taste, mass consumerism, a marketing-driven swamp, instead of promoting values-driven purposeful products and services that increase the quality of life and sustainability of our planet. Digital technologies and shared value for all stakeholders can serve as a bridge to diffuse a more sustainable global culture.

Education as a global standard is still engaged in regurgitation of content and striving for grades instead of cherishing creativity and breakthrough transformative learning. Education must go back to its roots as stimulating learning and discovery. Lifelong learning and digital collaboration ignite opportunities to address the challenges faced by humanity.

Global media are easy access sources of real-time information, but can they be trusted? Often our daily feed is biased or sometimes fake, and thus does not provide access to trusted, dependable sources. We have the technology and resources to provide authentic news that will rebuild the trust in our media.

Anthropocene era is the current historical epoch in which human activities (technology, governance, business, climate change), became the primary driver of many existential threats on our planet. Our business and political leaders are challenged to live their proclaimed values and transform their decisions and investments to support the achievement of Agenda 2030 Sustainable Development Goals.

Rising Voices are echoing globally their demand to be heard and included. Following the footsteps of Greta Thunberg, the *Next Generation* is taking to the streets protesting the unwillingness of politicians, businesses, and global organizations to take control of global climate change. *Women* are outspoken as both elected representatives and directing initiatives that tackle the challenges of humanity. While the *Marginalized,* those who live on the fringe of a country and are excluded from the "dream", demand equal opportunity, rights, and universal access.

Why, despite our access to powerful technological innovations are we unable to address most of these burning issues?

Why are we still pursuing questionable goals, trusting the same unsustainable pathways, and accepting the old excuses that block purposeful action?

The problem lies in our deteriorating values and unwillingness to empower them. Because of these conflicting realities, we allow the health and direction of our planet to deteriorate, even though we have the potential to reverse this process.

STRATEGIC HARMONY

We offer a solution which we call ***Strategic Harmony.*** It looks through new lenses at the challenging conditions and mobilizes radical, yet collaborative solutions, to assess and evaluate our impact on the future.

First, we must self-reflect on how: (1) we live our **core values**, (2) we use/misuse our **resources**, (3) we engage our **communities,** and (4) our **leaders** direct our institutions. Change begins with transforming our mindset. Let us take a closer look at the issues.

1. **Core Values** – We are and do what we believe. Our core values drive mindset which leads to action and creates outcomes. If we reject the outcomes, we must question the values, beliefs, and mindset. As Albert Einstein noted: *"We cannot solve our problems with the same thinking we used when we created them."* It is obvious that the values we preach are not the values we live by. John Steinbeck defined the problem as *"...the things we admire in men [indeed all of humanity], kindness and generosity, openness, honesty, understanding, and feeling, are the concomitants of failure in our system. And those traits we detest, sharpness, greed, acquisitiveness, meanness, egotism, and self-interest, are the traits of success. And while men admire the quality of the first, they love the produce of the second."*

2. **Resources** – We have vast resources including capital, technologies, knowledge, and expertise. These resources are focused on ourselves, our businesses, and our personal success, and not serving others, our communities, or the sustainability of our planet. Herein lies the gap: we must transform these resources into assets and optimize them for all stakeholders, empowering innovation, and synergy to create sustainable outcomes and harmony for our failed systems.

3. **Communities – We** are networked to local and global communities of resources and people. Thousands, even millions, of people may know and interact and share our interests. The issue is how are we leveraging these connections to foster trust and real collaboration for scalable sustainable impact? Most networks are not relationship-focused or built upon the principles of sharing and scaling global solutions that benefit all.

4**. Leaders** – The majority of executives, businesspeople, administrators, and managers do not interact with or listen to the stories of their constituencies. They do not have the courage and flexibility to act upon what they see, hear, and feel. It is also a common perception among many workers or constituents that executives, managers, chairpersons, and the like, do not care about those under their direction, and that not caring leads to not listening. This one-way, top-

down communication is creating a gap in trust between elected leaders and citizens, and between executives and their stakeholders and employees. The Edelman Trust Barometer each year reveals reduced trust across the institutions of government, business, media, and NGOs. The credibility of leaders dropped to an all-time low of 37%, plummeting in every country studied. Trust in media is at an all-time low in 17 countries, while the government is the least trusted institution in half of the 28 countries surveyed. These statistics reveal a growing polarization between citizens and market economy.

We are surrounded by conflicting realities and linked dualisms, e.g., polarized citizens protecting their turf vs electors striving for harmonious/sustainable solutions; egotistical leaders vs empathic "servant leaders;" concentrated wealth vs efforts to reduce poverty; escalating unemployment vs expanding high tech jobs; radicalized alienated youth vs inspired millennials; exploding technologies healing the planet vs destroying the world order. By connecting and linking these opposite forces, we accept their divisive nature as the norm that continues to influence our thoughts and our actions. These less than value-neutral dualities and polarities accentuate the gap in our minds, hearts, actions, and intents widening the fissure in our society between leaders' promises and people-action.

In each case, the different situations are outcomes of conflicting values and mindsets that drive behavior.

- If we want new outcomes, we need to transform our mindset.
- If we want organizational transformation, we must acknowledge and challenge the gaps between our words and actions.
- If we want to build the systemic change, we need to challenge the linked polarities in society and myths they have created that underpin our thinking.

Our world is broken. We may agree or disagree with some details but concur on the need to address the global condition of brokenness. The established rules and norms are disrupted; economy inequitable; governance corrupted; and citizen dialogue entrenched and partisan. There is a lack of trust in our major institutions, a deterioration of our values, and conflicting ideologies between generations.

For the most part, we are stuck in stale and outdated thinking, facing the results of unsustainable choices made by our business and political leaders. Furthermore, there has not been a response to the changes being called for by students, women, employees, voters, and consumers globally.

We propose fixing the broken world through *Strategic Harmony.* How are we going to get there?

The condition of our world reflects the misalignment and abuse of two forces—Power and Love, and the deterioration of our will to bridge the gap between our intentions and sustainable actions. We corrupt Power for own self-interest, while twisting Love as an infatuation with money, fame, and greed. The remedy is to flip the broken model and transform these forces. We call the first Transformative Power, and it is anchored in higher purpose. We call the second Transformative Love, and it emanates from consistently living our highest values. We must strategically analyze the gaps between what we intend and what we say; what we value and how we expend our resources; and how we act and how we impact our community. Reconciling these gaps creates harmony, direction, and sustainability.

Strategic Harmony is a transformative blueprint for an equitable economy and sustainable society. It harmonizes Power and Love, through values-driven strategies to generate workable outcomes. Focusing on integrating the mind and heart, *Strategic Harmony* is a model for organizational transformation that results in mutual stakeholder benefit, well-being, and sustainability. It requires collaboration to implement and scale.

The journey must begin inside ourselves by rediscovering the core that we call **TEST Values:** building ***Trust***, propelling ***Empathy***; igniting ***Sustainability,*** and living ***Transparency***. We also strongly believe that Transformative Power and Love, combined with our TEST Values are drivers of action and change. They serve as foundations of *Strategic Harmony.*

What is *Strategic Harmony?* Poetically speaking, we use **5H** model to describe a search for **Harmony** between what we think **(Head),** what we do **(Hands),** what we feel **(Heart)**, and what we **Hope** (Purpose and Intent). Pragmatically, we see it as a transforming framework necessary to realign our ethical compass and redesign the broken world by bridging the gap between generations, cultures, nations, leaders and the people they represent. It outlines a set of values, models, and best practices to build a sustainable

future. We need to look at the challenging conditions in the world through new lenses and mobilize radical, yet collaborative solutions to assess and evaluate our impacts.

MINDSET CHANGE

Strategic Harmony begins with a mindset transformation within each of us. It translates to the organization and its culture, is transmitted to its stakeholders, and then scaled to communities and networks.

Why do we need a new mindset? It is like a RESET button on your computer. Whenever we meet a problem extremely hard to solve, we better start anew. Transformation is so broad in scope; it requires expanded thinking and a new strategic model that reflects the challenges of today's world. We cannot base our actions on an old mindset, based on premises that do not work. We are immersed in a digital ecosystem facing an acceleration in the speed of innovation, changes in climate, and digital transformation with unexpected outcomes and exponential scale that we have never experienced. Therefore, our approach to transformation must reflect the flexibility and power of our current challenges.

The metamorphosis of a larva into a butterfly is a metaphor that provides context. This transition is also defined as the moment of ***singularity,*** a space of total openness to complete transformation when the changes in civilization are so vast that previous generations would not have been able to comprehend them. Historians call this a point of no return. Thomas Kuhn defines it as a new **paradigm** that manifests a new framework containing better assumptions, ways of thinking, and methodology that replace the old mindset that no longer explains the world around because it is unable to deal with its problems in an efficient way.

New paradigms have always depended on new leadership and new mindset. If we think the same, we act the same, and we accomplish the same. If we think differently, we act differently, and we change. If a point of no return situation takes place in our private or business life, or on a global scale, it means that we need different leadership, bringing along a different mindset and values to address the challenges we face today that impact us tomorrow.

Strategic Harmony is intended to build a Brand-New Word. Are we talking about a revolution? Yes, as Marianne Williamson suggests *"There is a revolution occurring in the world today, but it is not fought with armies and it does not aim to kill. It is a revolution of consciousness."* We are experiencing drastic changes in the way our world works, reflected in five "revolutions in mindset" that are taking place globally:

- **Revolution in Values** reflects the growing lack of Trust in leaders and institutions. We *must rewrite the trust equation for each stakeholder and integrate it in all our actions.*
- **Purposeful Revolution** *reflects a shift among employees, customers, and investors to become a force for good in society and the environment.* Purposeful companies bring greater customer loyalty, higher retention, more innovation, and a healthier bottom line.
- **Sustainability Revolution** is the one that touches every aspect of all 7.6 billion lives on this planet: energy, transport, food systems, population growth, healthcare, education, data management. It represents the investment opportunity and option for survival.
- **Revolution in Stakeholder Value** reflects the transition to sustainable financial models which can secure future prosperity. We must turn to impact investment as a movement that brings value to all stakeholders.
- **Digital Revolution** reflects the global imperative for all organizations (politics, business, nonprofits) to transform, to leverage the power of digital to listen and respond to their constituencies; to connect globally in real time; and to use data to personalize content.

There are also "revolutions" happening in various parts of the world, from yellow vests in France to movements fighting against arms, for climate change, for race equality, or for women's rights all over the world. In all these cases, people are dissatisfied with the values preached and even more with the values lived. They are walking the streets in protest.

It has become clear that we need politicians and businesspeople who listen and serve, who represent their markets' needs and not the selfish desires of the few driven by money, power, and greed. It is a revolution for those positive, humane values calling out for a more ethical, just, and caring world order. Of course, we do not advocate force or violence; hence, we call it **refolution,** a combination of revolutionary change in mindset and constant, gradual reforms.

Before I present our model, let us examine how **strategic** interfaces with **harmony**, and why we use that expression**.**

- "Strategic" because it is driven by specific intentions to create a values-driven plan that is inclusive and trusting, empathetic, sustainable, and transparent. It is Strategic as it must adjust the response to the forces affecting *"refolutionary"* transformation (values, purpose, stakeholders, digital, impact investing, sustainability).
- "Harmony" because it is a congruent combination of varied cultural values and mindsets resulting in win-win outcomes and shattering our status quo. Harmony unifies the love and purpose of all stakeholders to generate alignment. It is collaborative, empowering well-being, and strengthening sustainability efforts.

THE MODEL

Let us, now, look at our Strategic Harmony model. It is a circular journey with five values-driven modules. Each supports the objective of attaining *Strategic Harmony* and builds upon one another. It starts with DRIVERS and ends with LIGHT Impacts. Our approach balances *Power and Love* and applies the TEST Values *to drive* the transformation process.

Figure 1. Strategic Harmony Model

The elements of this model are operational in diverse sectors and organizations globally. In our book we provide many cases and examples to show that it is a purposeful approach to transformation which works and is sustainable. Its best practices can be translated to every organization and all conditions.

Our model starts with the Drivers, the ignition of the *Strategic Harmony* process. Since everything that we do is 'driven' by a constant balance between Power and Love, we use these two forces as the focus to the catalytic process that fuels transformation. The organization's values and ethics influence the transformation as the framework expands outward, powering the direction of the organization and impacting institutional societal/outcomes.

What drives individual and organizational change? Our *Strategic Harmony* model starts with two internal factors (based on Love) driving transformation and two external factors (based on Power) affecting leaders and organizations. Leaders must leverage these drivers to ignite transformation.

The first internal driver is **Spiritual Connection,** and it consists of two components: **Transformative Love** (self-reflecting on values and purpose directing actions); and **Self-actualization** (material possessions replaced with sustainable priorities).

The second internal driver is **Self-interest,** and it consists of three components: **Self-preservation** (we fear the loss of job, company, and viability for future generations); **Self-worth** (we lack confidence in traditional institutions such as higher education, economic systems, career mobility), and **Powerlessness** (women, marginalized, NextGen feel excluded, and want to be heard and involved).

The first external driver is **Digitization**, and it consists of two components: **Transformative Power** (a possibility to leverage digital resources providing unlimited search, easily publish content, access abundant data, crowd fund support, and mobilize networks); and **Business Transparency** (ability to respond to social distrust and gap in values and business decision-making).

The second external driver is **Leadership**, and it is affected by three components: **Transformation (**disruption, needed change in mindset); **Customer response** (driven by feedback); and **Disruptive environment** (ignited by social movements, environmental disasters, and new technology).

The Drivers reflect the Chinese **yin yang** that describes how the opposite forces give rise to each other as they interrelate to one another. It is important to note that *Love* and *Power* can be labelled as positive and negative and as internal and external.

Figure 2. Drivers

Transformative Power is the major motivator of the post-Covid world. Our model is based on the idea that we must replace the Old Power, garnered from outside sources (position, family, money) and controlled, with Transformative Power generated from both inside (beliefs, values, ethics, and purpose) and outside (information/data and digital assets) and the resulting Transparency.

Another feature of our model is the need to replace the Old Love which is selfish and controlling with the Transformative Love which is supportive and enriching. The Old is a chain; the Transformative gives you wings. When combined, Transformative Love and Transformative Power are the heart and soul of transformation that will fix our broken world.

The key idea is that transformation is driven from within and from without. From within by our **spirit,** our struggle and self-reflection with values, ethics, morality, and priorities and by our **self-interest,** including factors that affect our security, career, and lifestyle. Our Drivers are not new to this age; but they are significantly affected by explosive **digital technologies** and transformed by our access to vast volumes of real time information, instant transparency of data, how we reflect on it, leverage it, and judge it, giving powerful feedback to our institutions and leaders.

Digital technologies are coupled with **leadership** as the driver from without, initiating change based on a transformed mindset, responding to market and environmental disruptions, as well as to the rising voices of citizens and customers. Internally and externally driven change is faster, constant, and overwhelming; it disrupts us from within and transforms how we think and act!

How will the Drivers initiate transformation? Where will Transformative Leadership take us? It depends on their values. Transformation starts when an organization manages to pass the **TEST** (Trust, Empathy, Sustainability, and Transparency). These values must be aligned to an ethical standard, a compass that goes beyond local cultural morals.

Basically, we must rediscover the TEST values and learn how to incorporate them in everything we do. Living the TEST Values is an important step to achieving Strategic Harmony.

First, we must base all our communication and cooperation on **Trust**. It is becoming the global and most-valued currency of modern time. Trust generates the power to transform stakeholders and institutions. Trust builds harmony, it is the basis for movements, religions, and political parties. Trust in one's mission is the force behind all institutions, organizations, and businesses. Trust in mindset facilitates change. Trust in products and services generates value, and trust in people builds relationships. Trust in customers, employees and managers builds powerful business systems, while trust in technology builds networks and online communities. Trust in organizational culture builds employee loyalty and productivity, while trust between departments generates collaboration and innovation. Trust between stakeholders generates results and sustainable outcomes. Trust in relationships drives the shared economy and sustainable society.

To transform our broken world and all its institutions, we must discover the deficient and weak linkages of trust among all stakeholders and provide correctives.

The second TEST value is **Empathy**. It is defined as the ability of getting in tune with another person and learning to be in their shoes. It is the capability to feel and comprehend other's emotions, while imagining what someone else is feeling. Empathic people listen attentively to others and can facilitate communication. They tend to be more generous and concerned with others' welfare. Empathy is essential as the ability to look at the world through the eyes of others, as well as to reconsider and change one's point of view. It is rooted in humility.

In our broken world, radical empathy is gaining traction as a deep commitment to changing the world, one person at a time. It is getting to the root of relating to and caring for each other through shared experiences. It generates a more compassionate and connected world.

The third TEST value is **Sustainability**[1] which means living within the resources of the planet without damaging the environment, now or in the future. Sustainability is creating an ecosystem that provides for quality of life while renewing the environment and its resources. In a sustainable world everyone can have fulfilling lives and enjoy a rich level of well-being within the limits of what nature can provide. Sustainability means taking the long-term view of how our actions effect future generations. Therefore, it means living a life of dignity in harmony with nature. Still another definition of sustainability focuses on using resources efficiently, working to preserve cultures, protecting natural ecosystems, raising aspirations, and extending opportunities for all.

Sustainability is both a value and behavior. It interconnects all ecosystems and how they affect each other. It is based on a spiritual view of circular use of all resources - mental, physical, environmental, financial, and social.

The final TEST value is **Transparency**. Every person's honesty and credibility is transparent when it is established in the eyes of others. The prospect of being open and vulnerable is a necessity for survival in the digital age. Transparency invites trust by revealing there is nothing hidden or altered. It allows objects, data, information, and people to be seen clearly through the medium of integration. It reveals all facts and actions taken, even when some of them are uncomfortable. It enables open dialogue in areas of disagreement to facilitate mutual understanding. A culture of transparency requires a purposeful and methodical system-wide process with real time monitoring and open dialogue. As such, transparency is the cornerstone of trust. It ensures accountability as it makes people and their skills, knowledge, and ideas visible and accessible to others. It helps to build interpersonal trust, which is vital for people to share and collaborate with each other.

The TEST integrates values and ethics to benchmark the strength and potential to bring forth change in the marketplace or society. The values should be congruent, harmonizing to build and sustain the organization's culture. Obviously, the four TEST factors are not independent as the values interface and augment each other. The result is a synergy of all the four TEST values, and it is a powerful benchmark for individuals, organizations, even governments engaged in transformation.

Drivers and TEST values are the key tools of the future leaders, on their path to Strategic Harmony. We call these leaders "Catalyzers" because their Catalytic Mindset should consist of four "think lenses." Each lens demands us to reset the way we think about and approach a threat or opportunity. The Catalytic Mindset is authentic, open, and values-driven, focusing on organizational purpose. In contrast, the traditional company's mindset is driven by Old Power controlling communication, consumer and employee input, market strategies, and product design.

In organizations facing transformation, the executive team must determine a clear purpose to define *its goals and direction*. In our *Strategic Harmony* framework, the organization's, WHY becomes the soul and spirit of the organization, generating Transformative Power.

In our model, the key task of Leaders-Catalyzers is to **"shed LIGHT"** on community and society. What do we mean by that?

The integration of values with the mindset and operational activities is reflected as purposeful solutions at the societal level. We call it the principle of LIGHT. There are five LIGHT Impacts that bring harmony and sustainability to any organization or business:

1. **L**ifelong Learning
2. **I**nnovative Engine
3. **G**ood Governance
4. **H**olistic Living
5. **T**ransformative Economics

These five impacts define the action steps and sustainable solutions necessary to fix the broken world and transform organizations. They reflect the assets of the organization manifested at the community or societal level. Each of these impacts works both independently and interactively to propel change, heal, and illuminate organizations through the TEST Values. If we "place LIGHT" on our darkened (broken) organizations, transformation begin realigning their values and actions with purpose, reenergizing them, and bringing them to life. The principle of LIGHT brings balance and sustainability to organizations; thus, organizations need to incorporate these impacts into the design of social ventures, businesses, community action groups, and institutions as they strive to transform.

[1] https://en.wikipedia.org/wiki/Sustainability

There is an old saying that it is the journey, not the destination that counts. *Strategic Harmony* is a goal in the transformation journey, not a destination in progress. It is a model for personal and organization transformation. Our present culture is dominated by Old Power, competition, conflict, and the Darwinian survival of the fittest. It forces organizations and companies to do whatever it takes to make profit and grow, be it cheap child labor, wars to protect economic interests, or ecologically disruptive resource utilization. It makes the whole society insensitive to a growing gap between the rich and the poor and leads to an overall lack of humanity and solidarity.

Strategic Harmony is a blueprint for an equitable economy and society able to overcome the conflict-based and anarchic nature of capitalism, and shift the focus from competition, growth and profit toward mutual benefit, Love, well-being, and sustainability.

ABCD OF STRATEGIC HARMONY

So how can we reach the state of Strategic Harmony? According to Socrates, **"***The secret of change is to focus all your energy not on fighting the old but building the new "*.

To achieve the purposeful impact necessary to sustain our planet, we propose to transform our emerging and current leaders into a cadre of Catalyzers with the required agility and laser focused direction. This new generation of leaders must expand their capacity to apply four core actions, we call them the ***ABCD's of Strategic Transformation***.

A - Align leader's intent with values.

We begin with Harmony through the aligning leader's intent with TEST Values. As leaders transform into Catalyzers, they are anchored by their purpose and empower their operations and strategies through living these values. Consistently embedding these values generates the power to impact a genuine stakeholder experience and achieve sustainable outcomes. Harnessing strategic skills_(inclusivity, collaboration, targeted disruption) allows Catalyzers to realign blockages in the ecosystem by consistently harmonizing their values with their customers and organization culture.

B - Build transformative business models.

As the Catalyzer applies these different lenses, the business model is transformed: new catalytic strategies evolve and produce new outcomes. The rules of the enterprise change! It is driven by all stakeholders' rather than shareholders' interests – translating purpose and values to reflect social needs and business priorities. The corporate strategy paradigm must shift transforming the predatory business model into models that support and sustain harmony. These models incorporate both current business practices and circular/regenerative design to achieve win-win social impact as well as profit.

C - Catalyze stakeholders' impact.

Driven by a Catalytic Mindset, sustainable ventures harmonize profit with achieving the 17 UN Sustainable Development Goals. They mobilize stakeholders across sectors to collaborate and catalyze investment to generate a Quadruple Bottom Line. Systematic monitoring and holistic assessment of impact is vital and necessary to reduce risk and bridge the gap between available capital investment and the exploding need for impact investment to drive system change.

D - Drive and scale sustainable outcomes globally.

Sustainable ventures with proven impact must be scaled to fuel Global Social Change (GSC). Catalyzers must ignite "this sustainability revolution…as the largest investment driver in history" by confronting outdated mindsets and resolving existing gaps between words and actions. They require new integrated venues/networks and funding sources to drive and scale regenerative solutions that "fundamentally rethink established norms in areas including transport, food systems, healthcare, education, data management and infrastructure"[2] They must lead in the current world and beyond.

The **ABCDs** are designed to harmonize strategic inputs to achieve successful sustainable impact. They are built upon each other to generate the required and intended outcomes. Critical to GSC is building

[2] https://am.lombardodier.com/sites/am/home/sustainability/the-sustainability-revolution.html

networks of Catalyzers, anchored in purpose, who will collaborate across sectors and functions to access the impact investment required to implement Strategic Transformation.

Our model presents a set of solutions and tools that requires strong leadership aligned with values and intent to accomplish the goal. There is no alternative to individual initiative and collaborative action. Each one of us must live our values to start this process; take initiative and contribute through our own actions. We must build transformative business models and organizations that challenge/disrupt the traditional business rules that accelerate transformation. These business models catalyze impact among all stakeholders. This expands the intent and purpose of the business beyond just investors to all those that connect with the product or service including customer, employee, partner, and community. Finally, the model develops and scales the digital media and communications to spread the message and transform broken values on which many of our institutions, products and services are built.

CONCLUDING REMARCS

Most people see that our world is broken but remain apathetic or paralyzed. We want to share our passion to transform the world to what it can become, instead of accepting the present situation as the default. We provide a breakthrough in thinking about institutions, and the false models we accept and live by. We offer a resilient approach to managing and innovating, and a roadmap for transformation. As our world is facing a turning point, we need to visualize our new beginnings. If we do not have a dream, we are unable to make it come true.

In this article, I have presented the principles of our Strategic Harmony Model as a roadmap for restructuring, reinventing, and realizing the needs of our broken world; a roadmap for navigating the new, fixed world. It is a tool for every reader, potential change agent, that we call Strategic Harmony. Globally, people are in search of a new balance and harmony. We all need strategies that align Power, augment Love, and reduce resistance to change. If our model seems like Utopia, remember that every new idea is rather utopian, until it manages to succeed.

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SAŽETAK

Članak je pregled ključnih ideja i prijedloga iz knjige “EmpowerUs: From Crisis to Strategic Harmony” (Kitsap Publishing, 2020.). U predgovoru knjige Philip Kotler, otac modernog marketinga i jedan od najutjecajnijih stručnjaka za globalni menadžment ističe da „postoje mnoge knjige o popravljanju svijeta, a ova je jedna od najboljih“. Autori su Ira Kaufman, strateg transformacije i konzultant iz SAD-a, te Velimir Srića, menadžerski savjetnik i profesor menadžerskih informacijskih sustava iz Hrvatske. Obojica su poznati stručnjaci za upravljanje promjenama, digitalnu transformaciju i razvoj vodstva. Članak pruža pregled modela Strateške Harmonije i opisuje način njegove primjene. Nakon što je predstavio ključna pitanja “slomljenog svijeta”, tekst se usredotočuje na rješenja kojima će se stvari popraviti. Prvo, opisuje ulogu Pokretača promjena i njihovu zadaću u pokretanju nužne transformacije. Zatim opisuje važnost promjene načina razmišljanja, na temelju takozvanih TEST vrijednosti (Trust - Povjerenje, Empathy - Empatija, Sustainability - Održivost i Transparency - Transparentnost). Članak pruža uvid u model transformativnog vodstva koje omogućuje liderima u poslovanju, upravi, znanosti, obrazovanju, kulturi, medicini i drugim ljudskim aktivnostima da postanu katalizatori promjena i vode svoje institucije prema Strateškoj harmoniji.

Ključne riječi: svijet u krizi – model strategijske harmonije – promjena mentalnog modela – povjerenje – empatija – održivost – transparentnost

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Review article

CRIMINAL ASPECT OF THE COVID-19 PANDEMIC IN BOSNIA AND HERZEGOVINA AND THE REGION

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SUMMARY

The COVID-19 pandemic (SARS-CoV-2) has caused multiple consequences globally, and all can be researched and addressed multidisciplinary, ie from a health (medical), legal, economic and security aspect. In this paper, the author focuses on the legal, ie criminal law aspect of this pandemic. After more than a year of the COVID-19 pandemic in the world, based on the measures taken in almost all countries, it can be concluded that the health and legal aspects are primary and complementary. This claim is supported by the fact that the protection of human health must be regulated by adequate legislation, which is, above all, the Law on the Protection of the Population from Infectious Diseases. However, in such an emergency situation without criminal protection, it is difficult to achieve effective health care for the population.

Therefore, this article analyzes the criminal and medical aspects of crimes against human health that are similar or almost identical in all countries in the region, such as Bosnia and Herzegovina, Croatia, Slovenia, Serbia, Northern Macedonia and Kosovo.

Key words: infectious disease - pandemic - COVID-19 - health protection - criminal law - medical law

INTRODUCTION

The criminal law aspect of the COVID-19 pandemic includes the criminal offenses of Transmission of Infectious Diseases, Failure to Comply with Health Regulations During an Epidemic and Failure to Apply Measures to Protect Against Infectious Diseases. The regulation of these crimes protects human health, which is especially important at the time of this global pandemic.

The organization was on 11.03.2020. declared a pandemic (https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-March-2020) (accessed 10.04.2021.)). Thus, at the beginning of 2020, the largest global activity for the protection of human health in recent history was launched. This activity is based on previous medical knowledge and applicable laws in the field of medical, criminal and misdemeanor law that protect human health. Unlike the countries of the region of Southeast Europe, Bosnia and Herzegovina does not have a single legislation at the state level, so the first health care measures were different in certain parts of the country. Time has shown that this disunity further favored the spread of the pandemic, ie slowed its suppression.

Viewed from the criminal law aspect, these criminal acts have not been in the focus of the scientific and professional public for a long time and have not been the subject of major analyzes, research and scientific papers. However, with the advent of the COVID-19 pandemic, these crimes came to the fore, as their application by the competent state authori-

ties in all countries of the world has become inevitable. Last but not least, there is the issue of basic human rights and freedoms, ie the justification of their restriction during this situation.

CRIMINAL ASPECT

Transmission of infectious diseases

What all the countries of this region have in common is that they know the criminal offense of Transmission of Infectious Diseases in their criminal laws. In some countries, such as Bosnia and Herzegovina (Article 225 of the Criminal Code of the Federation of BiH and Article 211 of the Criminal Code of the Republika Srpska), Slovenia (Article 177 of the Criminal Code of Slovenia), Serbia (Article 249 of the Criminal Code of the Republic of Serbia) and Northern Macedonia (Article 205 of the Criminal Code of Northern Macedonia), this work is entitled "Transmission of a contagious disease", in Montenegro (Article 288 of the Criminal Code of Montenegro) it is "Transmission of a dangerous contagious disease", in Kosovo (Article 249 of the Criminal Code Republic of Kosovo) "Spread of infectious diseases" and, finally, in Croatia (Article 180 of the Criminal Code of the Republic of Croatia) "Spread and transmission of infectious diseases". The legal texts of these incriminations are very similar, which is reflected in the scope of protection of human health through the prescribing of almost the same criminal zone, criminal liability of perpetrators and sanctions that can be imposed on them. There is a significant difference only in Bosnia and Herzegovina, where the criminal laws of the Federation of BiH and the Republika Srpska prescribe a different criminal zone, which will be discussed in the continuation of the work.

The basic characteristics of this criminal offense are the act of commission, the manner of its realization, the nature of the disease that is prevented and the consequences of the offense (Lazarević et al. 2017).

The act of committing can be manifested as inaction or as doing, and is reflected in non-compliance with regulations or orders of the health service bodies which determine measures for the suppression or prevention of infectious diseases in humans. This can be refraining from an order contained in a regulation or order, or undertaking activities that are contrary to such orders (Petrović & Jovašević 2005). The law requires that measures taken to combat and prevent infectious diseases, such as attending a medical examination, be respected; disinfection of persons upon entering the premises; isolation of patients who are ill and their placement in special rooms (isolation), as well as those persons who were in contact with the patient and there is a reasonable suspicion that they are ill, who will be ordered not to leave their apartments (self-isolation); then reporting of patients by health institutions, conducting vaccinations; prohibition or restriction of movement or assembly of the population (eg a maximum of ten persons indoors or thirty outdoors); mandatory keeping a distance of 1.5m or 2m between persons; mandatory wearing of protective masks indoors and / or outdoors, etc. (Petrović & Jovašević 2005, Lazarević et al. 2017, Babić & Marković 2009).

The blanket character of this criminal offense derives from such a specific action, because the criminal law in its description does not determine the entire content of criminal behavior, but only states that this behavior consists of violating some regulations governing certain health areas (Petrović & Jovašević 2005, Petrović et al. 2015, Roksandić & Mamić 2020).

The consequence consists in the transmission or spread of a contagious disease to humans (Lazarević et al. 2017), while according to the Criminal Code of the Federation of BiH the consequence consists in creating a danger of spreading a contagious disease (Petrović & Jovašević 205, Babić et al. 2005).

The perpetrator can be any person who has contracted this contagious disease, a person living with the patient, but also medical staff who treat patients with contagious disease (Petrović & Jovašević 2005, Lazarević et al. 2017, Jovašević 2003). In Serbia and Montenegro, this criminal offense can be committed only with intent, and in other countries with intent and through negligence.

For the basic form of the offense, the most severe punishments are prescribed in Serbia, Montenegro and Kosovo - up to three years in prison, while the mildest punishment is prescribed in Slovenia and Bosnia and Herzegovina - a fine or imprisonment for up to one year. Furthermore, for a more serious form of crime, when a person has been seriously injured, or his or her health has been severely impaired, or an existing illness has significantly deteriorated, the perpetrator shall be punished by imprisonment for a term between one and eight years. Finally, for the most serious form of this crime, when one or more

persons die, the prescribed prison sentences range from eight years (Slovenia) to twelve years in Bosnia and Herzegovina (Petrović et al. 2016) and other countries.

As previously indicated, the criminal legislation in Bosnia and Herzegovina is not uniform in many segments, not even in terms of the criminal offense of Transmission of Infectious Diseases, the text of which is not identical throughout the country.

Thus, according to the Criminal Code of the Republika Srpska (Article 194), the perpetrator can be any person who does not act in accordance with regulations or orders by which the competent authority determines examinations, disinfection, isolation of patients or other measures to combat or prevent infectious diseases in humans. this leads to the transmission of an infectious disease. This act is classified as a tort offense (Babić & Marković 2009, Babić et al. 2005).

However, according to the criminal laws of the Federation of BiH (Article 225) and the Brčko District of BiH (Article 221), the perpetrator of this act may be any person who does not act according to regulations or orders by the competent health service body ordering examinations, disinfection, separation of patients or other a measure to control or prevent a contagious disease in humans, thereby endangering the spread of a contagious disease. As can be seen, the name of this criminal offense is not in line with its legal description, given that the existence of the offense does not require that the act of commission led to the transmission of a contagious disease, but only to create a danger of spreading a contagious disease (Babić et al. 2005). It follows from the legal norm that a criminal offense exists only if the perpetrator of the offense, who did not act in accordance with regulations or orders, created an immediate or specific danger of spreading a contagious disease (Petrović & Jovašević 2005). This is, therefore, a consequence that creates a danger of spreading a contagious disease, which classifies this act as a crime of endangerment (Petrović & Jovašević 2005).

Criminal analysis of these legal norms leads to the conclusion that their inconsistency contributes to the inequality of citizens before the legislation of Bosnia and Herzegovina, and thus to legal uncertainty, which means that such different actions of legislators can be interpreted as a violation of basic human rights.

The Criminal Code of the Republika Srpska follows the legislation of the countries of this region, when it comes to the criminal offense of transmitting a contagious disease, while the situation in the Federation of BiH is different from all countries. By logical interpretation of the legal norm, it can be concluded that a person who by his behavior, ie failure to act according to regulations and orders causes the transmission of a contagious disease, can be criminally liable for creating a danger of spreading a contagious disease, according to who can do more and less! Conversely, it could not be concluded that a person who, through his unlawful conduct, causes a risk of spreading a contagious disease, may also be punished if the disease is transmitted. We base this on the fact that the creation of danger is a consequence of endangerment, ie someone's life is endangered, but not damaged or injured. These are situations in which one or more people are at risk of spreading a contagious disease, but the transmission of the contagious disease itself has not occurred, ie no one is infected with it.

Failure to comply with health regulations during an epidemic

The action of this criminal offense is defined as non-compliance with regulations, decisions or orders that determine measures to combat or prevent an epidemic (Petrović & Jovašević 2005, Babić & Marković 2009, Lazarević et al. 2017). Failure to act in accordance with the orders and decisions made on the basis of the regulations of the competent authority may be manifested as inaction, but also as an act that is not in accordance with the orders or decisions. Therefore, it is a matter of not taking the necessary measures, or taking those activities that are contrary to the content of regulations, decisions or orders of the competent authorities, or that are not fully compliant with them. An important feature of this crime is time, because the action can be taken only during an epidemic of a contagious disease in humans, or a pandemic. As can be seen, the legal description of this crime does not contain a consequence as its element, because the consequence consists in an abstract danger to human health (Petrović & Jovašević 2005, Babić & Marković 2009). This, in practice, means that by the very act of committing the act, the consequence is considered to have occurred. This is an absolute presumption of the occurrence of a consequence, and the opposite cannot be proved.

The perpetrator may be any person who is obliged to act in accordance with the regulations, decisions or orders of the competent authorities which determine the measures for the suppression or prevention of the epidemic. Guilt requires intent, because the perpetrator must be aware of the existence of a pandemic and act contrary to certain measures to suppress or prevent it, and that he wants to or agrees to it. According to some theoretical views, the nature of this crime is more indicative of possible intent (indirect intent) (Lazarević et al. 2017). The prescribed sentence of imprisonment for the basic form of the offense is up to one year (Bosnia and Herzegovina), and up to three years (Serbia and Montenegro). It is interesting that the Criminal Code of Montenegro stipulates that due to a serious bodily injury or serious impairment of a person's health, the perpetrator will be punished by imprisonment from one to eight years, and in case of death by imprisonment from two to twelve years.

We are of the opinion that the regulation of this criminal offense covers a very wide criminal zone in the law and that it thus enables the prosecuting authorities and the court to act effectively in the suppression and prevention of dangerous infectious diseases.

Non-application of measures for protection against infectious diseases

The Criminal Code of the Republika Srpska recognizes the criminal offense of Non-Application of Measures for Protection against Infectious Diseases (Article 213), while the criminal laws of the Federation of BiH (Article 228) and the Republic of Kosovo (Article 253) prescribe a very similar criminal offense entitled Employment of Persons suffering from an infectious disease. This criminal offense completes the criminal zone of protection of human health from the transmission and spread of the infectious disease COVID-19.

The act of this criminal offense is non-application of appropriate hygienic measures in certain institutions, then, employment or keeping employees, contrary to health regulations, of a person suffering from a contagious disease.

Failure to apply appropriate hygiene measures may in practice manifest itself as an act (eg the application of certain hygiene measures, but not those that should have been taken or not in the way they should have been taken) or as inaction (complete failure to apply hygiene measures). Which hygiene measures are considered appropriate is determined on the basis of health regulations, rules of the profession and hygiene standards in certain industries. Furthermore, employment means the act by which a person suffering from a contagious disease is hired, and keeping employees means keeping a person at work who has contracted a contagious disease after employment or who, after his employment, became known to have contracted a contagious disease. infectious diseases or keeping at work a person suffering from a contagious disease who was employed by someone else even though he or she was already suffering from a contagious disease (Babić et al. 2005).

Employing or keeping an employee, contrary to health regulations, of a person suffering from a contagious disease shall constitute an act of committing this criminal offense if that person is employed or held by an employee of a hospital, maternity hospital, brothel, school, business or other legal entity, or an independent businessmen, in the activity in which food products are handled or which performs hygienic services or in a similar activity (Babić et al. 2005). These are activities where people with a contagious disease can cause a significant spread of the disease. It follows that the consequence of the act consists in the transmission of a contagious disease, or in the creation of a danger of the spread of a contagious disease (Babić et al. 2005).

The perpetrator of this act can be any person, but it is most often a person who, given his legal or factual position, is authorized or able to hire someone or keep him employed. The act can be committed with intent and intent. The basic form of the crime is punishable by up to one year in prison, and if a serious bodily injury or serious impairment of the health of one or more persons has occurred, the perpetrator shall be punished by imprisonment for one to five years. Finally, if a fatal consequence has occurred, the perpetrator will be punished by imprisonment for two to twelve years. If, on the other hand, the act was committed through negligence, a fine or imprisonment of up to six months is prescribed, and in the event of serious consequences, imprisonment of up to three years. Finally, in the case of causing death by negligence, the perpetrator will be punished by imprisonment for one to eight years.

MEDICAL LEGAL ASPECT

Law on Health Protection of the Population from Infectious Diseases

According to the Law on Health Protection of the Population from Infectious Diseases (ZZSZB) of the Republic of Srpska (Article 4, paragraph 11), a pandemic of an infectious disease is an infectious disease that crosses national borders and spreads to most of the world or the world as a whole. affected areas.

Given that the infectious disease COVID-19 caused by the SARS-CoV-2 virus has just appeared in the world, it is logical that it was not in the list of infectious diseases in the Laws on the Protection of the Population from Infectious Diseases (ZZSZB). However, the laws of the countries in the region, as well as in Bosnia and Herzegovina, recognized the infectious disease SARS (acute respiratory syndrome - Article 8 ZZSZB FBiH, or TARS (severe acute respiratory syndrome - Article 6 ZZSZB RS). may take special measures to protect the population in emergencies, but the emergence of this pandemic required the strictest measures that needed to be specifically regulated by law. of this region, in which COVID-19, a disease caused by the SARS-CoV-2 virus (eg Serbia, Croatia) has been introduced into the catalog of infectious diseases, as well as certain measures whose implementation is necessary in such emergencies. Laws were necessary so that the competent state authorities could apply the necessary measures to combat and prevent a pandemic.

We mentioned earlier that the criminal offense of Transmission of a contagious disease is of a blanket nature, which means that its complete content can only be determined by interpreting certain laws and regulations in the field of medical law (Petrović et al. 2015). These are a number of these laws, decisions and orders that we list here in accordance with the Laws on Health Protection of the Population from Infectious Diseases in Croatia and Serbia, many of which were introduced by the 2020 amendments.

Thus, according to the Croatian Health Insurance Act (Article 47), it is stated that, in order to protect the population from the introduction of COVID-19 disease caused by the SARS-CoV-2 virus, measures may be taken in accordance with this Act and international agreements to which the Republic of Croatia is a party. These are the following measures: 1) implementation of mandatory anti-epidemic disinfection, disinsection and deratization, 2) establishment of quarantine, 3) ban on travel to the country where there is an epidemic of this disease, 4) ban on movement of persons or restriction of movement in infected or directly endangered areas , 5) restriction or prohibition of trade in certain types of goods and products, 6) mandatory participation of health care institutions and other legal entities, private health care workers and natural persons in disease control, 7) prohibition of use of facilities, equipment and means of transport, 8) isolation of persons in own home or other appropriate space - self-isolation, 9) obligation to properly wear a face mask or medical mask, 10) prohibition or restriction of maintenance and / or gathering, 11) prohibition or restriction of private gatherings, 12) early detection of sources and ways of transmission of infectious diseases, 13) epidemiological testing and research, 14) laboratory testing works determining the causes of infectious diseases, 15) health education of certain categories of employees and 16) informing health workers and the population. Finally, a measure prohibiting entry into the country for persons coming from areas where there is an epidemic of infectious diseases, and do not have a valid certificate of vaccination or when required by the public health interest. In this regard, it should be added that in this situation of the COVID-19 pandemic, mandatory emergency vaccination can be ordered!

Decisions and orders to act during the COVID-19 pandemic

In order to implement these security measures, numerous Decisions were made: 1) suspension of teaching at universities, secondary and primary schools and regular operation of preschool education institutions and establishment of distance learning (online), 2) temporary ban on crossing state border crossings, 3) determination of border crossings through which transit traffic of freight vehicles through the state territory will take place, 4) measures during marriage and life partnership, 5) manner of holding funerals and last farewells, 6) strict restriction of detention on streets and other public places, 7) measures of special organization of work of the epidemiological service and special epidemiological measures related to SARS CoV-2 virus, 8) special organization of emergency medical service and medical transport, 9) general and specific protection measures obligatorily implemented by taxi service providers, 10) mode

of operation and working hours of shops, 11) special organization of social welfare institutions and other p of social services, 12) special way of working in markets, 13) restriction of social gatherings, work in trade, service activities and holding of sports and cultural events, 14) way of using children's playgrounds and outdoor sports playgrounds, way of doing recreational sports outdoors, 15) ban on entry of passenger ships on international cruises to seaports and inland ports, 16) organization of public transport, 17) control of compliance with recommendations for the prevention of infectious diseases in the catering industry of nightclubs, 18) mandatory use of face masks or medical masks.

Similar or identical decisions have been made in other countries in the region. Thus, various prohibition measures and restrictions are introduced, such as movement bans, suspension of public transport, ban on gatherings in public places, restrictions on gatherings indoors, wearing face masks indoors and outdoors, ban on the operation of some service facilities , some of which have provoked many reactions and criticisms in terms of their justification.

Restrictions and prohibitions on movement have their basis in the Constitutions of the countries, the Laws on the Protection of the Population from Infectious Diseases, as well as the Convention on Human Rights and Freedoms. Of course, always in emergencies and under strictly limited conditions. Thus, for example, according to Article 54, paragraph 2, item 2 of the Federal Law on Protection of the Population from Infectious Diseases, the Federal Ministry of Health may "order a ban on the movement of the population, ie restriction of movement in infected or directly endangered areas". Such provisions are also known by the laws of other countries we are talking about here.

Here we will briefly look at the beginning of the application of measures of prohibition and restriction of movement in the Federation of Bosnia and Herzegovina.

Date 20.03.2020. An order banning the movement of persons under the age of 18 and those over the age of 65 was issued on On March 27, 2020, the duration of this measure was extended, and on April 17, 2020, its duration was extended again. Finally, on 24.04.2020, the measure was mitigated by allowing persons over 65 to move on Mondays, Wednesdays and Fridays from 09:00 to 13:00, and persons under 18 to move on Tuesdays, on Thursdays and Saturdays from 14:00 to 20:00. This order exempts persons who have the constitutional right and obligation to perform certain duties in the legislative and / or executive branch (representatives in the legislative bodies in Bosnia and Herzegovina, members of the Presidency of Bosnia and Herzegovina, the Council of Ministers of Bosnia and Herzegovina, the Government of the Federation of BiH). are active and professionally engaged in judicial and other bodies (judges, prosecutors, notaries), as well as persons who are active and professionally engaged in entities whose work is not prohibited by the orders of the Crisis Staff, on 29.04.2020, an amendment to the earlier order was issued which allows persons over the age of 65 and under the age of 18 to move in the vehicle on a daily basis.

Date 21.03.2020. An order was issued to ban the movement of citizens from 18:00 to 05:00 (the so-called curfew); the measure was mitigated by the order of 29.03.2020, so that the movement ban begins to apply from 20:00 to 05 hours, to 24.04.2020. this measure was abolished. However, by order of 29 April 2020, the curfew measure was reintroduced from 22:00 to 05:00; This order exempts persons who have the constitutional right and obligation to perform certain duties in the legislative and / or executive branch (representatives in the legislative bodies in Bosnia and Herzegovina, members of the Presidency of Bosnia and Herzegovina, the Council of Ministers of Bosnia and Herzegovina, the entity government). working and professionally engaged in judicial and other bodies (judges, prosecutors, notaries), as well as persons who are active and professionally engaged in entities whose work is not prohibited by the orders of the crisis headquarters.

Date 22.03.2020. An order was issued on the prohibition of movement and detention in the open space of more than one person at a distance of 1.5 meters, as well as that only one person can be transported in a taxi vehicle; and on 29.04.2020. An order was issued banning the gathering of more than five people in one place.

On 29.05.2020. The Government of the Federation of BiH passed the Decision on declaring the cessation of the state of the accident, which led to the relaxation of all measures on the territory of the Federation of BiH.

The introduction of these, but also all other measures, has led to a drastic change in everyday life, especially since in some countries a state of emergency

has been introduced which restricts and / or abolishes some of the basic human rights. Thus, the everyday life of citizens meant respecting certain regulations in the field of medical law, then decisions, orders and recommendations of the competent state authorities. It is these regulations, decisions and orders that complete the essence of the criminal offense of Transmission of an Infectious Disease, giving it complete and true meaning. This created the possibility of determining the criminal responsibility of persons whose violation causes the spread of a contagious disease (i.e. the danger of the spread of a contagious disease).

The key question is whether there was a legal basis for the introduction of such strict measures, especially the ban on the movement of persons over 65 years of age. That is, whether the competent state authorities paid the necessary attention when assessing the proportionality of this measure and the protection of human health.

The issue of restrictions on freedom of movement is, in addition to domestic law, also addressed in the Convention on Human Rights. Thus, Article 2 of Protocol No. 4 to the European Convention for the Protection of Human Rights and Fundamental Freedoms stipulates that: "1. everyone lawfully within the territory of a State shall, within that territory, have the right to liberty of movement and freedom to choose his residence; 2. Everyone is free to leave any country, including his own; 3. no restrictions may be imposed on the exercise of these rights other than those which are in accordance with the law and which are necessary in a democratic society in the interests of national or public security, to preserve public order, to prevent crime, to protect health or morals. or to protect the rights and freedoms of others; 4. These rights may, in certain areas, be subject to limitations imposed by law and justified by the public interest in a democratic society."

This issue was addressed by the European Court of Human Rights and the constitutional courts in Bosnia and Herzegovina, Slovenia and Serbia, in order to determine whether the competent state authorities acted too strictly in banning and restricting movement, especially according to the category of persons over 65 years of age. In this regard, the Constitutional Court of Bosnia and Herzegovina, deciding on the appeal, issued a Decision "concluding that the appellant's right to freedom of movement guaranteed by the Constitution of Bosnia and Herzegovina and the European Convention for the Protection of Human Rights and Fundamental Freedoms was violated, because there is no proportionality, ie a fair balance between the measures imposed by the disputed order and the public interest in public health protection since the impossibility of imposing milder measures was not previously considered and explained, that the imposed measures are not strictly limited in time, nor is the obligation of the Federal Staff to review and extend these measures. it is necessary in a democratic society."

The Constitutional Court of Slovenia was of a similar opinion, pointing out in its decision that "such regulations are not necessary to achieve the purpose desired by the regulation. The same objectives could be achieved by setting a periodic review of the proportionality of the measures. An extension of measures should only be granted if, given the circumstances and the expert opinion, it is still considered necessary to achieve the objectives set. In this way, the possibility of disproportionate violations of human rights and fundamental freedoms would be reduced. The court ordered the government to assess at least every seven days whether the measures introduced are still necessary to achieve certain goals. Based on the expert opinion, it will decide whether the measures will be extended, modified or repealed and will inform the public about it."

Similar decisions were made in some other European countries, such as Germany, the Czech Republic, Spain, Romania, etc.

Finally, summarizing the previous consideration, one gets the impression that certain state bodies have shown different levels of (ir) responsibility within their competence. According to the reactions and perception of the public, as well as the writing of the media, one gets the impression that the highest levels of government are the weakest link in the fight against this pandemic; they showed the least empathy for the most vulnerable categories of the population - the elderly and children. They most often found justification in similar treatment in other countries, which also prescribed such restrictive and prohibitive measures. It is unjustified, and incomprehensible, that the highest state bodies of Bosnia and Herzegovina, its Presidency and Council of Ministers, did not pursue a consistent policy of fighting the COVID-19 pandemic, which resulted in various measures in the Republika Srpska and Federation BiH entities. Also, the state has not taken the necessary measures to procure vaccines for its population. This

(failure to act) of the highest state bodies has put, and still puts, the citizens of Bosnia and Herzegovina in a difficult position, which indicates a violation of basic human rights and freedoms. Given that this is a problem of global proportions, it would be logical that the responsible persons, in addition to the official, have the moral responsibility to do everything within their powers. Furthermore, irresponsibility has been manifested through various forms of abuse in the procurement of medical devices for the treatment of patients with COVID-19.

CONCLUSION

By analyzing the prescribed criminal offenses in criminal legislation, as well as adequate regulations of medical law, it can be concluded that this legal aspect of human health protection is fully realized. However, problems are evident in the implementation of these regulations. Under the implementation of regulations, the behavior of citizens should be observed, as well as the competent state bodies. Citizens do not have much choice, because they are in a situation to respect the prescribed prohibitions and restrictions in terms of protecting their health or, otherwise, to come under attack from criminal and misdemeanor sanctions. This is a matter of multiple responsibilities, of which in the first place should be the responsibility towards one's own health, then towards the health of other citizens and, finally, towards legal regulations. In that sense, it can be said that the citizens are in a very difficult situation.

However, it could be said that in Bosnia and Herzegovina, the irresponsibility of those who should be the most responsible is on the scene, and that is certain representatives of the highest authorities! On the one hand, they did not do what they should have done the most, and that is to take the necessary and adequate actions in order to combat and prevent the COVID-19 pandemic, and on the other hand, some did what they should not and should not have done. By their irresponsible behavior, they endangered people's health more than individual citizens did by their irresponsible behavior. Some ongoing court proceedings speak in favor of that, as well as frequent protests of citizens due to dissatisfaction with the work of the competent authorities. We also believe that health professionals work even beyond their objective capabilities, given the difficult working conditions, the lack of adequate medical resources, and the lack of a clear medical strategy. Finally, it could be said that the police and the judiciary, with their responsible actions and empathy, to a certain extent amortized the problems caused by the COVID-19 pandemic, because they did not resort to the most severe sanctions prescribed for violating certain prohibition measures and restrictions.

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SAŽETAK

Pandemija COVID-19 (SARS-CoV-2) prouzrokovala je mnogostruke posljedice na globalnom nivou, a sve se mogu istraživati i obrađivati multidisciplinarno, tj. sa zdravstvenog (medicinskog), pravnog, ekonomskog i sigurnosnog aspekta. U ovom radu autor se fokusirao na pravni, odnosno krivičnopravni aspekt ove pandemije. Nakon više od godinu dana, koliko traje pandemija COVID-19 u svijetu, na temelju mjera koje se poduzimaju u gotovo svim zemljama, može se zaključiti da su zdravstveni i pravni aspekti primarni i komplementarni. U prilog ovakve tvrdnje ide činjenica da zaštita zdravlja ljudi mora biti uređena adekvatnim zakonskim propisima, a to je, prije svih, Zakon o zaštiti stanovništva od zaraznih bolesti. Međutim, u ovakvoj, vanrednoj, situaciji bez krivičnopravne zaštite teško je ostvariti efikasnu zdravstvenu zaštitu stanovništva.

Stoga se u ovom članku analiziraju krivičnopravni i medicinskopravni aspekti krivičnih djela protiv zdravlja ljudi koja su slična ili gotovo identična u svim zemljama regiona, kao što su Bosna i Hercegovina, Hrvatska, Slovenija, Srbija, Sjeverna Makedonija i Kosovo.

Ključne riječi: zarazna bolest - pandemija – COVID-19 – zaštita zdravlja – krivično pravo – medicinsko pravo

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Review article

TECHNOLOGICAL, ECOLOGICAL AND ENERGY ASPECTS OF THE DEVELOPMENT OF BOSNIA AND HERZEGOVINA

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SUMMARY

Bosnia and Herzegovina has generally opted to join the European Union. Preliminary decisions have already been taken, but BiH needs to meet some of the standards/criteria contained in the 14 recommendations made by the European Commission before formal negotiations with the EU begin. One of the important assumptions of a successful path to the EU is that BiH accelerates economic development and modernizes the economic structure as a whole. In this regard, it is especially important that BiH advances technological development, improves its environmental policy and accelerates the energy transition. The text analysed the current development level of these areas and suggested some measures that should improve the current unsatisfactory situation in them.

Particular attention was paid to measures to increase innovation capacity, the need for more vigorous interventions in solving environmental problems and the energy transition as a precondition for entry into Industry 4.0, the introduction of the green economy and the acceptance of decarbonisation as long-term policies. It was stressed that these are the ultimate targets by 2050, in agreement with the long-term development orientation of the European Union.

Key words: technological development, research and development, green economy, decarbonization, efficiency

INTRODUCTION

The future of Bosnia and Herzegovina has been strategically determined by the decision to join the European integrations, primarily the European Union. It is true, although, that the realization of that decision has not been entirely certain, partly because of the internal obstruction, but more because of the fact that fundamental reforms of the political-organizational structures are needed, as well as the improvement of the functioning of the legal system, and significant improvement of the references of the currently nonfunctional state. The program of the reforms needed to start dialog with the EU has been formulated in 14 criteria/priorities, defined in the Avis of the European Commission, and adopted by the Presidency and the Council of Ministers of Bosnia and Herzegovina. Although the work on the realization of the program has started as a priority, so far there are no any visible progress. In addition to internal difficulties and misunderstandings regarding already adopted the 14-priority program, some new, big problems are being cumulated: still unpredictable consequences of the Covid-19 pandemic and emigration wave that has been sweeping over Bosnia and Herzegovina.

The structural improvement and efficiency enhancement are among the central subjects in the 14-priority program. There is no need to stress that Bosnia and Herzegovina has achieved, since the 1990-s, the weakest development performances among the transition countries. That is, partly, the consequence of the devastating war, but also, in a high degree, of the inadequate economic policy and actually nonfunctioning state. That is why is Bosnia and Herzegovina is currently confined to the very bottom in all the rankings within the transition circle of the European economies.

Having in mind the generally outlined development path for the future, here I will deal with some

key development aspects, which will significantly affect the fulfillment of the 14 priorities, and hence the future economic and social development of the country. These are, as the title of this text says, the technological development and overall innovation capacity of the country, ecology, and energy transition. There is no doubt that all the three mentioned frameworks belong to the very top of the developmental priorities in the future of every country, also the most developed ones. Simply, the modern world witnesses revolutionary changes in the fields of technology, energetics, biotechnology, medicine, and other fields.

Since the economy in Bosnia and Herzegovina legs significantly by the members of the European Union, and also by other transition countries, in all aspects of technological development, its priority goal is to achieve some breakthroughs in those sectors. This text will analyze the achieved level, potentials, and limitations regarding the development in the fields of technology, ecology, and energy transition, and then suggest certain measures that could dynamize the developmental processes in them.

It should be mentioned that the lack of statistical data made the work on this work fairly difficult. The internal statistics is not developed enough in analytical sense, and the external one is oriented more generally, insufficiently representing domestic specific characteristics. Still, I think that enough data and analytical materials has been gathered to enable a general outline of the current situation and the developmental possibilities in the above mentioned sectors.

SOME GENERAL CHARACTERISTICS OF THE ECONOMIC POSITION OF BOSNIA AND HERZEGOVINA

In order to understand the importance of the technological development, ecology, and energy transition in the economic, as well as in social development, the economic position of Bosnia and Herzegovina will be described in short, as compared to the developed transition countries, especially the countries formed after the breakdown of ex-Yugoslavia. The latter comparison is especially indicative since the states we compare B&H with came from the same economic and legal environment; they have partly inherited the advantages and flaws of the self-management system, but they achieved significantly more dynamic economic growth.

It is common knowledge that Bosnia and Herzegovina emerged from the war, in mid-nineties, severely devastated both in material and spiritual sense. By way of illustration, in 1993 Bosnia and Herzegovina achieved only 12-13 per-cent of the gross domestic product compared to the 1990 (WIIW Handbook of Statistics 2011, Central, East and Southeast Europe, Wien, 2011). The war did not destroy only the economy, but also the entire society. During the war, hundreds of thousands men, women and children were killed or wounded; over million people left the country – mostly younger generations; public infrastructure was destroyed; manufacturing, and transportation systems were devastated; education and schooling system was neglected, cultural institutions were devastated, as well as all other social segments.

After the peace was restored and the county established based on the Dayton Agreement, the gradual recovery has begun. At first, with the generous financial and material help from abroad- but that help later practically stopped flowing in. The total foreign help, in various forms, has been estimated at 5 billion USD. Still, Bosnia and Herzegovina significantly lagged behind during the whole period of postwar recovery and transition, trailing behind other countries formed after the breakdown of Yugoslavia. The table below illustrates that.

The above numerical illustrations point convincingly to the considerable lagging of the overall development in Bosnia and Herzegovina behind the comparable countries. The gap is especially evident in relation to Slovenia, whose GDP per capita today is over four times bigger than the average of Bosnia and Herzegovina. Even before the war, Slovenia was the most dynamic socialistic republic, but the developmental gap, compared to other republics, was not nearly so deep. Bosnia and Herzegovina lags also behind Croatia, although in a lesser degree than is the case with Slovenia. That is probably the consequence of the fact that Croatia, too, suffered significant wartime damages, and, also, its developmental policy during the last quarter of the century shows high oscillations.

In addition to the size and dynamics of the GDP, Table 1. also shows certain elements of economic structure, which are directly connected to the focus of this text. Namely, the indicators of the manufacturing industry share in the domestic product are really

		Bosnia and Herzegovina	Croatia	Slovenia	Serbia
1	GDP per capita in eur	4,900	12,600	22,100	6,100
2	GDP growth rate /average,10 years/ in %	1.7	0.7	1.5	1.5
3	Unemployment rate /%/	20.8	8.9	5.5	13.5
4	Average monthly gross salary/ wage, in eur	697	1,139	1,682	580
5	Share of the manufacturing industry in the BDP (%)	13.2	12.3	20.4	14.5
6	Share of investments in the GDP (%)	18.9	20.1	19.2	20.1
7	Share of education in the GDP (%)	4.1	4.1	4.6	3.4
8	Share of investments in education in the total investments, in %	1.8	1.2	2.8	1.2

Table 1.
Selected indicators of the level of development of Bosnia and Herzegovina in 2018.

symptomatic. They illustrate how the current economic structure in all the included countries, except Slovenia, has been considerably changed in relation to the pre-war condition.

The illustrated relation of the manufacturing (not the total industry) to the GDP aims at drawing attention to that industrial segment, because the future overall technological development of the manufacturing will strongly depend on it. Industry 4.0: circular economy, digital economy, energy transition, as well as the most of the traditional technologies, have been realized mostly through the development and progress of the manufacturing. The size of the manufacturing industry in the GDP shows how much Slovenia, with share of 20.1%, has pulled away from all the others. The other countries – Bosnia and Herzegovina with 13.2%, Croatia with 12.3%, Serbia with 14.5% - are far deep at the bottom on the list of other transition countries (WIIW: Handbook of Statistics 2019).

Next illustrative indicator of the growth potential and the dynamics of the economic structure transformation is the share of investments (fixed capital formation) in the gross national product. The relations here are somewhat more balanced, since all the analyzed countries maintain roughly the same investment dynamics. However, it should be noticed that Slovenia, with the biggest share, has built and modernized its industry, which is not the case with other countries.

Also interesting for Bosnia and Herzegovina are the figures on investments in education, where Slovenia stands out again according to that indicator. In 2018, Slovenia invested in education 2.8% of total investments, while in other countries these percentages are considerably lower: Bosnia and Herzegovina 1.8%, Croatia 1.2%, Serbia 1.2%.

Bosnia and Herzegovina's falling behind in all sectors could be, partly, explained by the war and its consequences. However, it has been 25 years since the war ended, Bosnia and Herzegovina received considerable international aid for material reconstruction and establishment of institutions, so there is a legitimate question: what other reasons affected such a big lagging behind?

Apart from the consequences of war, the post-war slow development of Bosnia and Herzegovina was

	Criteria	B&H	Croatia	Serbia	Slovenia
1	Global rank	92	63	72	35
2	Public sector performance	137	122	74	84
3	Institutions	114	77	75	33
4	Government responsiveness to change	139	136	75	97
5	Government long-term vision	138	137	80	97
6	ICT adoption	80	60	77	40
7	Skills o current work force	134	128	75	41

Table 2
Some indicators of the quality and efficiency of the public sector

under the influence of other processes, among them nonfunctioning state, lack of clear strategic basis for the economic growth, that is, low quality of managing practically in all developmental processes.

Certain indicators from the Global Competitiveness Report for 2019 point to the problem of the public functions management They are concentrated on the significance of the quality public sector management for the overall social and economic development of a country. In order to capture big picture regarding the significance of the public function management, it would be well advised to consult the exceptional book, recognized world-wide: D. Acemogly, J.A. Robinson, Why Nations Fail, Crown Business, New York, 2012. The authors describe excellently the example of Nogales, a city at the American-Mexican border, to show how political and legal system makes difference between success and failure in the economic development.

In order to analyze the position of Bosnia and Herzegovina, and to describe the influence of quality public management on economic growth, the following table was constructed. Table 2. shows the ranks the quality of individual management functions in Bosnia and Herzegovina, compared to Slovenia as the most developed transition country, not only among the countries formed after the breakdown of Yugoslavia, but in the whole transitional circle. The overall ranking within the framework of this report includes 141 countries, from all continents (World Economic Forum: Global Competitiveness Report 2019).

The above Table shows most vividly the falling behind of Bosnia and Herzegovina, caused by low efficiency of the government and not readiness of other public institutions All rankings in the above mentioned report on competitiveness put Bosnia and Herzegovina in the group of the countries at the bottom. Especially unfavorable are the indicators of the capacity of the managerial functions, i.e. the government, for foreseeing future developments and the adaptation of growth strategies to the changing circumstances. In this segment, the governmental bodies of Bosnia and Herzegovina have the lowest rating, at the bottom of the list. Only two countries are positioned lower than Bosnia and Herzegovina with regard to willingness to embrace changes, or efficiency of the public sector.

Such evaluations of the efficiency of the public services in Bosnia and Herzegovina are catastrophic, but do not come as a surprise to those who monitors the social and economic scene in the country. By the way, the constitutional system in Bosnia and Herzegovina is based on the Peace Agreement concluded in Dayton in 1995. The Dayton Agreement had, undoubtedly, contributed to the establishment of peace, but, as a constitutional and legal framework for the efficient functioning of the state, it is utterly unsuitable. Simply put, the hypertrophied political and legal infrastructure, based on 13 constitutions and the same number of legislative bodies, with 600 representatives, and hundreds of ministers, currently active in Bosnia and Herzegovina, cannot be neither

efficient nor productive. For this reason, the fundamental reform of the socio-political system of the country and its main institutions is one of the most important conditions for the normalization of the situation in the country and for the first steps towards execution of serious strategies for faster social and economic development.

TECHNOLOGICAL DEVELOPMENT – A VITAL PREREQUISITE FOR THE TRANSFORMATION OF THE ECONOMIC STRUCTURE

The world today experiences a stormy era of deep technological changes. The explosive development of new technologies is happening in all segments of human activity, and, as it seems, in economy most of all. The technological progress in the economic system has been based on new achievements in biotechnology, new materials, digitalization, energy transition, and many other changes.

Many estimates show that, based on new technologies, the global industrial structure and the models of its functioning will be significantly changed in the next ten years.

In the focus of this text are a short analysis of the present status of the Bosnian-Herzegovinian economy and an evaluation of the possibilities for its enhancement by the end of this decade.

As was already stated, Bosnia and Herzegovina significantly lags behind economically, compared to all the states that emerged from the former common state. That falling behind is especially pronounced in the industrial development, which is, in turn, as already said, the most important platform for technological advancement. The reasons for this lagging are well known; here are some of them:

- the devastating war, nontransparent privatization, and lack of reasonable development strategy destroyed the relatively developed (inherited) industrial basis. In the year before the last one, Elektroliza Mostar was closed, definitely the last modern industry in the field of non-ferrous metallurgy,
- for the same or similar reasons, the research and development institutes within economy practically disappeared, or were significantly reduced. Among others, the scientific and research institutes of Energoinvest were destroyed, and they were undoubtedly the most developed R&D group in the pre-war Bosnia and Herzegovina,
- biologically looking, by depopulation and lack of nonrenewal, a significant intellectual potential was lost in the research and development sector in economy
- investments in research and development coming from the state budget and the business sector were reduced to negligible levels.

All that was mentioned above has reduced the scientific and research basis, and hence the technological development in the economy of Bosnia and Herzegovina. Thus, the possibilities for the technological growth in the future are confined to a very modest framework. The extent to which the technological basis in Bosnia and Herzegovina today (not only in manufacturing) has been impoverished, almost neglected, is shown in next table (World Economic Forum: Global Competitiveness Report 2019).

The Table 3. enables the real estimation of the innovation capacity of Bosnia and Herzegovina. All the above BiH indicators are below those for Croatia, which, also, is not particularly active in the field of innovation. The comparison with Slovenia is almost inappropriate because the difference is too big. By way of illustration, the allocations from the GDP for financing scientific and research activities in Slovenia (2.0%) are ten times higher compared to Bosnia and Herzegovina (0.2%) with, at the same time, more than four times larger Slovenian GDP. It should be kept in mind that the stated percentage of allocations for R&D includes financing high education.

Although there seems to be no point in comparing allocations for R&D in Bosnia and Herzegovina with the leading European Union countries, because the differences are too big, some comparable data will still be mentioned. The average allocations for financing R&D in the European Union amounts to 2.03% of the GDP. According to this indicator, the European Union did not achieved the charted goal for the year 2020, namely, 3% of the BDP. The leading European countries, according to this criterion, are: Denmark with 3.8%, Finland, 3.1%, and Sweden, 3.16%. (European Commission: Key Figures 2018).

Regardless of that enormous gap, some substantial positive changes in the technological status of Bosnia and Herzegovina in the following years could not be realistically expected. A good start would be

	Criteria	B&H		Croatia		Slovenia	
		Score	Rank	Score	Rank	Score	Rank
1	Innovation capacity	28.4	117	37.8	73	58.2	28
2	R&D potential	20.2	106	35.7	49	56.8	27
3	R&D expenditure in GDP /%/	0.2	88	0.8	42	2.0	19
4	Patent application per million population	0,53	77	4.14	45	51.6	25
5	References of research institutions	1.1	88	3.3	64	5.6	54

Table 3
Indicators of the technological development level
Note: Score are position on O to 100 scale; 100 represents the optimal. Rank represents position on the ranking list between 141 countries.

for the state to adopt a realistic strategy for technological development and to start introducing changes according to the 14-priority Program. One should hope that the political and other responsible structures will, finally, commit themselves to the strategic turn in this sector.

HIGH ECOLOGICAL STANDARDS – A PREREQUISITE FOR SUSTAINABLE DEVELOPMENT

Future development will, certainly, depend on ecological challenges, and they are numerous in Bosnia and Herzegovina. Still, no serious development of economy, manufacturing industry in particular, could not be planned without recognizing the requirements of sustainability and green economy.

First, a few words about the current ecological situation in Bosnia and Herzegovina (See: Izvještaj Bosne i Hercegovine za UN Konferenciju o održivom razvoju, UN CSD, Sarajevo 2012). The real ecological situation in Bosnia and Herzegovina is not nearly satisfactory and comparable to the more developed transition countries. Partly because of the consequences of the war, but mostly because there is no any policy in the field of environmental conservation and protection, and because the sustainability requirements have not be respected, large areas and their natural potentials (land, water, air) are ecologically endangered. In this context, areas contaminated by land mines should be mentioned (about 1,092 square miles are still not cleared of mines), high levels of air contamination in Sarajevo and some other places, ecologically dangerous waste dumps (near mines or closed ferrous-metal factories and other metallurgical facilities), abandoned and not recovered large areas of former coal mining, and others. That is why Bosnia and Herzegovina has very low position on the international rankings measuring threats to the environment and sustainability. Among 188 countries in the list, Bosnia and Herzegovina is on the 93th place, while all the other surrounding countries have better positions: Croatia 42, North Macedonia 76, Serbia 77, Montenegro 92.

Instead of the deeper analysis of the actual ecological conditions, here are several guidelines important for the projection of the future growth. First of all, it is important to stress that the difficult ecological state, mentioned in short above, will have to be improved, and that will require large investments.

But, without it, it would be impossible to follow the chosen path towards the European Union., and to use more abundantly international resources to finance economic development. In other words, Bosnia and Herzegovina, in its developmental policy, will have to commit itself strategically to the postulates of the green economy and sustainability. That means that Bosnia and Herzegovina will have adopt European goals and criteria regarding decarbonization and green economy, determined by European Union as its strategic goals to be achieved by the year 2030 and 2050, respectively. Such a commitment will substantially influence the developmental policy of Bosnia and Herzegovina. Also, Bosnia and Herzegovina, in its developmental policy, will have to observe more actively the 17 sustainability goals, as determined by the United Nations in 2015 (The UN Agenda for sustainable development up to 2030, New York, 2015).

The above observations about ecological situations are meant to point to big challenges facing Bosnia and Herzegovina in order to solve the current state of ecology, but more so for making the concept of the strategy for the ecological development in the future. It should be kept in mind that Bosnia and Herzegovina, when it adopts ecological goals and policies, will have to adjust its strategies in the sector of energy, and maybe also some others. Namely, in the new European ecological framework, it would be difficult to maintain the orientation towards building the sources of energy based on fossil fuels, that is, burning coal and building thermo-electric power plants.

In addition, within the re-industrialization policy, it will be necessary to accept more determinedly the orientation towards the 4.0 industries, based on knowledge, digitalization, robotization, and industrial policies of the 21st century (Dani Rodik: Industrijska politika za 21. stoljeće – Globalizacija, institucije I gospodarski rast, HGK _ Privredni vjesnik, Zagreb). The most important for this orientation will be the intellectual capital, industrial knowledge, orientation toward foreign markets, etc. And something like that, again, requires high quality education, more investments in research, development, up-to-date technologies, modern equipment, and other things. In other words, everything said so far points to the imperative of serious turn in the developmental policy, attitude toward environment, and protection of the nature – forests, air, waters.

ENERGY TRANSITION - AN IMPORTANT ASPECT OF THE DEVELOPMENTAL POLICY

Generally speaking, energy transition is a process where the conventional power sector, based on fossil fuels, is being transformed into a new system based on renewable energy sources. The transition of the energy industry includes also a whole complex of new strategies and policies which make the power sector more efficient, as well as a number of measures meant to enable more rational consumption, lower distribution cost, and modernization of the storage system and management using digital networks. Now, that is really a revolutionary endeavor in an important segment of the industrial structure in every country. Hence, the energy transition is a key component of the Industry 4.0 and represents an entry into the new industrial era. The main goals of the power industry transition are, also, very far- reaching. They, in the first place, enable the **sustainability of energy system** – by using renewable energy sources: water, sun, wind, biomass; enhanced **efficiency** - by the use of renewable energy sources, rationalization of consumption, and by the modernization of management models. And, finally, the advanced technologies in distribution, storage, and consumption provide **safe** supply of electric power.

The transition of the energy industry is not only a technical and technological process, but also includes serious economic and social components. It changes the economic structure of a country, but also the organizational model of the economic and social life.

Bosnia and Herzegovina, having accepted the strategic commitment to take the European path, namely, to join the European Union, also accepted the energy transition as its strategic goal. It remains to be seen whether Bosnia and Herzegovina is fully prepared for this orientation.

Regarding the prerequisites for energy transition, first a few words about some basic indicators for the power sector. Although the facilities for the energy production in Bosnia and Herzegovina are relatively old, still the share of the renewable energy sources (RES) is comparatively high, at 40.8%; that is more than in Croatia with 33.1%, Slovenia 20.9%, and Serbia 21.2% (Global Competitiveness Report 2019). The high share of the RES in the structure of power sources in Bosnia and Herzegovina is the result of still functional significant hydropower capacities, built

before 1990 on the rivers Neretva, Rama, Drina, Vrbas, Trebišnjica. Since the 1990s, only two small hydropower stations were built: Mostarsko blato (2010) and Peć Mlini (2004). In addition, 113 mini power stations were built, which produced some 2.2% of the total electrical energy production in 2020. Among the renewable sources, solar power stations and wind farms should be also mentioned, all build after the war, but their production amounts to only less than two percent of the total energy production. Despite the significant opposition in the local communities, several hundreds of new mini power plants have been planned.

The main segment of the power sector in Bosnia and Herzegovina, however, are still thermo-power facilities, and all of them, except TE Stanari (capacity 300MW, put in production in 2016), were built and started producing energy before the 1990s. Obviously, the basic segment of the energy system are the objects that are using and burning coal as the fuel.

Although, according to the installed capacity, Bosnia and Herzegovina has over 40% of renewable power sources, the structure of the production gives somewhat different picture. Thus, in 2019, 71.9% of the total electric energy production came from the thermo-power capacities, 26.3% from hydro-power facilities, and 1.8% from wind farms and solar power plants.

The above data show that the energy sector structure in Bosnia and Herzegovina is mainly based on classical sources. That is why the country is faced with big challenges when it comes to the transition of power sources and power consumption.

As was already mentioned above, Bosnia and Herzegovina has chosen, generally, the European path, meaning that it will follow the European energy policy. And that "European" path in this field is the complete decarbonization of the European Union by the year 2050, and very specific goals which should be achieved by 2030.

Bosnia and Herzegovina, too, outlined some specific goals which should reduce the current concentrations of carbon dioxide near and around the classic energy sources and production; building several new hydro-power plants has been planned, as well as more solar plants and wind farms, also many mini hydro-power plants (despite the resistance in local communities). Still, the country plans to continue building thermo-power plants, for example, Tuzla 7, and others. It seems that the Federation of BiH is determined to build Tuzla 7, with 450 MW capacity, based on the Chinese technology and with Chinese investors, despite unfavorable reactions from the European Union. In addition to this project, longer-term plans include building more thermo-power plants, or enlarge the capacity of the existing ones. It seems that this pushing ahead with the building of classical energy sources is directly opposed to the commitment of the European Union.

These confusing signals from the long-term energy orientation of Bosnia and Herzegovina raise the question, what is the real energy policy of the country? It seems, unfortunately, that, as in other fields, there is no consent among the relevant factors not even about the choice of strategic goals and policies in the energy sector. Despite the fact that the development strategy in this sector should be clear and achievable, because it has been based on the European orientation (and resources), in this field, too, there exists a considerable confusion, and, thus, uncertainty. So, when energy strategy is concerned, disharmony is evident, as in other fields, among authorities and interests of state bodies and political groupings, revealing, again, the non-functioning of the state and public administration.

In this context, some other limitations facing the clear energy strategy should be mentioned, such as the inherited structure of the sector and mindset formed around it and which, by its nature, has difficulties with adopting new orientation and modernization (See: Mirza Kušljagić, Energetska tranzicija u Bosni I Hercegovini, Impresum, Tuzla 2019).

Undoubtedly, Bosnia and Herzegovina will have to follow the energy policy of the European Union if it wants to join it. And not only for that reason, but also because of general inclusion into the up-to-date energy processes, which enable sustainable, efficient, and secure production and consumption of electric energy. In this framework, the decarbonization by the year 2050 should, undoubtedly, be the ultimate goal, with interim goals that should be achieved by 2030.

It should be stressed once again that, taking into account the long-term strategy for energy sector, formulating strategic development goals is more urgent, but also more complex. It is more complex and difficult to shape a clear strategy in the politically complex state, with very wide administrative structure and intertwined authorities, but also the interests. More so, because the list of limitations facing a successful energy strategy is not exhausted by that.

Since not only the development and transition of the energy sector are in question, but also the development of manufacturing industry, financing, profitability, emission of greenhouse gases, development of human resource basis, and many other elements, Bosnia and Herzegovina should, despite all the difficulties, strongly confirm its orientation toward decarbonization with all of its components. In other words, it should shape, and accept by consensus, the state strategy for decarbonization for the period up to the year 2050. It has enough potential for such a strategy, which is the imperative of the time.

INSTEAD OF CONCLUSION

First of all, Bosnia and Herzegovina, undoubtedly, has been lagging considerably, according to all measures of economic successfulness, behind all comparable countries. Hence, it is in a very low starting position for launching serious developmental operations within the Industry 4.0, implementation of new technologies, decarbonization, and power sector transition. That is why it has to, unquestionably, undertake serious efforts to dynamize economic and overall social development, in order to fulfill the conditions for joining the European Union, as it is determined to do.

Especial efforts are needed in the segments of technological development, re-industrialization, implementation and obeying modern ecological standards, and energy sector transition.

Within the launching and affirmation of the strategic developmental turnaround, the exceptional responsibility is on the state in the wider sense. It should provide the political willingness, important so much for all strategy changes, and, in addition, the state is an exponent of the appropriate developmental strategies, it provides legal and regulative framework, and participates in providing funding.

Furthermore, the manufacturing sector has very significant role in developmental strategies; but today, in Bosnia and Herzegovina, this sector is considerably deteriorated, as is also the case with the energy segment. Still, this sector has been creating, advancing, and executing ideas for developing technologies from the program of the IV industrial revolution – the Industry 4.0, and so important energy sector transition.

The academic community must be an integral part of all the programs for the development and modernization of the economic and social structure. In order to achieve this, it is necessary to enlarge investments in the R&D, to qualify the research and development institutions, to raise the educational level, especial in the field of natural sciences, and motivate the renowned experts of the Bosnian and Herzegovinian origin to return to the country.

Despite a very low starting point, all of the mentioned programs can be started, if there is the political will, consensus of the interested institutions, the adequate level of knowledge and competences, as well as the strategic plan. Hence, within everything that was mentioned above, the significance of the planning and strategic thinking in general should not be neglected.

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SAŽETAK

Bosna i Hercegovina se načelno opredijelila za priključivanje Europskoj uniji. Preliminarne odluke su već donesene, ali BiH treba, prije početka formalnih pregovora s EU-om, ispuniti neke standarde/kriterije koji su sadržani u 14 preporuka što ih je dala Europska komisija. Jedna od bitnih pretpostavki uspješnog puta prema EU-u jest da BiH ubrza privredni razvoj i modernizira ekonomsku strukturu u cjelini. U tom pogledu, posebno je važno da BiH unaprijedi tehnološki razvoj, poboljša svoju ekološku politiku i ubrza energetsku tranziciju. U tekstu je analiziran sadašnji razvojni nivo spomenutih područja i sugerirane su neke mjere koje bi trebale poboljšati sadašnje nezadovoljavajuće stanje u njima. Posebna pozornost posvećena je mjerama za povećanje inovacijskog kapaciteta, potrebi energičnijih zahvata u rješavanju ekoloških problema i energetskoj tranziciji kao preduvjetu za ulazak u Industriju 4.0, uvođenje zelene ekonomije I prihvaćanje dekarbonizacije kao dugoročnih politika. Naglašeno je da su to ultimativni ciljevi do 2050. godine, u suglasnosti s dugoročnom razvojnom orijentacijom Europske unije.

Key words: technological development, research and development, green economy, decarbonization, efficiency

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Review article

SCIENCE METRICS SYSTEMS AND ACADEMIC PROMOTION: BOSNIAN REALITY

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ABSTRACT

Societal importance and the quality of scientific research highly depend on the usefulness of the results of research for the societal and scientific community. The wish to allocate the funds to high-quality research and to establish right criteria for scientific evaluation and academic career progression, make scientific criteria increasingly important to measure the quality of research and knowledge valorization. However, it is very difficult to apply the right criteria which can objectively assess scientific research. For many years, there has been a great interest in scientific ranking and evaluation of scientific journals, but also of scientific contribution of scientists. It is generally accepted that the IF (WoS) and the total number of citations of articles published in the journal, are the most relevant parameters of the journal's significance. However, the significance of a scientist and the value of their scientific production are much more complicated to evaluate and they cannot be directly reflected by the importance of the journals in which their articles are published. In this article, the authors describe and evaluate the most known scientific databases which are used in science. The majority of existing science metric systems, which evaluate the achievement of scientists are focused solely on the number of citations of their articles. For example, H-index, which is calculated as the lowest ranked article which number of citations matches its ranking number, has considerable shortcoming because it does not take into account the individual contribution of each author and allows expanding author lists with authors whose contribution may be insignificant or none. Therefore, the authors propose Z-score, as a new science metric system, which takes into account the author's contribution to the scientific article and greatly remedy major discrepancies in evaluating scientific production of individual authors and institutions.

Keywords: science metrics systems, impact factor, Z-score, number of citations, author contribution, academic promotion

INTRODUCTION

There are few processes and events in the history of mankind that have transformed society more than science and contributed to the common good. The knowledge gained through scientific research has saved billions of people from poverty, encouraged industrialization and mass communications of unprecedented proportions, eradicated many diseases and enabled man to leave his mark on the moon. Science is a large industry that produces new knowledge, usually to solve certain issues facing humanity, using its tools and resources - scientists, money and time - to create its products: scientific knowledge, which is presented through publications in the scientific literature. Societal importance and the quality of scientific research highly depends on the usefulness of the results of research for the societal and scientific community. The scarcity of scientific research funds and the wish to allocate the funds to high-quality research, make criteria, which measure and assess the quality of research and knowledge valorization, increasingly important. (Bowen A & Casadevall A 2015; Bornmann et al. 2016).

The publication of scientific research in scientific journals ~~are~~ is a cornerstone of knowledge dissemination, as well as an essential criterion for academic and scientific evaluation, recruiting funds and career progression. Therefore, there has been a great interest in scientific ranking and evaluation of scientific journals, but also of scientific contribution of scientists. However, it is very difficult to apply the right scientific criteria which can objectively assess scientific research. It is generally accepted that the IF (WoS) and the total number of citations of articles published in the journal, are the most relevant parameters of the journal's significance. However, the scientific significance of a scientist is much more complicated to evaluate and the value of their scientific production cannot be directly reflected by the importance of the journals in which their articles are published. The majority of existing science metric systems, which evaluate the achievement of scientists are focused solely on the number of citations of their articles (Dixon 2009, Lippi&Mattiuzzi 2017, Zerem 2017, Zerem 2018).

It is true that, beside evaluation of scientific publications, there is a wide range of other scientific activities that also reflect scientific credibility of a scientist as (Zerem 2017):

- number and quality of extramural grants,
- leadership in national or international academic societies,
- service on editorial boards of respected journals,
- service on government sponsored national peer review committees,
- the number of PhD students delivered,
- the amount of coverage of one's scientific output in the lay press, etc.

Although those activities are important and give certain significance to the scientific credibility of a scientist, the relevant science metrics systems only cover publications, and omit other criteria of scientific relevance, which are typically used in judging promotions and tenure of scientists. The reason for this is the fact that these activities, regardless of their importance, are very heterogeneous since each of them has specific characteristics and requires different parameters for evaluation. Hence, for these parameters of scientific relevance there are no universal evaluation criteria and their value is mainly assessed individually depending on the purpose of the assessment (Thwaites 2014, Zerem 2017)

THE RANKING OF SCIENTISTS AND SCIENTIFIC JOURNALS

For many years, there has been a great interest in scientific ranking and evaluation of scientific journals, but also of scientific contribution of scientists. Also, scientists and other professionals rely on information in scientific and professional journals to keep up to date on advances in various areas of science and to find answers to specific questions related to their research, education and routine practical activities. For most of them, literature search tools, particularly searchable online databases, are the major mode of accessing scientific information. Therefore, easy access to scientific information in the literature is very important (Tisdale 2004). The most known scientific databases are:

- Current Contents (CC)
- Web of Science (WoS)
- Journal Citation Reports (JCR)
- Index Medicus, Medline, PubMed
- Excerpta Medica (EMBASE)
- Scopus,
- Scholar,
- H-index

Most of those scientific bases (except for Scopus, Scholar, H-index and WoS which rank scientists) present and rank scientific journals only.

Current Contents (CC)

Current Contents is a service database from Clarivate Analytics (formerly the Institute for Scientific Information and Thomson Reuters). It is the most appreciated database that is usually available through the Web of Science. The reasons for its popularity are the relatively high journal selection criteria, its coverage of all areas of science, the update frequency, the author's summary, the author's address, the names and addresses of the publisher, and its ability to review the content of a particular issue of the journal. Current Contents is published in seven following sections (each containing more than 1000 sources):

- Current Contents / Agriculture, Biology & Environmental Sciences
- Current Contents / Arts & Humanities
- Current Contents / Clinical Medicine
- Current Contents / Engineering, Computing & Technology
- Current Contents / Life Sciences
- Current Contents / Physical, Chemical & Earth Sciences
- Current Contents / Social & Behavioral Sciences

Through the above noted seven sections Current Contents covers all areas of science. Most biomedical journals are included in the Current Contents/Clinical Medicine section, but some biomedical journals are classified under the sections of Current Contents/ Life Sciences and Current Contents/Social & Behavioral Sciences (Thwaites 2014, Zerem 2017).

Web of Science (WoS)

The Web of Science is a platform for Clarivate Analytics, which provides access to quoted databases covering all areas of science. The platform contains more than 33,000 indexed journals and nearly one billion records of quoted references, and includes articles, conference proceedings, reports, patents, and more (Wikipedia). A citation index is built on the fact that citations in science serve as linkages between similar research items, and lead to matching or related scientific literature, such as journal articles, conference proceedings, abstracts, etc. In addition, literature which shows the greatest impact in a particular field, or more than one discipline, can be easily located through a citation index. For example, a paper's influence can be determined by linking to all the papers that have cited it. In this way, current trends, patterns, and emerging fields of research can be assessed. The following databases are available through the Web of Science interface (Garfeld 1955, Stonehill 1965, Thwaites 2014):

- Science Citation Index Expanded
- Social Sciences Citation Index
- Arts & Humanities Citation Index
- Emerging Sources Citation Index
- Book Citation Index - Science
- Book Citation Index - Social Sciences & Humanities
- Conference Proceedings Citation Index- Science
- Current Chemical Reactions
- ESCI Backfiles
- Index Chemicus

Journal Citation Reports (JCR)

On the basis of the data obtained from the citation databases (Science Citation Index and Social Science Citation Index) Eugene Garfeld created a special statistical database and named it Journal Citation Reports (JCR). At the end of June each year, Clarivate Analytics publishes the JCR list for the previous year. Impact factor (IF) is a quantitative aid for ranking, evaluating, categorizing and comparison of the journals. IF is calculated as a quotient when dividing the number of citations received during the year that refer to articles from the previous two years. It is generally accepted that IF and the total number of citations of all articles published in the journal represent a relevant measure of their value and scientific influence. For some domains, it is much more relevant to have an IF for a 5-year period rather than for a standard 2-year period (Garfeld 1955, Abbott et al. 2010).

Index Medicus, Medline, PubMed

Index Medicus is the print version of the bibliographic citation database of the National Library of Medicine, and MEDLINE is its online counterpart. PubMed is an online database that provides access to citations in MEDLINE as well as those from additional life sci-

ences journals. MEDLINE and PubMed are among the most popular and widely used literature databases for professionals. Early in the history of Index Medicus, quality was determined by manually sifting through publications and choosing what subjectively seemed good, but later the Editor of Index Medicus convened a committee of world experts to identify the world's best medical journals and then have citations for articles from those journals made accessible. Inclusion into the Index Medicus is not automatic and depends on a journal's scientific policy and scientific quality (Roda et al. 1987). Nearly 4500 journals are indexed in MEDLINE, and even more are indexed in PubMed (Tisdale 2004).

Excerpta Medica (EMBASE)

Embase is a highly versatile, multipurpose and up-to-date biomedical research database. Produced by Elsevier, it covers the most important international biomedical literature containing over 32 million records from over 8,500 currently published journals from 1947 to the present. Embase's international coverage expands across biomedical journals from 95 countries and is available through a number of database vendors (Abbott et al. 2010).

Scopus

Scopus is Elsevier's quotation database that indexes sources from all over the world launched in 2004. Scopus covers nearly 36,377 titles (22,794 active titles and 13,583 inactive titles) from approximately 11,678 publishers, of which 34,346 are peer-reviewed journals from almost all fields of science: life sciences, social sciences, physical sciences and health sciences. It covers three types of sources: book series, journals, and trade journals (Wikipedia). All journals covered in the Scopus database are reviewed for sufficiently high quality each year according to four types of numerical quality measure for each title; those are h-Index, CiteScore, SJR (SCImago Journal Rank) and SNIP (Source Normalized Impact per Paper). Searches in Scopus also incorporate searches of patent databases (Kulkarni et al. 2009).

H-index

Almost all relevant scintimetric indexes which evaluate the achievement of scientists are focused on the number of citations of their articles. The best-known scintimetric system which assesses the individual scientific contribution of scientists is the so-called H-index which is calculated as the lowest ranked article which number of citations matches its ranking number (for example, a scientist whose H-index is 10 must have at least 10 articles which have 10 or more citations) (Hirsch 2005). However, H-index has considerable shortcomings because the system is based solely on the evaluation of the number of individual article citations. Therefore, H-index obviously favors older articles which are available for quotation for a longer time, and negatively impacts on assessment of scientific value of new articles and scientific production of prospective scientists. Besides, H-index does not take into account the individual contribution of each author in an evaluated article, since according to H-index all authors of an article are treated as equal. Hence, H-index does not tackle the ever-present problem of expanding author lists with authors whose contribution may be minute or none (Zerem 2017, Zerem 2018).

Other scientific database

There are several other databases such as: Google Scholar, PageRank index, Altmetrics, g-index, e-index, i-index, EndNote, Essential Science Indicators, Publons, ScholarOne, total publications; total number of citations etc. (Abbott et al. 2010, Gao et al. 2016, Sugimoto&Larivière 2017).

DOES ZEREM-SCORE BRING IMPROVEMENTS?

The existence of such a large number of science metric systems shows that there is no perfect scientific metric index that accurately measures the scientific contribution of scientists and scientific journals. It is generally accepted that the IF (WoS) and the total number of citations of articles published in the journal, are the most relevant parameters of the journal's significance. The scientific significance of a scientist is much more complicated to evaluate than that of a scientific journal, since the scientific production value cannot be directly reflected by the importance of the journal in which the article is published (Zerem 2017). The evaluation of the significance of a scientist and the value of his scientific production is complicated for several reasons: some authors have published more articles; there are different types of

articles which are published in journals indexed in different scientific bases; it is known that the number of citations of a particular article, as the relevant measure of the value of that article, has its limitations since it requires excessive time lag and gives advantage to older articles of similar quality; the contribution of all the authors in a scientific article is usually not the same. Therefore, it is very difficult to apply the right measures and scientific criteria which can objectively assess a new scientific research and provide precise qualitative and quantitative data on which new articles could be evaluated. These problems cannot be solved by the H-index scientometrics system, because this system is based solely on estimating the number of individual citations of an article. In addition, the H-index does not take into account the individual contribution of each author in the rated article, because according to the H-index, all authors of the article are treated as equal. Therefore, H-index cannot solve the ever-present problem of expanding author lists with authors whose contribution may be minute or none (Zerem 2017, Zerem 2018).

The new criteria (named Z-score) have been published in the Journal of Biomedical Informatics as criteria which can objectively estimate the scientific effect of scientists and institutions (Zerem 2017, Zerem 2018, Zerem&Kunosić 2018). According to the Z-score criteria the overall scientific score of an author is calculated as the sum of two scores (author contribution score-AcoS and author citation contribution score-ACCS). ACoS is calculated as the scientific value of the journal in which an article is published and the authors' specific contribution in this article. ACCS is calculated as the scientific values of the particular article expressed through the number of quotations that this article has received and the authors' specific contribution in the article. In order to successfully apply and calculate Z-score, we have created the adequate computer software-Z-score calculator, which encompasses all the parameters described in the proposed criteria. Also, Z-score calculator is designed to be compatible with all browsers and it is capable of automatic collection of data once linked to a browser (Zerem 2017, Zerem&Kunosić 2018).

WHAT IS THE RIGHT CRITERIA FOR ACADEMIC PROMOTION

Whether scientists like it or not, the societal impact of their research is an increasingly important factor in their academic and scientific evaluation, recruiting public funds for scientific research and career progression (Zerem 2017). This has always been the case, but current trends in scientific and academic community increasingly emphasize the need to improve criteria and establish measures that can objectively assess the societal impact of research and would provide better qualitative and quantitative data which will enable the societal and scientific community to objectively assess the value of scientists and scientific research. This is especially important in developing countries where a complex interrelation between politics and the academic community significantly impacts on the process of acquisition of scientific and academic titles (Zerem 2013, Zerem 2014, Zerem 2017).

It is not disputed that, academic excellence either in teaching or practice activity as well as his scientific production, should be the most important criterion for appointment to an academic position and for subsequent promotion. However, it is very difficult to apply right measures and scientific criteria which can objectively assess scientific research, providing precise qualitative and quantitative data on which funding agencies could base their decisions. The existence of a large number of science metric systems shows that there is no perfect scientific metric index that can accurately measure the scientific contribution of scientists and scientific journals. It is true that the current science metric systems have multiple shortcomings and are not ideal for an objective assessment of scientific research and the scientists' significance. However, without the introduction and application of internationally recognized scientific criteria in the evaluation of scientific research, and the coordination of academic progress in accordance with these criteria, there is room left for the decision makers within the academic community to lower the criteria margin to the level which they subjectively consider relevant, without complying with the internationally recognized criteria. Therefore, the application of internationally recognized scientific criteria in the evaluation of scientific research is necessary and these criteria should be constantly improved. We consider Z-score criteria sustainable and capable of objective estimation of the scientific effect of scientists and institutions. We hope this article contributes to the discussion about science metric systems, raising questions and motivating the expression of different viewpoints with the intention to improve

science metric systems and make them more objective and competent in the complex process of evaluating scientific production of an individual scientist and scientific institution.

IMPACT OF INTERNATIONALLY RECOGNIZED CRITERIA ON THE ACADEMIC COMUNITY IN BOSNIA AND HERZEGOVINA

Bosnia and Herzegovina is a country in transition where the interrelation between politics and academic community is impacting badly on the latter. Forcing the issue of university autonomy in the way it is being done in our case does not exclude the influence of politics. In fact, this creates space for those decision makers within the academic community to lower the criteria margin to the level they consider appropriate without having to adhere to any internationally recognized criteria.

Our academic community keeps pointing at the lack of investment in science and accentuates this as the main cause of its own poor status. However, the root causes of the persisting problem are almost never traced back to the lack of internationally recognized criteria in the acquisition of academic and educational titles. The growing number of MAs, PhDs and academic titles does not reflect the reality of us being on the scientific periphery. Absurdly, we are a country with an enormous number of scientists in comparison with the miserable and almost nonexistent scientific production.

There doesn't seem to be a critical amount of responsibility among decision-makers in academia and politics to deal with the mediocrity that reigns everywhere! This seems, there is no critical amount of responsibility among those who are making the decisions in academic comunity and politics with mediocrity that prevailing everywhere! The statements claiming that even international criteria are not perfect are just lame excuses retaining the status quo. We first need to get closer to clearly seeing the target board. Only then can we start to discuss the „bow and arrow" design (Zerem 2013, Zerem 2014).

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Enver Zerem: idea, design, writing article, approval of the final version; **Suad Kunosić**: suggested critical intellectual content, literature searches, approval of the final version; **Bilal Imširović**: made critical revisions related to important intellectual content and the approval of the final version; **Admir Kurtčehajić:** literature searches and the approval of the final version.
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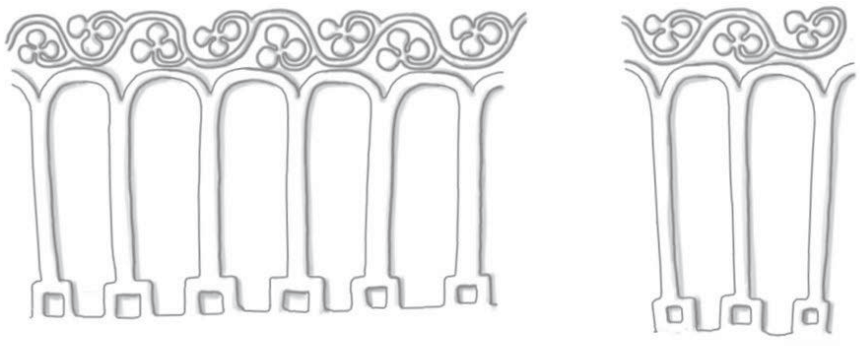
SAŽETAK

Naučni sistemi vrjednovanja znanja i akademsko napredovanje

Društveni značaj i kvalitet naučnog istraživanja u velikoj mjeri ovise o korisnosti rezultata istraživanja za društvenu i naučnu zajednicu. Nedostatak sredstava i želja da se sredstva dodijele visokokvalitetnim istraživanjima čine sve značajnijim procjenu kvaliteta istraživanja i valorizaciju znanja. Međutim, vrlo je teško primijeniti kriterije koji mogu objektivno procijeniti naučna istraživanja. Proizvod naučnog istraživanja su informacije objavljene u naučnim časopisima. One su temelj širenja znanja i osnovni kriterij za akademsku i naučnu evaluaciju, regrutovanje sredstava za naučna istraživanja i napredovanje u karijeri. Pored evaluacije naučnih publikacija, postoji širok spektar drugih aktivnosti koji odražavaju naučni kredibilitet znanstvenika, kao što su: broj i kvalitet grantova za naučnoistraživačke projekte, liderstvo u nacionalnim ili međunarodnim akademskim društvima, članstvo u redakcijama uglednih časopisa, mentorstva u doktorskim disertacijama i slično.

Mada su te aktivnosti važne i daju kredibilitet znanstveniku, relevantni scientimetrijski sistemi pokrivaju samo publikacije, izostavljajući druge kriterije od naučne važnosti, u ocjenjivanju prilikom akademskog napredovanja znanstvenika, kao i konkursima za dobijanje grantova za finansijsku potporu naučnim istraživanjima. Razlog tome je činjenica da su ove aktivnosti, bez obzira na važnost, vrlo heterogene, sa specifičnim karakteristikama i zahtijevaju veoma raznolike parametre za ocjenu. Stoga, za ove aktivnosti ne postoje univerzalni kriterijumi vrjednovanja i njihov se kvalitet, uglavnom, procjenjuje individualno, ovisno o namjeni procjene.

Ključne riječi: međunarodno priznati kriteriji, naučnoistraživački rad, edukacija, akademsko napredovanje



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Review article

MUSIC, RELIGION AND HEALTH; A SCIENTIFIC PERSPECTIVE ON THE ORIGIN OF OUR RELATIONSHIP TO MUSIC

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SUMMARY

Why do we react emotionally to music? Does music appreciation have an adaptive value? What is the role of music in spiritual and healing practices? Music is a fascinating area of research for evolutionary theory, psychological development, and emotional perception and elicitation. It is a highly valued feature of all known living cultures and societies, pervading many aspects of daily and devotional life and playing many roles. The question that still lingers among music researchers however is why is this so. This paper will discuss the influence of music on our emotional life, psychological wellbeing, spiritual practices and finally on physiological processes present in our body. The aim is to examine the origin of our relationship to music through the mentioned perspectives and to attempt to link the various theoretical perspectives on this subject across two major domains; health and spirituality.

Keywords: music, religious ritual, trance, brain plasticity, music therapy

INTRODUCTION

Musicians and music lovers have always been curious about the true nature and function of music. What is its purpose and why do we listen to it? Does music need to relate to extra-musical material to be meaningful or does it simply exist for its own sake? This debate became a central theme of argument between musicologists and composers in the early 19th century Europe, and continued well into the 20th century with Wagner's idea of Gesamtkunstwerk where words and music are indissoluble and Hanslick's opposing view of 'pure' music (Robinson 1997).

In the past 20 years certain musicologists have raised suspicion that the current widely accepted method of music analysis that concentrates exclusively on formal features of the pieces can fully explain the meaning and nature of music. A variety of different interpretations of musical meaning emerged. Some theories hold that music conceives its meaning only in social and historical context (Adorno 1976, Born et al. 2000, McClary 1991, Kramer 1995): These theories tend to see music as a social construct which meaning we can explain only by analysing the processes that relate to the contexts within which music is produced and received (Cross 2008). Alternatively, other musicologists see music's aesthetic meaning in the elicitation and expression of emotions: Cross argues that questions such as whether the affective states that music elicits arise through empathic processes (Davies 2001), arise directly in response to objective properties of musical structures, or both, still need to be thoroughly investigated. However, emotional dimensions of specifically musical meaning have been explored from both sociological and psychological perspectives: DeNora (2000) and Sloboda

(2001) suggest that music can be meaningful in being employed by listeners to do 'emotional work' in regulating their emotions and moods in everyday life and Juslin (2013) and Zentner (2008) point out that music can be expressive of not only basic emotions but additional layers of more complex emotions and affects.

MUSIC AND EMOTIONS; THE ORIGIN

But why do we react emotionally to music? Does music appreciation have an adaptive value? Music is a highly valued feature of all known living cultures and societies, pervading many aspects of daily and devotional life and playing many roles. Researchers (Parncutt & Chuckrow 2019, Teie 2016) have looked for the origin of musicality in human gestation period, namely the prenatal development (Parncutt 2009). The complex web of associations among patterns of sound, movement and emotion that characterise music they argue, may ultimately be of prenatal origin. The fetus may acquire information about these relationships by passive exposure: The internal patterns of sound and movement to which the fetus is repeatedly exposed (the mother's voice, breath, heart-beat, digestion, and body movements) depend in consistent ways on her physical and emotional state (Mastropieri & Turkewitz, 1999). Patterns of sound and movement that largely depend on the mother's emotional state can also be associated with hormonal changes by classical conditioning. Since the behavioural correlates of a change in maternal emotion (sound and movement patterns) are perceived before the physiological correlates (hormonal changes), the behavioural correlates may predict the physiological correlates. After many repetitions of such patterns in a given context, the fetus may begin to respond emotionally to changes in sound and movement patterns that occur in a similar context - that is, to anticipate the corresponding hormonal changes (Parncutt & Chuckrow, 2018). Music-like sequences may be created postnatally when the patterns of sound and movement produced in motherese resemble patterns of sound and movement that had been heard before birth.

According to this theory, protomusical aspects of motherese, play and ritual may have emerged during a multigenerational process of conditioning on the basis of prenatally established associations among sound, movement and emotion. The infant's multimodal cognitive representation of its mother (mother schema) begins to develop before birth and may underlie music's personal qualities, religion's supernatural agents, and the link between the two, Parncutt (2009) suggests. His prenatal theory contributes to an explanation of musical universal such as associations between music and body movement, commonalities of musical and religious behaviour and experiences such as meaning, fulfilment, and altered states of consciousness when listening to music. The emotions typically associated with music and religion are according to this theory evolutionary 'side effects' of prenatal auditory and kinaesthetic development. The adaptive value of these prenatal developments lies in the promotion of postnatal infant-mother bonding, motor development, and language acquisition. Even emotions associated with music and religion may ultimately be a by-product of those adaptations.

MUSIC, ALTERED STATES OF CONSCIOUSNESS AND RELIGIOUS RITUAL

The connection between music, spirituality and religious experience has long been established. This long lasting bond is mainly achieved through a state of trance which occurs through the means of music, dance and other ritual practices. In fact, traditional forms of music therapy consider trance as an important aspect of the healing process: Helen Bonny, an American violinist and a music therapist, explored the connection between music and altered states of consciousness and developed a type of therapy called Guided Imagery and Music (GIM). In her novel approach she combined music programmes (empirically developed from the Baltimore research project of psychotherapy based on hallucinogens) with the technique Guided Affective Imagery to achieve therapeutic goals with clients. In GIM clients listen to a series of classical music pieces in a state of deep relaxation and as a result, develop spontaneous imagery that is presumably related to the music's temporal structure (Bonny 1995). The types of imagery emerging vary from person to person and can include descriptions of various settings (from natural environments to human made structures), descriptions of different characters that appear (real or imagined), developments of various physical and mental situa-

tions in which the protagonist of the story (always the client) engages, and a wide array of emotional states that the clients experience in reaction to the elicited imagery. Clients report imagery such as the following:

'*I'm on a meadow. I'm wearing a white dress. It's sunny and there are flowers. There are people around me... Playing different instruments. They are smiling. I can see a shining light nearby. Small animals are around me. A rabbit, a deer.*' (one client)

If the music is chosen carefully and correctly, it is able to access the feelings associated with the imagery events, allowing a reliving of the original experiences (Bonny 2000). The images the clients experience are somewhat like dream images, but unlike dreams, are not lost once the client comes to the normal state of consciousness. This allows the client to have very direct insights into their otherwise unconscious emotions and behavioural patterns. During the listening experience, the images are immediately told to the therapist thus bringing the experience into the 'here and now' in order to relieve the experience in the present time. Images can also involve other four senses: olfactory (smell), gustatory (taste), auditory (hearing), and kinesthetic (touch). The imagery is interpreted on the basis of Freud's concept of the mental apparatus, individual maps of experience, or Fischer's cartography, as well as Jung's theory of archetypes (Aldridge et al. 2006). Bonny's technique is thus in the nature of trophotropic trance (Bonde 1999) in which the music is used for both healing and spiritual purposes. Her intentions of GIM therapy were twofold (Muller 2010): On the one hand she insisted that GIM is a type of music psychotherapy that offers the clients an opportunity to work on their therapeutic aims. This is primarily true for the individual therapy sessions where it is possible to have a longer discussion concerning the client's aims and therapeutic goals and in which the latter can be directly addressed in therapeutic and musical guidance during the listening. On the other hand, Bonny has often referred to group GIM sessions as non-therapeutic, but educational, spiritual and designed for personal growth (Bruscia 2002).

Besides healing effects, musical trance was often used in religious rituals as a means of achieving spiritual connection with various divine beings. In fact, music is a universal feature of religious rituals around the world. All these rituals share basic structural components of formality, pattern, sequence and repetition (Alcorta et al. 2005). Described by Bloch (1989) as 'distinguishing marks of ritual', these elements include music, chanting, and dance and constitute recurrent and important components of religious ritual across cultures. Even in the most ritually constrained religions, music remains a key consistent feature (Atran 2002). Not only is music an important component of religious ritual across traditional cultures, it is inseparable from it (Becker 2001). The use of music in religious rituals is closely connected to the states of trance that often accompany the rituals. Trance is, according to Rouget (1985), always associated with greater or lesser degree of sensory overstimulation (noises, music, smells, agitation) whereas a somewhat similar state of ecstasy is on the contrary, most often tied to sensorial deprivation (Fachner 2011). Trance thus has a more direct relationship to the body and its function, and may thus be, as Parncutt argues, one of the emotional 'side effects' of prenatal auditory and kinaesthetic development. Every trance occurs in a ritual context and gains its power through the particular music used during the different phases of the ceremony. The function of the music is to provide the atmosphere, to evoke identification processes in groups and to induce a trance. Rouget (1985) differentiates emotional, communal and shamanic trance, noting that emotional trance has the most direct connection to music as it draws its power out of a high degree of correspondence between words and music. Such a powerful relationship in perfect harmony overwhelms the listener (Rouget 1985). Most common features during ceremonies where emotional trance is induced include: continuous accelerations, mostly in tempo and volume, focused use of accelerando and monotony during ecstasy, long duration (over hours), simple musical forms with minimal variations and many repetitions, ostinato or bordun, no exact motives but step by step progressions, a play around tones often with slow glissandi and a narrow tonal range. Complex parts and crossing voices may occur but only occasionally, and they do not allow a unifying resolution. A constant low timbre and pulsating structures, as well as sharp high-pitched modulations (acoustic 'roughness') seem to be appropriate to support trance induction. Acoustic triggers of trance are mostly certain transitory processes as well as slow, constantly increasing and decreasing amplitude curves (Aldridge et al. 2006). If we take a closer look at the musical features described above, we can see some similarities between them and the intra-

uterine auditory environment to which the foetus is exposed during prenatal development.

Features of music that are based on sounds that are present in the uterus include heartbeat, respiration, mother's voice and footfalls. They can be compared to musical structural elements (Parncutt & Chuckrow 2019). Heartbeat pulse is compared to musical pulse, the amplitude contour of pulse to the amplitude contour of a musical sound, combined heartbeat and footfalls may represent the origin of musical meter, spoken syllables of the maternal voice can be compared with musical notes, and the prosody of maternal speech can be compared with melodic phrasing. Finally, the frequency range of an adult female voice can be related to the typical frequency range of melodic instruments (Parncutt & Chuckrow 2019, Teie 2016). Prenatally audible sound stimuli are not always constant; stress causes physical, psychological, and behavioural variation, changing the usual heart rate, breathing, digestion and voice patterns (Kim et al. 2018). When presented with a stressful stimulus, subjects usually show a faster heart rate, quickened breathing, more active digestion and shaky or uneven voice (Van Puyvelde et al. 2018). These changes in physical parameters change the sounds the fetus perceives in the uterus, and he or she presumably perceives and reacts to those changes. It is thus logical to presume that similar musical sounds made during the ritual religious practices may induce profound and intense emotions in the adult individual.

Besides being able to induce a trance and altered states of consciousness, music has also been reported to elicit pronounced physiological and behavioural reactions including out-of-body experiences, a feeling of intimate physical contact with music and loss of awareness of self, body, time or space. The prenatal mother-schema concept described above has the potential to explain these intense experiences and to account for some of the most salient universal features of music: its robust personal qualities, its strong link to dance and movement, and its connection with religion (Parncutt & Kessler, 2006).

MUSIC AND HEALTH

As we have seen, music has the ability to induce strong emotional experiences and trance like states, but alongside this, has important neurophysiological effects that include its ability to synchronize body rhythms to external stimulus, change the hormonal levels, reduce stress and impact the immune system.

Music's impact as a 'rhythmic driver' on the autonomic functions is interesting. It synchronizes 'internal biophysiological oscillators to external auditory rhythms' (Scherer & Zentner 2001) which can help in stress reduction as well as promote empathy. The coupling of respiration and other body rhythms to the outside rhythmic drivers affects a wide array of physiological processes; brain wave patterns, pulse rate, and diastolic blood pressure (Gellhorn & Kiely 1972, Lex 1979, Mandel 1980). This effect has been shown to be present in humans at a very early age (Scherer & Zentner 2001). Music acts as a type of rhythmic driver and amplifies and intensifies the coupling through the use of instruments, thereby providing a means of synchronizing individual body rhythms within a group of people. This effect is also used in music therapy sessions as means of communication and understanding between a particular individual and the group. Additionally, research by Levenson (2003) has shown that synchronized autonomic functions, including such things as pulse rate, heart contractility, and skin conductance are positively and significantly associated with measures of empathy, which further extends the positive effects of music on not only physiological well-being but also on psychological health.

Music has thus demonstrated effects on measures of stress and immunocompetence. A significant negative correlation between exposure to relaxing music and salivary cortisol levels was found in experiments conducted by Khalfa et al. (2003) which shows that music has indeed a direct impact on the body's biochemistry, therefore regulating both physical and psychological parameters. Music does not only relax, but also contributes to the feelings of well-being, autonomy and sense of purpose mainly regulated by the release of two neurotransmitters; dopamine and oxytocin (Dukić 2018). These neurotransmitters are capable of influencing the emotions linked to prosocial behaviours (Thompson 2007) arousal (Schultz 2015) and feelings of happiness and well-being (Fessler 2001), all of which are important factors in enhancing the psychological resilience.

Other research demonstrates significant positive correlation between music and immunocompetence as measured by salivary immunoglobinA (SIgA), with active musical participation correlating most highly with immune competence and no music expo-

sure correlating the least (Hirokawa & Ohira 2003). These associations between music and measures of stress and health are mediated by music's ability to alter autonomic functions and evoke emotions. Most striking changes however can be seen in certain areas of brain in both children and adults who practice music (actively or passively) on a regular basis, demonstrating the fact that music actively changes the mind of an individual.

THE MUSICAL MIND

Many studies have shown that music training in particular has an effect on brain development. Research has shown structural and functional differences in the brains of adult instrumental musicians compared to those of non-musicians, with intensity and duration of instrumental training and practice being important predictors of the differences (Schlaug et al. 2005). Schlaug also studied the effect of music training on the developing brains of children (aged 5 to 11) and found that in 5 to 7 year olds (14 months after the beginning of training), cognitive and brain effects from instrumental music training can already be found, mainly in domains of fine motor and melodic discrimination. In 9 to 11 year olds with an average of four years of musical training, the observed effects become more pronounced, as well as the new transfer effects begin to emerge, namely those in closely related motor and auditory domains. Thus, their research has demonstrated that music training in children results in long-term enhancement of visual-spatial, verbal, and mathematical performance, although the underlying neural bases of such enhancements is still unknown, as are the contributions of factors such as the intensity and duration of instrumental training, extracurricular activities, attention, motivation, or instructional methods.

Most recent studies in neuroplasticity show that adult brains can also be shaped by music. Researchers (Pinel et al. 2004, Piazza et al. 2007) have come to a conclusion that music making can enhance the function and structure of many brain areas in adults, proving that training-induced plasticity is not restricted to the developing brains of children. Studies demonstrate that music making leads to structural and functional changes in the vicinity of the intraparietal sulcus (IPS) which is the region for neural representation of all types of numerical representation and operations and also involved in the meaning of symbols and the mental manipulation of symbolic representation. Thus, music making can lead to not only changes in primary and secondary motor and auditory regions of the brain but also in multi-modal integration regions in the frontal and parietal regions (Wan & Schlaug 2010).

Even more relevant is the effect of music listening on the brain plasticity in adults.

Daily music listening, research shows, can improve auditory and verbal memory, attention, and mood as well as induce structural grey matter changes in the early post-stroke stage (Särkämo ët al. 2012). Further research on stroke patients done by Särkämo ¨ et al. (2014) confirmed these results: Voxel-based morphometry (VBM) analysis was performed on the 6-month post-stroke stage structural magnetic resonance imaging data of the patients who either listened to their favourite music (MG- music group), verbal material (ABG- audio book group) or did not receive any listening material (CG- control group) during the 6-month recovery period. All groups showed significant grey matter volume increases. However, there was a specific network of frontal areas and limbic areas in patients with left hemisphere damage in which the grey matter increases were larger in the MG than in the ABG and in the CG. The study thus showed that music listening after stroke enhances behavioural recovery and induces neuroanatomical changes in the brain.

Finally, Stegemoller (2014) has pointed out three principles of neuroplasticity that explain why music therapy in particular is effective in promoting changes in patients' behaviour. First, music affects the release of neurotransmitters such as dopamine and serotonin which are responsible for the reward system in the brain and for the induction of feelings of happiness. Since the stimulation of dopaminergic neurons has been shown to result in cortical remapping (Bao et al. 2001) it is well accepted that dopamine plays a vital role in neuroplasticity. The second principle is based on the Hebbian theory; 'neurons that fire together, wire together'. This means that neurons that fire together within less than tens of milliseconds, will make a new connection or strengthen an existing one. Musical rhythm is a feature in music that can be entrained or synchronised to a diverse palate of non-musical behaviours inducing synchrony in the neural networks underlying the behaviours. In other words, by pairing music with movement, vocalization, breathing, and heart rate, therapists might be

able to elicit simultaneous firing of neurons in areas that control the described behaviours. Third, continuous listening to noise can negatively affect brain plasticity; it increases stress, which consequently impairs both cognition and memory (Amemiya et al. 2010). Long term exposure to music however, leads to improvements in learning, due to changes in the hippocampus in animal models (Kim et al. 2006). This is probably due to the fact that the acoustic signal of song is more consonant than that of speech (Stegelmoller 2008). Music therapists, as professional musicians, are thus in advantage because of their ability to optimize the level of noise in the vocal and instrumental sounds. In the end, we can see that the significant differences observed in the brains of individuals who practice music and those who do not point to the fact that there can indeed be a term called 'a musical mind' to describe the joint effects of music on psychological, physical and biochemical changes in an individual.

CONCLUSION

In this paper we saw that the capacity of music to entrain autonomic states and evoke emotions in listeners provides the basis for creating and synchronizing motivational states in ritual participants and also presents the basis on which most music and health practices operate. Consequently, it is plausible to assume that such a profound connection with music can only stem from our earliest developmental stages; the prenatal life of the foetus and its physical and emotional connection to the mother (Parncutt 2009). In other words, we appreciate music because the understanding of its elements (simple rhythms and pitch changes) was important for our survival and adaptations in the intrauterine environment and in the early postnatal stages of development. The happy 'by product' of these adaptations are our emotional and physical reactions to music that can be profound, meaningful and beneficial in many areas of human activity, including spiritual and healing practices.

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Helena Dukić: concept and design of the article, writing manuscript, literature searches, approval of the final version.
Miro Jakovljević: idea, concept and design of the article, approval of the final version.
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SAŽETAK

Zašto reagiramo emocionalno na glazbu? Da li glazba ima adaptivnu vrijednost? Koja je njezina uloga u religijskim i iscjeljujućim obredima? Glazba je izuzetno zanimljivo područje istraživanja za teoriju evolucije, psihologiju te percepciju i elicitaciju emocija. Vrijedan je dio svakodnevnih duhovnih i svjetovnih rituala u gotovo svim kulturama svijeta. Usprkos njenoj rasprostranjenosti, pitanje koje se još uvijek nameće jest zašto je tako. Ovaj članak će diskutirati utjecaj glazbe na naš emocionalni život, psihološku dobrobit, duhovne obrede i konačno na fiziološke procese u našem organizmu. Cilj je istražiti podrijetlo našeg odnosa s glazbom i pokušati povezati različite perspektive i teorije o ovoj temi kroz dvije velike domene; duhovnost i zdravlje.

Ključne riječi: glazba, religija, rituali, trans, plastičnost mozga, terapija glazbom

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Review article

THE QUEST FOR THE SACRED IN THE PAINTINGS OF SAFET ZEC

Prof dr Aida ABADZIC HODZIC

What kind of art could we introduce today into sacral spaces to radiate a universal message and to be, at the same time, a witness of our time? Has the search for the sacred disappeared from the horizons of contemporary art?

Jose Ortega y Gasset wrote in the 1930s that man has lost his essential characteristic, "the ability to gather into oneself." However, we should not forget the fact that a large number of masters of modern art have dedicated significant parts of their work to the themes of *ars sacra*. Paintings of Safet Zec have been embraced by sacred spaces for the last twenty years. In 2005 and 2006, he exhibited his works in Scuola Grande di San Giovanni Evangelista, in one of the oldest and most significant sacral spaces in Venice, following in the footsteps of Carpaccio and Bellini. Or, more recently, in 2014 Safet Zec was chosen, among other competitors, to paint the great composition *The Deposition from the Cross* (oil on canvas, 172x289) for the Chapel of the Passion in Church of the Gesù in Rome.

From the very beginning, Safet Zec has adhered to the firm belief that a painting makes sense only when it addresses another man and when it addresses the central issues of human existence. Safet Zec inextricably believes in the power of painting to sublimate the drama of human existence and to offer a kind of transformed reality. That is why Safet Zec's painting resonates so powerfully in the spaces of the sacred and when portraying the themes of human suffering, temptation, the struggle between good and evil. Although much has been written about the meaning of motifs in his painting (the importance of childhood rooms, facades of old Bosnian houses, harems of mosques, still lifes), Safet Zec is, in fact, one of the few artists for whom the whole visual world can represent a challenge, a topic. In *Letters to a Young Poet*, the poet Reiner Maria Rilke advises his young colleague, who turned to him for advice on the nature of artistic creation, in the following words:

"If your everyday life seems poor, don't blame it; blame yourself; admit to yourself that you are not enough of a poet to call forth its riches; because for the creator there is no poverty and no poor, indifferent place." (Rilke, 1903:14)

When Safet Zec made his appearance on the art scene in the early seventies of the last century, mostly with fairytale landscapes of Bosnia, he won the

immediate attention of art critics, who recognized his exceptional painting skill. The motifs of *Sister's House* (1974), *Mother's Room* (1976), *Landscape with a Road* (1976) were filled with the lived experience of a culture and spirituality that was inscribed in the then synchronous and multilayered weaving of European postmodernity. To this day, Safet Zec has remained surrounded by things that make up his rich, inner world, whether in his Sarajevo, Počitelj, or Venetian studios. The motifs from the studios seem to have just been transferred to the paintings: wooden baskets with dried flowers, old photographs of Sarajevo, citrus fruits from the picturesque, Herzegovinian "stone city of green beard" (Z. Džumhur), freshly-baked hard crusty bread, wooden chairs, cans with brushes... However, his numerous early studies of *Hands* and *Embraces* from the 1960s, done in various techniques, already anticipated his later topics and interest in the ways how people express their feelings and quest for the sacred through certain gestures that speak the archetypal language of hope and faith.

Hands are the most difficult task for painters. They often hide more emotions and human experience than faces. The entire history of art could be written through the way great artists painted character and feelings through human hands, following the eloquence of hands as they rest or are in motion, as they prepare for movement, and as they change it. Hands outstretched in hope towards another man, hands in prayer, hands exhausted by suffering, hands of love and support have appeared in all his cycles during the last twenty years, from a series of graphics *Christ Heals the Sick - Hommage to Rembrandt* to the great cycle of Srebrenica, *Deposition from the Cross* (Chiesa del Gesù, Rome, 2014), *Il Pane della Misericordia (Bread of Mercy,* 2016/17), *Exodus* and *Embrace* (Chiesa della Pietà, Venice, 2017/2019). In palms, slightly bent at the prayer of the *Fatiha*, Safet Zec captures the light of divine grace. In the etchings *Hands for Prayer* (2005/6), in fine tonal variations, achieved by his exceptional graphic skill, Safet Zec writes a century-long search for God's grace, forgiveness, and compassion on the inner reliefs of human palms.

BEAUTIFUL AND MENACING

In moments of the greatest doubts about the meaning and significance of arts, at the time of the aggression against Bosnia and Herzegovina, Safet Zec returned to Rembrandt's graphic Christ Heals the Sick seeking for the universal message of human suffering and hope. While working on his most expressive cycle dedicated to the tragedy of Srebrenica, Zec played with light and shade in the manner of Rembrandt, to render his subjects at once beautiful and menacing (Spence:2005).

These are the elective affinities (*Die Wahlverwandtschaften*) that Goethe already wrote about and that allow great artists from different eras to be contemporaries. It is a certain vocabulary of forms that Aby Warburg called "forms of pathos" - certain forms of expression of emotional states that live from antiquity to our time and achieve the power of persuasion through imaginative arousal of pain and empathy - from the pain of the Trojan priest Laocoon and his sons over crucifixes from medieval altars and Rembrandt's *Pietàs* to Goya's execution of the rebels. In it, through the memory and repetition of certain gestures (intertwining hands, embraces, burials, silent crying), emerges a universally understood language of human suffering and compassion. On one level, these works, whose backgrounds are abstract blurs of colour and strokework, symbolise archetypal human suffering. They obviously echo the suffering Christs of the old maestros.

Bread is often featured in his still lifes: bread as a universal symbol of life and sacrifice:

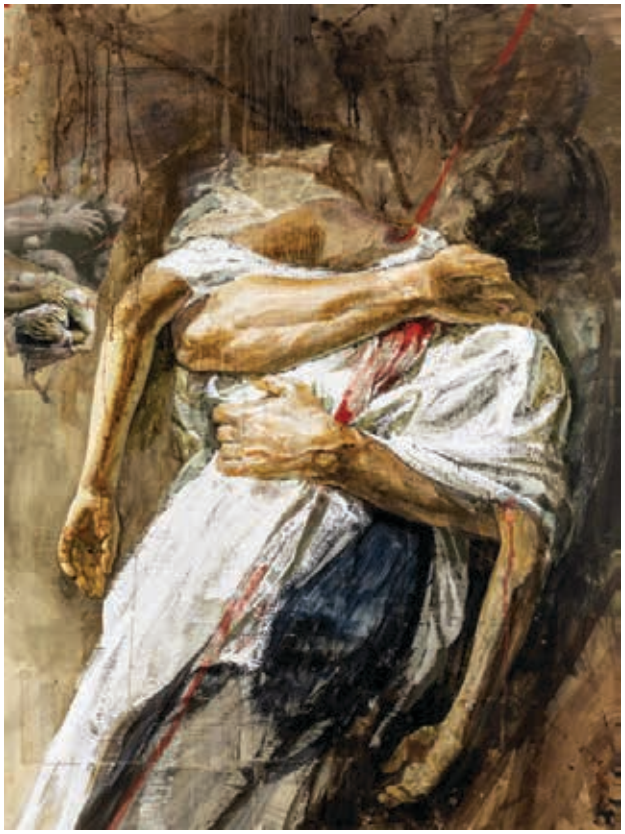
"I am the living bread that came down out of heaven; if anyone eats of this bread, he will live forever; and the bread also which I will give for the life of the world is My flesh."

(John 6:51)

In many paintings in *Il Pane della Misericordia* cycle, Zec simply lays down freshly baked bread on the whiteness of a clean kitchen cloth. In a broken piece of homemade bread, Safet Zec embedded smells and memories of his childhood, but also a contrite and pious prayer, filled with reverence.

With these new themes, a new approach has emerged in his oeuvre since the late 1990s. The compositions seem increasingly open, unfinished and, in a sense, "imperfect". His figures, meanwhile, have become more anxious, more tortured, more poignant. Arms reach upward as if grasping for something out of reach. Strong, urgent, loving arms embrace another person — one whose arms are limp, the body slipping to the ground. Instead of a somewhat idyllic-playful world of memories and a warm game of green and earthy tones of early works, the paintings from the last cycles featuring chairs from the studio, folded sheets, unfolded bed, bowl with brushes, fresh meat, embraces, hands etc. display a new expressiveness and a narrowed color scheme. The new approach is dominated by the disturbance of "whiteness", its cooling with the use of blue-gray tones, a certain "soiling" of the perfect background, a destruction of balance, and an emphasized fragmentation of the whole. The paintings seem to want to step out of the dedicated space of museum security and completeness. As the early cubist painters, Zec is fascinated by collage and often builds up his canvases out of old newspaper strips. Not only does the textured effect make the chiaroscuro more potent, but newspaper clippings frequently break through the finished work, annulling the aura of completeness of "museum painting". The very surfaces on which Zec paints and draws have also become ever more complex. He loves varying paper textures; he emphasizes the fragility of old paper, old books, newspaper, their smell, and their color. He never works straight on clean white paper or canvas, placing instead a layer of other paper and collages of newspaper, to establish a base of color. His meticulous preparatory procedures have something in common with pious preparations for a prayer.

On a large format of paper background, with irregular edges and no frame, the facades of old houses transition into portraits of mothers and exiles. Each composition is fragmented into dozens of "micro-events", which create a possible, independent whole from each segment of the composition – lead-



ing almost to sensory saturation. The transparency of the newspaper covering the edge of the plate, the reflection of the pot in the hollow of the spoon, the cracked crust of freshly baked bread, the embossed folds of the rug laid over the chair give Safet Zec's compositions an extremely plastic strength, testifying to his rich painting experience.

The multitude of preparatory studies of this artist are almost a rarity in contemporary production. All this is reminiscent of the great masters of modern art, such as Matisse, for whom nature was a mystery and painting an "inner trembling", prayer, and meditation. Doubt and restlessness, which accompany great art, become in the graphics and paintings of Safet Zec a part of our experience - the experience of the observer.

In the works of Safet Zec, extremes meet in a unique way, as in life: ugly and beautiful, dirty and clean, permanent and transient (*Dirty Windows*, 1992; *Chair*, 1996/7; *Meat*, 2003), while questioning the conflicting feelings, through the theme of human face, this greatest mystery, as the greatest masters of modernity (*Portrait of a Mother*, 1972; *Srebrenica Cycle*, 1995-2020). In his oeuvre, there is a great mnemonic ability, a great painting culture in which the memory of famous predecessors resonates: from a series of graphics - *Hommage to Rembrandt (Christ Heals the Sick)* to the great cycle of Srebrenica.

While working for the last twenty years on cycles that carry the painful experience of war suffering, an experience that evokes the closeness of faith and the sacred, Zec described an encounter with the face of a Bosnian mother and sought to elevate it to a universally understood language of suffering and pain:

I admire, and constantly before my eyes, the character of this older woman and mother. A small photo I found in some newspaper. A woman of ancient beauty, a beautiful old woman in a perfectly calm expression, whose eyes are full of tears. Silent, petrified expression and uncontrollable tears. Like all our mothers. This "beautiful suffering", so to speak, I tried to realize in this great format, hoping to achieve the universal "calmness" of deep inner suffering. (S. Zec, 2009)

HOW TO EXPRESS WHAT IS UNSPEAKABLE?

Safet Zec's search for the meaning of the sacred was also an obsessive, individual search for the answer to the following questions: How to paint the face of a cosmic tragedy as the genocide in Srebrenica was? How to paint the face of Srebrenica in July 1995? How to paint more than eight thousand lost souls? How to artistically express what is unspeakable?

Safet Zec's paintings, created in reverence for the Srebrenica tragedy, are gathered in four major cycles - *Faces, Bread of Mercy, Exodus, Embraces* - on which he has worked for the last twenty years, demonstrating his great knowledge and achieving the strongest expressiveness of expression so far. In the great cycle of *Faces*, Zec started from the realization that only humans have faces, and that every face carries an expression. The great faces of the pain and suffering of Safet Zec invite us to meet the experience of the individuality of each human suffering. It is an encounter that seeks closeness and immediacy - it is an encounter in which the act of looking becomes an act of complete devotion and asceticism. In the face of the other in pain and suffering, in the feeling of the other as a sense of his own existence, Zec transcends the intellectual superficiality of our time in which the belief that "*art is the expression of the person in whom I am, the artist is significant*" (Karl Popper) prevailed.

In the face of these paintings, we are called to step into the loneliness that Hannah Arendt wrote about in her reflections on evil, in which an encounter with oneself takes place; an encounter in which the individual ceases to be a man of mass whose emotions can be synchronized; an encounter in which morality concerns the individual in its singularity (Arendt, 1964:138-9) and when, after experiencing a cosmic evil such as the Srebrenica genocide, the answer to the question of what to do ultimately depends on what I decide about myself. Only in the encounter with oneself, in that infinity of loneliness, is the absolute beginning born, the moral life begins, the decision is made. In questions about these borderline situations, art itself is confronted with a decision about the meaning and possibilities of its action.

The clasped hands of a mother who covers the mouth with her headscarf, suppressing a painful cry; intertwined, tired hands carrying the crippled bodies of the wounded; hands supporting a painfully bowed head, dumb in the face of evil; hands begging and crying for help; hands lying helplessly beside the lifeless body build reliefs of human suffering on the large paintings of Safet Zec. His large canvases dissolve his artistic and ethical credo providing a *"response to the sarcasm of contemporary art, which has completely forgotten its duties, but also its powers."* (Jean Clair: 1997).

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Mile Stojić

STROFE ZA JOBA

Zašto si mi gospode dao mogućnost da pišem
Da zapisujem i pamtim ono što zaboraviti treba
Živjeti u skučenome i malom a težiti prema višem
Ispod ovog okrutnog sunca, ovog sivoga neba.

Zašto si mi gospode dao iluziju da se nadam
Da stolujem u plaveti i kraljujem u oblacima
Kad znao si da ću pasti i da još uvijek padam
U ove kratere oštre u kojima caruje zima.

Zašto si mi gospodine dao slabost da plačem
Da svaki prag prekoračim i odem bez osvrtanja
A sve što sam gradio i tkao prepustio si jačem
Čija je pohlepa veća a blagorodnost manja.

Zašto si mi gospode dao sposobnost da volim
I da se moja ljubav godinama ko nijagara pjeni
Zar bolje mi ne bi bilo u nebeskoj karanteni
U čijoj bjelini traju prezreni i nevoljeni.

Pred čijim si me vratima pustio dok očaj romori
Sa tijelom koje ne leti i dušom koja ko dim praminja
Što me nisi ostavio na suroj hercegovačkoj gori
Koja je i o ilindanu prekrita pokrovom inja.

VOLIM POPLJUVANE

Volim one lude, što su prvi vrisnuli
ne racunajuci što ce dobiti, što izgubiti
One što su vazda bili u manjini. Što su
stajali po strani na koncertu i na stadionu
Kad je svjetina tražila vješala i krv.

Volim one blesave što nisu cekali kraj
da bi uzeli rijec. Za njih je
lomaca spremna, neprestano tinja
Uvijek ih ceka omašten konopac,
podmazana giljotina, skovan križ.
U ovom se casu zida tisucu zatvora
za nekoliko njih.

Volim budale što su prešutjele glas
opreznih, što su prve stavile glavu u torbu

STROPHES FOR JOB

Why did you give me Lord the option to write
To take notes and remember what ought to be forgotten
Live in the small and cramped and long for the higher
Under this harsh sun, this gray sky.
Why did you give me Lord the illusion to hope
To hold court in the blue sky and reign in the clouds
When you knew I'd fall and am still falling
Into these crag-filled craters full of winter.

Why did you give me Lord the weakness to weep
To cross every threshold and go without looking back
And everything I wove and built surrender to the stronger
Whose greed is stronger and nobility feebler.

Why did you give me Lord the ability to love
And for my love to froth for years like Niagara
Wouldn't I have fared better in heaven's quarantine
In whose whiteness those who are scorned and unloved thrive.

Before whose door did you leave me to despair
With a body that cannot fly and a soul that like smoke drifts
Why didn't you leave on the cruel Herzegovian mountain
That even on St. Elias's Day is covered with hoarfrost.

Translated by Charles Simic

I LOVE THE ONES THEY SPIT ON

I love the mad, the ones who scream first
without calculating what they'll gain, what they'll lose
Those who always in the minority, who stood
to the side at concerts and sports stadiums
when the crowd asked for gallows and blood.

I love nitwits who don' to wait till the end
to ask for their turn to speak. For them
the stake is ready, the fire is always slowly burning.
The greasy rope forever awaits them,
the lubricated guillotine, the put-together cross.
Right at this moment a thousand prisons
are being built for them few.

I love fools those who ignored the voice

(i još uvijek ih tamo drže)
jer im oci nisu mogle mirno gledati zlo.
Volim bene što su proklele izvodace radova
kad je podizan zid, kad je rušen most.

Volim popljuvane, ismijane,
One što se nisu obazirale na formu
Što su ustali protiv rimske vlasti
nacionalnog raja, one što su ih se
odrekla braca, što su ih napustile žene
zatajili ucenici, osudili svecenici.

Oni su nam osvjetljavali put.

MOLITVA

Isuse moj
zaštiti nas od onih koji te štite
obrani nas od onih koji te brane
koji te brane od mladića koji u očaju hule tvoje ime
mladića sličnih tebi
zaštiti nas od onih koji te štite
jer njihove riječi zvone zveketom zlatnika
dok licitiraju tvojom mukom, dok te sažaljevaju
kažu jadni naš gospod, umro je mučeničkom smrću
kao da si ti netko dostojan sažaljenja
a možda si se ti toj smrti radovao
i otići što prije iz svijeta u kome oni kroje pravdu

U svakom slučaju ti nisi umro da bi te oni žalili
tvoja rasječena usna i danas
odbija ocat iz pehara njihove milosti
zaštiti nas od onih što siti podriguju
dok te brane od gladnih, od prezrenih
opljačkanih novih proletera i prosjaka
čije se kćerke na drumu prodaju za deset maraka
čiji mladi sinovi od bola režu vene
jer im je ukradena budućnost

Zaštiti nas od pljačkaša narodne muke
od utajivača poreza
od pedofila i krivokletnika
od novinskih strvodera
koji od tvoje probušene utrobe
i trnove krune prave udarne vijesti
od organizatora izbora ljepotica
od svećenika bordela
koji tvojim imenom ušutkavaju
gnjev ljudi koji pate

Možda je tvoja smrt bila spasenje za tebe
a ne samo nas
jer si želio što prije otići iz ove doline suza
iz ove doline kojima stoljećima vlada tek zakon jačega

of the cautious (who were the first to stick their head
inside a sack and still keep it there)
since they couldn't look calmly at evil.
I love dunces who cursed the ones hard at works
building a wall, tearing down a bridge.

I love the ones they spit on and laugh at,
the ones who lack good manners
who rose against the Roman authority
of national paradise, those denounced
by their own brothers, left by their wives,
whom the priests' cursed and students hid.

They were the ones who lit our way in the dark.

Translated by Charles Simic

PRAYER

My Jesus
protect us from those who protect you
defend us from those who defend you those who protect
you from the men in despair who blaspheme your name
the young men similar to you
protect us from those who protect you
because their words ring with the clanking of gold coins
while they auction off your passion, while pitying you
poor our Lord, they say, died a martyr's death
as if you were someone worthy of pity
and maybe you rejoiced in that death
and in leaving this world in which they administer justice

In any case you did not die so they would lament
you your cut up lips even today
refuse vinegar from the cup of their mercy
protect us from those gluttons who belch
while they defend you from the hungry, from the
disdained
plundered new proletarians and beggars
whose daughters sell themselves on the streets for ten
marks
whose young sons slice their veins from pain
because their future has been stolen from them

Protect us from the looters of people's pain
from the tax evaders
from the pedophiles and perjurers
from the journalistic dog-catchers
who from your pierced insides
and thorny crown make breaking news
from the organizers of the beauty pageants
from the priests of brothels
who with your name silence
the anger of the people who suffer

zakon noža
iz ove zemlje koju nitko ne voli
a čije krvave prnje njeni sinovi
prodaju u bescjenje
želio si se sresti s licem oca
koji te je prodao razbojnicima
otišao si jer nisi htio ovakav svijet

Isuse moj
znam da više vjeruješ ružnim riječima onih što se
krvavo znoje, nego laskama licemjera
da više voliš muslimane sirote bosne
nego katolike bogatoga rima
Puno više mladiće i djevojke što su te hinjili iz svoga očaja
no krvnike što su ti podizali zlatne oltare
bio si neprijatelj svećenika i farizeja
a brat prosjaka i pijanica
radovao si se životu
stvarao od vode vino
da bi se slavila gozba rađanja
a ne ples smrti

Rekao si „tko je od vas bez grijeha nek prvi baci kamen“
Amen.

BRATSTVO I SESTRINSTVO

Kada bih se ponovo rodio
i mogao birati, ne bih izabrao
ovaj jezik, ni ovo zanimanje.

Ni ovaj znak vjere, ni ovu vjeru
bez nade. Ne bih prihvatio
da me ubojice uče pravdi.

Ne bih izabrao ovo vrijeme
ni ovu zemlju u kojoj utjehe
nema. Ni ovu braću koja su me

prodala. Ni ovaj narod što
svoje sinove prinosi teletu
od zlata. Bacio bih svoje

ime. Jedino bih ponovo
izabrao tebe, što te u svakom
danu tisuću puta dodirnem

pogledom odanosti i sjaja.

Maybe your death was salvation for you
and not only for us
Because you wanted to leave this valley of tears
This valley ruled by the law of the strongest
the law of the sword
for centuries
this land no one loves
This land whose bloody rags are sold by her sons
for nothing
You wanted to see the face of your father
Who sold you to the thugs
You left because you didn't want this kind of world

My Jesus
I know you believe more in the ugly words of those who
sweat blood, rather than the flattery of hypocrites
and that you love the Muslims of poor Bosnia
more than the Catholics of rich Rome

and much more the young men and women who imitated
you out of their own despair
than the executioners who erected golden altars for you
you were an enemy to the priests and the Pharisees
and a brother to the beggars and the drunks
you rejoiced in life
made wine out of water
so the feast of birth could be celebrated
and not the dance of death

You said "Let the one among you without sin cast the first stone"
Amen.

Translated by Amy Gopp

BROTHERHOOD AND SISTERHOOD

If I could be born again
and I could choose, I would not choose
this language, or this vocaton

Or this sign of faith, or this faith
with no hope. I would not accept
murderers teaching me justice.

I would not choose this time
or this country with its want of consolation.
Or these brothers who

sold me out. Or this people that
yields its sons to the calf of gold.
I would cast off

DJEVOJKE MOJE MLADOSTI

Djevojke moje mladosti, nausikaje
Djevojke moje mladosti, dijane, danaje, lolite
imaju tek četerdeset, a već sijede kose, izborana
čela, smeđurane ruke
te »ladylike za šivaćim strojevima«
Mnoga od njih već je ogrubjela,već zaboravila ljubav
kao što se zaboravi strani jezik

Djevojke moje mladosti, rute i sulamke
Djevojke moje mladosti, primorkinje vile
imaju velike i prazne oči
Sve svoje suze one su isplakale
A bile su kao stvorene za nevjerstva, sestre estere i judite

Sva svoja nevjerstva one su potrošile
u skloništima, u podrumima, u redovima za kruh
sve svoje grešne misli one su darovale mrtvacima
Ponekad u prolazu mi se nasmiješe
al više brižno, kao majka nerazumnom djetetu
Kad im, onako uz kavu, spomenem propuštene
mogućnosti
kažu: ti si otišao, i tebi je do toga. Ti ne znaš kako je
kad ogugla se na sve
Kad zima rađa svoje čedo

Njihove teške kose ponekad mrsim u snovima
Njihove gorde stražnjice dodirujem šuštajem svile
Njihove male grudi nježno prekrivam dlanovima
i pomislim: zaboga, za deset godina sve one će biti mrtve

Brzo će poumirati te boginje moje mladosti,
skršene ratom, glađu i suzama
te penelope bez prosaca, nevjestice ugaslog osmijeha
Ti davni nedostupni i tajanstveni bunari užitka
te antigone što zazivaju prazninu, prazninu bez nade
prazninu bez odjeka

PJESMA O PRVOJ LJUBAVI

Svi pričaju (pjevaju) o neprolaznosti prve ljubavi
O poljupcima i susretima na školskom izletu, ili
iznenadnoj
Provali emocija u neočekivanome pejzažu,
restoranskoj bašti, morskoj uvali, dunavskome keju
Moje je iskustvo drugačije

Prva ljubav za mene bješe nešto čega se sjećam sa stidom
Gdje bijah zakazao kao muškarac i kao čovjek
Njoj koja je sve to znala i pokušala razumijeti
Mašem nakon svih ovih uludo izgubljenih decenija
Maramom zahvalnosti i kajanja

my own name. Another time I'd choose
only you, whom every single
day a thousand times I touch with

glance of glory and devotion.

Translated by Graham McMaster

THE GIRLS OF MY YOUTH

The girls of my youth, nausicaas
The girls of my youth, dianas, danaias, lolitas
they are only in their forties, but they are already gray
haired, creased
foreheads, wrinkled hands
those "ladylike ones behind the sewing machines"
Many of them are already toughened, have already
forgotten love
as a foreign language is forgotten.

The girls of my youth, ruths and sulamkas
The girls of my youth, sea fairies
have large and empty eyes
All of their tears they have depleted
But they were as if created for adultery, sisters of esther
and judith

All of their adulteries they spent
in bomb shelters, in basements, in lines for bread
all of their sinful thoughts they bestowed upon the dead
Sometimes in passing they smile at me
but more with care, like a mother to a foolish child
When, during coffee, I mention missed opportunities
they say: you left, and you still feel up to it. You don't
know how it is
to be numb to everything
When winter gives birth to its child

Their heavy hair I sometimes ruffle in dreams
Their proud behinds I touch with the rustle of silk
Their small breasts I gently cover with palms
and I think: by god, in ten years they will all be dead

Quickly will die these goddesses of my youth
crushed by war, hunger and tears
those penelopes without suitors, brides with extinguished
smiles
Those inaccessible secret wells of pleasure of long ago
those antigones that evoke emptiness, emptiness without
hope
emptiness without echo

Translated by Sara Elaqad

Iz rata izišla s izboranim licem i odlučnošću antigone
Ali ne ona koju ljubim, ali ne ona pred čijim bih pojasom
Pao ničice i čijim bih zavodljivim ustima
Svaku laž priznavao za istinu. To mi se događalo s drugima

S njom i danas razgovori o financijskim poteškoćama
O jednostavnim problemima što ti se čine nerješivim
O zdravlju i ljekovitim travama, o tom da bih morao
Smanjiti piće i pušenje, više se kretati, potom
Jezična fraza koju je jedino ona u stanju razumjeti
Strijela iz Zenonova zavičaja što je stigla na svoj cilj

Mogli smo imati kuću na buni, na rotimlji
Buljuk djece, solidnu farmu, sretan život
Ali, svejedno, s ljubavima ona nije mogla imati nikakve veze
Ljubavima što su dolazile kasnije s hukama oluja
I odnosile krv i suze sa sobom

SONET

U osmrtnicama *Oslobođenja*
nađem da je umrla F.

Bila je najljepša cura na sarajevskom
Filozofskom fakultetu, generacija 1974.
Moj cimer u studentskom domu
Pio je dan i noć zbog nje,
ali ona mi je jednom rekla
«Ti se meni više sviđaš».

Nije između nas bilo ljubavi.
Jednom sam je milovao
u Vilsonovu, na sjenovitoj klupi
Pitala me: «Hoćeš li mi posvetiti pjesmu?»
«Kada bih imao talenta, odgovorio sam,
tvojim bih nogama rado posvetio sonet
Jer vrhunski sklad zahtijeva
savršenu formu».

Ona se radosno kikotala.
Nisam je vidio više od trideset godina
Čuo sam da je imala nekoliko
Neuspjelih brakova. Siroto dijete
Niklo i otišlo u vremenima stradanja i boli.

Sinoć sam razmišljao o rimovanoj formi
Ali sve što sam uspio nažvrljati
jesu ove nepovezane rečenice
Što se rimuju sa zemljom
Što se rimuju sa travom.

A POEM ON FIRST LOVE

Everyone is talking (singing) about the imperishableness of first love
About kisses and encounters on school trips, or surprise
Outbreaks of emotions in unexpected places,
Restaurant gardens, sea coves, quays along the Danube
My experience is different

First love for me was something I remember with shame
Where I fell short as a male and as a man
To her who knew all of that and tried to understand
I wave a scarf of gratitude and remorse
After all these decades lost in vain

Emerged from the war with a wrinkled face and the decisiveness of Antigone
But not her whom I love, nor the one in front of whose sash
I would fall prone and with whose seductive mouth
I would concede each lie to be truth. That happened to me with others

With her even today the conversations about financial difficulties
Simple problems that seem unresolvable to you
Health and medicinal herbs, about how I need to
Cut down my drinking and smoking, walk more, and then
One phrase that only she may be able to understand
An arrow from Zeno's homeland that hit the bulls-eye

We could have had a house on the Buna, on Rotimlja
A mob of children, a reliable farm, a happy life
But, all the same, with other loves she could never establish any connections
Later loves came with the roar of storms
And carried blood and tears along with them

Translated by Amy Gopp

SONNET

In the obituary notices in *Liberation*
I find that F. died.

She was the most beautiful girl at the Sarajevo
Philosophy Faculty, class of 1974.
My roommate in the student dormitory
Drank day and night because of her,
although she once told me
"I am fonder of you."

There was no love between us.

TI SI DIJETE

Ti si dijete, i rad bi da ti pričam
o bijelim jedrima, dalekim gradovima
Morima kojima sam plovio, sirenama i brodolomima
A sve to bijahu kule na pijesku što ih je odnijela voda
Munje zarobljene u škriljcu matokita, apeiron
Ljepota koja umara

Ti si dijete koje očekuje od mene
Da govorim o ljubavima, vrtuljku nejasnih sjenki
I traži da priznam strašne pokolje koje sam počinio
U noćima očajničkim i pjanim, u tamnim vrutcima
pohote, u valovima djevojačke kose

Ti si dijete koje se naslanja na mene kao
Na zid ruševne kuće, u kojoj mrmore duhovi
Rata i vijeka, ljubavi i zaborava, oluja u aleji lipa
Ti ne znaš ništa o stablu čije se grane lome
Uz prasak davnih zabluda.

A ja sam kamičak, ljuštura školjke, poslušaj:
Ja sam nevjerna beskonačnost, ritam sakramenta
Drevna ilirska suza zastala u četinarskoj smoli
Ja sam dijete koje zariva svoju sijedu glavu
među tvoje mirisne sise. I plače.

I fondled her once
on a shaded bench on Wilson's Promenade
She asked me: "Would you write a poem for me?"
"If I were talented," I replied,
"I would willingly dedicate a sonnet for your legs
Because superior proportion requires
perfect form".

She burst into joyful laughter.
I didn't see her for more than thirty years
I heard that she had some
Unsuccessful marriages. Poor child
Germinated and left in times of suffering and pain.

Last night I reflected on the form of rhyme
But all I succeeded to mutter
are these incoherent sentences
That rhyme with earth
That rhyme with grass.

Translated by Amy Gopp

YOU ARE A CHILD

You are a child, and I would gladly tell you
about white sails, distant cities
Seas I've sailed, sirens and shipwrecks
All of which were towers in the sand water washed away
Lightning trapped in the shale of Matokit, apeiron
Beauty that exhausts

You are a child who expects me
To speak about love, a merry-go-round of vague shadows
And asks me to confess the horrible massacres I have committed
In desperate and drunk nights, in dark sources of
lust, in waves of girls' hair

You are a child who leans on me as
On the wall of destroyed houses, where spirits of
War and eternity, of love and oblivion, of storms in a linden-lined lane murmur
You don't know anything about the tree whose branches break
From the thunder-peals of past mistakes.

But I am but a pebble, conch shells, listen:
I am unfaithful infinity, rhythm of sacrament
Ancient Illyrian tears captured in coniferous resin
I am a child who thrusts my own gray head
between your fragrant breasts. And cries.

Translated by Amy Gopp

NE MOGU DA TE PREŽALIM

Ne mogu da te prežalim, jer tvoja bol traje
U mome mesu. U svakoj riječi koju izgovaram
U svakom zalogaju gorkog kruha. Ne mogu
Više koračati alejom, ni piti s čistog izvora
Odavno su majke skinule velove i rasule
Bujne kose, odavno se jasen osuo novim listom
Samo ja ne mogu da te prežalim, i dugo već te
Srećem u snovima, u bistrim gorskim očima.

Ne mogu da te prežalim u zimska predvečerja
Kad bogorodica u zavičaju razgovara s čobanicama
Prošlo je stotinu ljeta od rečenica koje su izgovorene
Jezera su se odledila i proljeće šumi krošnjama
A ja čekam da mi se javi nepoznati glasnik
Da me obasja večernja zvijezda ledenim sjajem
I kako pojmiti ovu entropiju ljubavi. Što žmirka
Kao znak runolista na golim hladnim vrhuncima.

Ne mogu da te prežalim u česticama, u morskim
valovima što oplakuju hridi tijela i ljeta. Što duže ljeto
traje to brže tijelo ulazi u jesen, u tamni pijesak
Razbojnici sa druma opljačkali su moje zlatnike
Pa mi pjesme danas zveče kao polomljen krčag
Umjesto dukata sad su tu duge kiše, hladni vjetrovi
Oblačim plašt šutnje u čekanju nepoznatog glasnika
Večernje zvijezde da me obasja ledenim sjajem.

KĆERKE VELIKIH SINOVA

Nitko nema razumijevanja za njih
Eddu Mussolini, Svetlanu Džugašvili
Raghad Hussein, Mariju Milošević
Za njihovu patnju nitko nema uha
Dok tate bijahu opsjednute urotama
one su svoje lutke skrivale tankim velovima
od dvorjana koji su, tek kad bi
očevi bili svrgnuti - na fotografijama
otkrivali patološke crte

Samoću su tumačili kao oholost
Tupilo od depresije dijagnosticirali
kao nasljedni zločinački gen

“Pljunuta otac, samo joj brkovi fale”,
govorili su za Svetlanu, ženu tužnog pogleda
lica nimalo čeličnog, što je u Americi dobila
predujam za knjigu s tezom da je otac zvijer
Nije se bavila politikom i nije mogla, nije znala
A sanjala je očeve prste u zlatnoj kosi
i čas kad je vrti oko sebe i štipa za obraz
za rupicu iz koje zeko pije vodu

I CAN’T GET OVER YOU

I can’t get over you, because your pain remains
In my flesh. In every word I utter
In each bite of bitter bread. I can
no longer step on the tree-lined path, or drink from a pure source
For ages mothers have taken off their veils and let down their
Luxurious hair, for ages the ash-tree has been covered with new leaves
Only I am not able to get over you, and for a long time already I have been
Meeting you in my dreams, with clear alpine eyes.

I can’t forget you on winter evenings
When the mother of God converses with the local shepherd girls
A hundred summers have passed since the sentences were spoken
Lakes melted and spring roars with tree-tops
But I wait for an unknown messenger
To enlighten me with the evening star’s icy splendor
And how to conceive of this entropy of love. Which twinkles
As a sign of edelweiss on bleak cold peaks.

I am not able to forget you in particles, in sea
waves that wash over cliffs of body and summer.
The longer summer lasts the faster the body enters autumn, in dark sand
Robbers along the road plundered my gold coins
And my poems now clink like a broken jug
Instead of gold coins now there are long rains, cold winds
I dress in a haystack of silence waiting on an unknown messenger
To enlighten me with the evening star’s icy splendor.

Translated by Amy Gopp

THE DAUGHTERS OF GREAT SONS

No one has any understanding for them
Edda Mussolini, Svetlana Džugašvili
Raghad Hussein, Marija Milošević
No one has an ear for their suffering
While dads were obsessed with conspiracies
they concealed their dolls with thin veils
from chamberlains who, only when their
fathers would be dethroned – in photos
discovered pathological features

They explained loneliness as pride
The dullness of depression they diagnosed
As inherited criminal genes

Kod Edde su otkrivali snažnu duceovsku bradu
mada bi se prije moglo reći da je bila lica ženstvena
i lijepa. "Edda, lijepo ime", govorio joj je pape
"Toliko lijepo da ga je i Göring dao svojoj kćeri"
Lako je podnijela kapitulaciju, svrgavanje muža,
pepeo carstva, ali smrt oca nije mogla, jer je
vjerovala da je od svih obožavan i besmrtan

Raghad je imala drugačije iskustvo
Nisu je zanimali očevi poslovi sve dok
joj nenadano i okrutno nije ubio muža
Pobjegla je od njegova gnjeva u Siriju
pa u Jordan. Mrzila ga je i nije suze pustila
kad su ga Amerikanci uhvatili u zagušljivoj rupi
Ali su joj suze navrle na oči
kad ga je vidjela u donjem rublju u zatvoru
na naslovnoj stranici tjednika *The Sun*
"Zaboga, pa to je ipak previše", rekla je

Marija je u noći očeva izručenja
ispalila u zrak pet hitaca iz malog pištolja
"Mislim da ni ptice tad nisu više htele da lete,
ni muva nema, koliko su se uplašile onih napolju",
Objašnjavala je svoj urođeni strah od okoline
U oca nije posumnjala: "Ostat će, sigurna sam,
dobro zapisan u istoriji, ali mene ne zanima istorija
on treba odmah meni, živ i zdrav"

Piše se iz dana u dan o stotinama tisuća umorenih
o milijunima prognanih, o unesrećenoj djeci
Ali nitko još nije pokazao ni mrvu razumijevanja
za njih koje su, kao i sve druge, bile djeca i
voljele svoje očeve. Za njinu patnju
odnjegovanu u raskošnim aulama
što su bile popločane urlikom.

"The spitting image of her father, she only misses a moustache",
referring to Svetlana, the woman with the sad look
and a face that was anything but tough, who in America
won a scholarship for her book on the thesis that a father is a beast
She wasn't engaged in politics nor could she, she didn't know how
But she dreamed of her father's fingers in her golden hair
and the moment he twirled her around and pinched her cheek
from her eyelet the bunny drinks water

At Edda's they discovered Duce's strong chin
Although it would have been better to say that her face was feminine
and pretty. "Edda, what a pretty name", dad said
"So pretty that Göring gave it to his own daughter"
She easily endured defeat, the dethroning of her husband,
the ashes of empire, but the death of father she could not, because
she believed that of them all he was idolized and immortal

Raghdad had a different experience
She was not interested in her father's affairs until he
suddenly and cruelly killed her husband
She escaped from his anger in Syria
and then to Jordan. She hated him and didn't shed tears
when the Americans caught him in a suffocating hole
But she was moved to tears
when she saw him in underwear in prison
on the front page of The Sun
"For Gods' sake, that's a bit too much", she said

On the night of her father's extradition, Mary
shot her small pistol five times into the air
"I don't think the birds wanted to take flight then,
Not even a fly, as they were frightened of those outside",
She explained her innate fear of her surroundings
In her father she had no doubt: "He will remain, I am certain,
finely written into history, but I am not interested in history
I need him now, alive and well"

Day after day it is written the hundreds of thousands of slaughtered
the millions expelled, the unhappy children
But no one has yet showed even a bit of understanding
for those who, like all others, were once children and
loved their fathers. For her suffering
raised in luxurious assembly halls
paved with howling.

Translated by Amy Gopp

GUIDELINES FOR AUTHORS

General considerations

Psychiatria Danubina is a peer-reviewed open access journal of the Psychiatric Danubian Association, aimed to publish original scientific contributions in psychiatry, psychological medicine and related science (neurosciences, biological, psychological, and social sciences as well as philosophy of science and medical ethics, history, organization and economics of mental health services). Its scope includes mental health in general and all psychological aspects of any branch of medicine, surgery, or obstetrics; and any subspecialty of psychiatry and related clinical and basic sciences.

The specific aim is to promote psychiatry in Danube region countries as well as to stimulate collaboration and joint projects. Manuscripts are published in English language only. All submitted manuscripts are given equal consideration, irrespective of the country they originate from, as long as the following main criteria are met:

A manuscript is written and prepared according to the Journal's Instructions for authors.

Throughout the entire editorial process, Psychiatria Danubina follows the best practice guidelines given by the Committee on publication ethics (COPE) (available at: *http://publicationethics.org/files/Code_of_Conduct.pdf*) and Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly work in Medical Journals by International Committee of Medical Journal Editors (ICMJE) (available at: *http://www.icmje.org/recommendations/*)

Editors at Psychiatria Danubina are committed to ensure the integrity and promote innovative and evidence-based sources of information in order to maintain the quality and ensure the impact of the papers published in our Journal, according to the principles set by Sarajevo Declaration on Integrity and Visibility of Scholarly Publications communication (*http://www.cmj.hr/2016/57/6/28051276.htm*).

Instructions for authors

Manuscripts must be written in standard and grammatical as well as clear and concise scientific English. It is the responsibility of the authors to ensure the quality of the language. The acceptance criteria for all papers are the quality and originality of the research and its significance to our readership.

Submission of the manuscript

Submission of a manuscript implies:

- that the work described has not been published before (except in the form of an abstract or as part of a published lecture, review or thesis);
- that it is not under consideration for publication anywhere else;
- that its publication has been approved by all co-authors, if any, as well as by responsible authorities – tacitly or explicitly – at the institute where the work has been carried out.

This must be stated in the Covering letter.

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Types of accepted papers are given below. Word count for the manuscript includes only the plain text (not tables, figures, abstracts or references). Contributions will be considered for the following categories:

- Original research;
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- Brief report;
- Viewpoint;
- Letter to the Editor: 600-800 words, up to 10 references, 1 figure/table;
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- Book review;
- Invitation/Announcement.

Preparation of the manuscript

- Submit the manuscript as an editable Word (preferred) or rich text format (rtf) document.
- Use Times New Roman in 12 point size and double line spacing.
- All pages should be numbered.
- Use a clear system of headings to divide up and clarify the text, with not more than three grades of headings.
- Figures should be submitted as separate TIF or EPS format files and the desired position of figures and tables should be
- indicated in the manuscript.
- Footnotes to the text are not allowed.
- All measurements must be given in standard SI units.
- Abbreviations should be used sparingly and only where they ease the reader's task by reducing repetition of long terms. Initially use the word in full, followed by the abbreviation in the parentheses. Thereafter use the abbreviations.
- Drugs should be referred to by their generic names. When a brand name is used, it shall begin with a capital letter and the manufacturer's address details should be given.
- Do not use pejorative labels such as 'schizophrenics', instead refer to 'patients with schizophrenia'.

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The first page should contain:

- the title of the paper - should be short, informative and contain the major key words;
- the full names of the authors and position titles at the respective institutions;
- the addresses of the institutions at which the work was carried out (addresses for authors other than the correspondence

author should contain the department, institution, city and country);
- indicate all affiliations with superscript number after the author's name and in front of the appropriate address;
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The title page should be uploaded separately. The rest of the manuscript should not contain personal information of the authors.

2. Summary and Key words

The second page should carry on a Summary in the region of 300 words, followed by a list of 3-5 key words or short phrases drawn, if possible, from the medical subject headings (MeSH) list of Index Medicus (http://www.nlm.nih.gov/mesh/meshhome.html). The Summary should state, whenever applicable, very specifically, the main purposes, procedures, findings, and conclusions of the paper, emphasizing what is new or important.

For original papers and review articles, a structured Summary using the headings is preferred:

- Background (questions addressed; principal aims of a review);
- Subjects and Methods (design, setting, sample, interventions, chief outcome measures; for reviews sources of data and criteria for their selection);
- Results (main findings together with their statistical significance, if possible);
- Conclusions (those related to results, limitations as appropriate, clinical and researh implications; for reviews principal conclusions and clinical and research implications).
- 3. Text
- It should be divided by subheadings into the following sections:
- Introduction (authors should provide an adequate background and end with the aims of the study);
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- Conclusions (needs to summerize the content and purpose of the paper).

4. Acknowledgements

The source of financial grants and other funding should be acknowledged. The contribution of institutions, colleagues, technical writers or language editors should be noted. Thanks to anonymous reviewers are not needed. If there are no acknowledgements please state so by putting 'None' in the respective section.

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6. Contributors

It is required to declare every author's individual contribution to the manuscript. Every author should be mentioned for his exact work (e.g. design of the study, literature searches and analyses, statistical analyses, interpretation of data).

7. References

- In the text give the author last name and publication year within parentheses (e.g. Jakovljevic 2008, Sartorius 2009).
- If there are two authors, both should be named (e.g. Svrakic & Cloninger 2010, Sher & LaBode 2011).
- If there is an article with more than two authors, only the first author's name plus 'et al.' need to be given (e.g. Sartorius et al. 1996, Stinson et al. 2008).
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References should be listed in the following form:

1. Svrakic DM & Cloninger RC: Epigenetic perspective on behavior development, personality, and personality disorders. PsychiatrDanub 2010; 22:153-66

2. Grant BF, Hasin DS, Blanco C, Stinson FS, Chou SP, Goldstein RB et al.: The epidemiology of social anxiety disorder in the United States: results from the National Epidemiologic Survey on Alcohol and Related Conditions. J Clin Psychiatry 2005; 66:1351-61

3. Reiter RJ & Robinson J: Melatonin. Bantam Books, New York, 1995

4. Doghramji K, Brainard G & Balaicuis JM: Sleep and sleep disorders. In Monti DA & Beitman BD (eds): Integrative Psychiatry, 195-339. Oxford University Press, 2010

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Tables should be included on separate pages and numbered consecutively with Arabic numerals (e.g. Table 1). Column headings should be brief, with units of measurement in parentheses. All abbreviations and symbols should be defined in the legend. The table and its legend should be understandable without reference to the text. Desired position of tables should be indicated in the text.

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SAR SCIENCE, ART and RELIGION

The Mission Statement

The Science, Art and Religion (The SAR) is a new, peer reviewed transdisciplinary and integrative journal of the International Academy of Sciences and Arts in Bosnia and Herzegovina. The journal publishes editorials, viewpoints, reviews, original research, news, commentaries, etc. in two double issues per year.

The journal mission is to serve human community's well-being in the field of science, art and religion in transdisciplinary integrative way by:

- promoting original research, creativity and cooperation in and between sciences, arts and religions
- presenting important news from Bosnia and Herzegovina as well as from all the world, important organizations, projects and resources for public and global well-being and development;
- publishing high-quality peer-reviewed articles and providing objective reviews and creative viewpoints promoting public and global well-being and empathic civilization
- allowing independent intellectuals to express their personal opinions on issues in compassionate society and public well-being in Bosnia and Herzegovina and empathic civilization.

We particularly welcome papers with transdisciplinary integrative approach and with overarching concepts and paradigms that unify all the scientific and humanistic disciplines and highlight visions of scientific, technological, humanistic, spiritual and cultural development of Bosnia and Herzegovina as well as contributions which study and analyze positive and successful or harmful and destructive processes or practices. We need a common language that builds bridges over academic rifts and political and religious divides and easily exports insights across disciplinary and political borders. Our guiding ideas of talking across the boundaries and frontiers are to promote synergy between sciences, arts and religions as well as cooperation between all the three constitutive nations for the better world for all people.

All editors and members of the editorial board of the SAR journal are independent professionals enough experienced to provide objective professional evaluation of essential issues and ongoing programs and activities. We aim to stay faithful to art and practice of learning organization, scientific truth, creative knowledge, academic communication and free publishing of the new and original ideas and research results independently from selfish political interests and constraints.

Join us in this publishing hero's journey to provide evidence base for compassionate society and public well-being in Bosnia and Herzegovina and empathic civilization and global cooperation and well-being.

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