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Editorial

Beyond Campus Curriculum – The International Graduate Course on Humanistic and Socialistic Medicine for Healthcare Providers for Medical and Nursing Students

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Humanism stands as the foundational principle in healthcare, with humanistic medicine dedicated to enhancing comprehension of the scientific and ethical framework of medical practice [1]. This commitment seeks to enhance health outcomes by prioritizing patient autonomy, integrity, empathy, compassion, altruism, and respect [2]. This practice of humanistic and socialistic medicine that prioritizes equitable access to healthcare for all, emphasizing social justice, empathy, compassion, and collective well-being, resulted in higher job satisfaction and personal satisfaction [3]. But despite the introduction of the Competency-Based Education curriculum in India, the training for medical and nursing students in bioethics and professionalism is only at its nascent stage [4]. The densely packed medical and nursing curriculum often emphasizes more scientific and technical content, leaving little room for formal and in-depth training to foster compassion, empathy, professional conduct, and personal well-being. The absence of well-rounded training in these critical areas can lead to a sub-optimal understanding of complex ethical issues and humanistic practices in healthcare. This is the root cause of ethical lapses, unprofessional behaviour, patient harm, moral distress, legal complications, reduced public trust, and hindered collaboration and innovation in healthcare settings [5-6]. This affects patients and the healthcare setting and contributes to increased stress and burnout among health professionals [7]. To promote humanistic and socialistic medicine by equipping future healthcare providers with the essential ethical and professional skills required in their practice and their own welfare, we designed a beyond-campus curriculum for medical and nursing students.

The International Graduate Course on Humanistic and Socialistic Medicine for Healthcare Providers is a Beyond Campus Curriculum by the Department of Education, International Chair, Faculty of Medicine, University of Porto, Portugal that incorporates The Foundation Course on Moral Values, Bioethics, Professionalism, and Personal Wellbeing into the medical and nursing curriculum. This emerges as a ground-breaking initiative that provides formal education in moral values and bioethics to future health professionals, cultivating a profound understanding of bioethical principles, professionalism, and their critical application in clinical practice.

The course has been meticulously designed to offer a comprehensive and multi-year training on Moral Values, Bioethics, Professionalism, and Personal Wellbeing journey for medical and nursing students, beginning from their day 1 of medical and nursing education. Hence, this foundational course ensures the integration of critical topics and renowned speakers across the

globe for a well-rounded education that addresses the wide spectrum of ethical issues and personal well-being essential for the holistic development of future healthcare professionals. This thoughtfully designed curriculum provides students with a strong foundation, equipping them to make ethically sound decisions, prioritize patient care, and uphold the highest standards of professionalism in their medical and nursing careers.

Distinguished by its student-centred approach, this beyond-campus curriculum fosters experiential and contextual learning and encourages students to take control of their educational journey. The curriculum has been meticulously crafted by incorporating all humanistic and socialistic medicine, including bioethical, professional, and well-being aspects related to patients and healthcare professionals, to deliver holistic, humanistic, and empathetic care. This beyond-campus curriculum incorporates four face-to-face contact sessions (yearly once) and weekly virtual live synchronous interactive webinars featuring distinguished speakers from the USA, UK, Canada, Europe, Australia, and other parts of the world who address medical and nursing students. During each webinar, the speakers delve deep into the bioethical concepts with case discussions, short activities, and reflections from students at the end.

This dynamic learning environment equips students with valuable insights and strategies to navigate these complex challenges effectively. Through active participation in discussions, students are encouraged to articulate their views and enhance their confidence, creativity, and critical thinking abilities. To ensure accessibility and flexibility, all lectures are recorded and made available on a dedicated Google Classroom, allowing students to revisit the material at their convenience. To ensure that the intended learning objectives have been achieved, formative and summative assessments will be conducted to evaluate students on the content taught and obtain their perceptions and feedback for continuous quality improvement.

In addition to its comprehensive focus on humanistic and socialistic medicine, this beyond-campus curriculum emphasises research as a cornerstone of the educational experience. The integration of a robust research component not only serves to distinguish the curriculum's purpose but also establishes its contextual relevance in the ever-evolving field of healthcare. The curriculum encourages students to delve into evidence-based practices, fostering a deep understanding of the scientific and ethical landscape and encouraging high-quality scholarly output.

The evaluation and assessment of the Beyond-Campus curriculum are comprehensive, addressing different facets to ensure its quality and effectiveness. Participants' perceptions are gauged through online surveys, capturing their subjective views and expectations on a Likert scale. Satisfaction is assessed using questionnaires, delving into various aspects of the course experience. Participants' feedback is collected through online questionnaires, allowing them to share insights on the course's strengths and areas for improvement. An end-of-course assessment, comprising formative and summative evaluations are conducted to test participants' knowledge and application skills, ensuring they have acquired the necessary competencies. These evaluation mechanisms are vital for continuous improvement, customization, and accountability, contributing to the course's success in fostering ethical decision-making and professionalism in healthcare.

This beyond-campus curriculum comprising the International Graduate Course on Humanistic and Socialistic Medicine for Healthcare Providers holds profound implications. It serves as a beacon of ethical enlightenment and professionalism for the next generation of healthcare practitioners to practice humanistic and socialistic medicine, nurturing their ability to make ethically sound decisions and prioritize patients' welfare. Furthermore, it places a significant emphasis on the well-being of students themselves, instilling a deep understanding of personal values and self-care, which in turn contributes to a more compassionate and self-aware healthcare workforce. This visionary beyond-campus initiative is not just about education; it is a pathway towards creating a more ethical, empathetic, humanistic, and socialistic healthcare sector.

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Review Paper

Moral Values and Ethical Aspects to be Adhered in Preclinical Experiments with Laboratory Animals: an updated review

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ABSTRACT

Throughout the last century, seminal advances in pharmacology and medicine have been made and helped find medication for various life-threatening ailments. However, all drugs tested in preclinical studies do not reach meaningful outcome and this gives context for people's moral concerns about using animals in research for human benefit. Both animal and human studies raise serious ethical issues. This is principally because the lack of demonstrable advantages, insufficiency in rehabilitation process and possibility of injury to the animals involved in the research, present several ethical concerns. This review addresses the moral and ethical issues raised in animal testing and how to find a fine balance where both research and ethics needs to be pursued for the betterment of both humans and laboratory animals.

Keywords: Institutional Animal Ethics Committee, animal studies, animal experiments, and animal research

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Introduction

Medical research is an ever-growing need and animal research is at the forefront in drug development. The use of laboratory animals in biomedical and behavioural research have yielded significant benefits for drug development. Laboratory animals are an absolute necessity for research. But, of course, their use should be warranted and carried out in an ethical manner. The ethical principles do not get compromise in the animal kingdom. Hence, animal for either in vitro or in vivo experiments need to be conducted according to the approved ethical norms. The Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) is the regulatory point of conduct for animal research. The lower forms and higher-level forms of

animals have need for ethical research. It is the institutional animal ethics committee that ensures ethical research, locally.
The use of laboratory animals is an important aspect of the search for a cure for human illness and well-being. In this objective it is especially very important that in testing of novel drug/formulation formulations and surgical treatments and procedures animals need to be used to test the efficacy of the modality in test. In lieu of this, animal experiments and models are critical for the discovery of new medications and the assessment of the safety of novel surgical interventions.
From a bioethics perspective, utilitarianism promotes using laboratory animals in research despite the inherent danger of injury, arguing that the benefits to humanity exceed the risks involved in the experimentation. The outcomes may promote human well-being in ways that existing technologies cannot. However, use of surgical procedures and novel drugs can be extremely painful for the animals involved, increase morbidity, and may significantly reduce their quality of life. Furthermore, there is no evidence of any prospective human advantages of all interventions tested.

The widely held belief that animal pain perception is comparable to that of humans presents ethical concerns concerning animal cruelty methods. Researchers acknowledge this and agree on the most humane way to perform research. According to the US Department of Agriculture, animals only suffer mild discomfort in around 62% of tests [1]. After getting an anaesthetic or analgesic, 32% displayed no discomfort. This raises the concern that using animals in studies could generate serious moral issues and if it is wrong to subject animals to suffering. However, this data does not justify the continued use of animals in scientific studies for the simple fact that ethically it is wrong to subject laboratory animals to undue stress and pain [1].

Animal Research Ethical Problems
From a societal perspective, the morality of animal testing continues to pique the public's curiosity. There are two schools of thinking emerging: deontological (intrinsic) and consequentialist (utilitarian) [2]. The animal rights movement is frequently attributed to utilitarian ethicist Peter Singer. According to his classification of animal rights within the context of human rights, animals' best interests should be considered regardless of whether they are cute, endangered, valuable to people, or whether any humans care about them or not. He argues in his ground-breaking 1975 book Animal Liberation that humans have no right to be treated differently than other animals. Even if animals and people have some rights, he emphasizes that there are times when those rights must be compromised for the greater good. Jeremy Bentham expressed similar views, questioning the use of animal research. Questions were raised concerning their communication, mental clarity, and pain perception. Despite his opinions on the subject, he was not opposed to the use of animals in research if it could promote medical sciences and assist humanity. This, however, necessitates an honest assessment of the costs and rewards of using laboratory animals. Tom Reagan, a deontological ethicist, disagrees with this utilitarian viewpoint, arguing that using animals in scientific research is always unethical due to the species' inherent worth.

Due to the shared evolutionary lineage between humans and other primates, certain diseases, including AIDS, have been investigated using primate models in research endeavours. The animal result translation to humans was problematic because primates have higher immune system than humans, allowing them to fight sickness and aid the body in recovering from illness when treated. However, when tested on humans, the drug was shown to be ineffective, hastening the spread of the disease and eventually leading to death. What was distressing was that it took a considerable amount of time for this knowledge to be known and substantial numbers of primates were used for the study. The comparative observations brought in to fore the disparities in physiological, immunological, and biochemical functioning between the two species and questioned the need to use primates as predecessor for translational experiments in clinics.

Despite heated disputes about the best way to treat animals, utilitarianism remains popular, albeit with certain adjustments, since we continue to believe that "*the end justifies the means*" or "*the greatest*

good of the greatest number" is more important than any single life. From a moral dimension there are two key points of dispute in animal studies. The first is whether utilizing animals in research will yield useful results that would otherwise be difficult to get to treat humans. The second pertains to the ethics of potentially harmful animal use for these experiments primarily if it causes unnecessary pain to the animals. The benefits of animal research to humans are not always clear and add to the conundrum and question the use for experiments that may turn to be futile.
The animals' inherent worth must be recognized, and their well-being must always take precedence. Animal protection is unequally distributed due to its hierarchical character, with only cats, dogs, horses, and primates (among others) obtaining legal protection and when choosing on a study topic and approach, researchers must consider the demands of each laboratory animal [3].

William Russel and Rex Burch defined the three R's in their 1959 book The Principles of Humane Experimental Technique. The initial three R's have given way to the current six R's [1]: refinement, reduction, replacement, rejection to employ animals in favour of other approaches, and responsibility. Following these guidelines is the same as using humane methods while doing animal research.
All worldwide legislation governing the use of animals for scientific purposes, as well as all organizations committed to the development of alternatives to animal research, have allowed the use of these alternatives. It also prohibits the use of animals in research that cause severe, unwarranted, or prolonged pain. By enforcing the 3 R's and considering the rewards of the inquiry, the experimental design should reduce expenses. Each academic institution should have an established Animal Ethics Committee comprised of qualified individuals who can advise researchers interested in using animals in their study and can keep track of how well the three guidelines are being followed [1].
They have the right to reject proposed study protocols for improved animal welfare if they believe that continuing to use animals in experimentation is not justified [3]. Each study proposals should be critically evaluated and considering prospective costs and benefits thoroughly. The study's importance, objectives, and likelihood of yielding decisive results must all be made obvious and possible. The use of genetically modified (GM) mice presents extra ethical concerns. The insertion of a foreign gene into the genome of an organism results in phenotypic and physiological functions that are not found in the wild-type species and both the deontological theory, and the modified utilitarian theory disagree on their use. In the absence of a negative phenotype, however, there is no difference in animal wellbeing between wild-type and mutant animals since the animal is ignorant that its genome has been altered.

Replacement
The principle of replacement can be categorized into two distinct types: absolute replacement and relative replacement. According to Russell and Burch, animal replacement refers to the utilization of scientific methodologies that involve the substitution of non-sentient substances for conscious vertebrates in the context of animal experimentation. This observation suggests that clever higher creatures have been supplanted by unconscious matter. This statement suggests that if there is an alternative scientific approach available that can effectively achieve the desired outcome without involving animals, then studies on animals of that species should be avoided. When there is a need for animal cells, tissues, or organs, in vitro research is often undertaken using perfused organs, tissue slices, tissue cultures, and cellular and subcellular fractions thereby reducing pain/sacrifice of animals.

Reduction
In the past, a variety of animals were employed to fulfil the necessary quality control regulations for vaccines. The utilization of animals has experienced a significant decrease after the implementation of the 3Rs. Adhering to the principles of the 3Rs (Replacement, Reduction, and Refinement) in vaccination management has the potential to result in the complete elimination of animal utilization. The researchers bear the responsibility of ascertaining if a reduced number of animals may be employed in the proposed experiment, while ensuring that the scientific rigor of

the techniques and the significance of the results are upheld. This statement suggests that it is imperative for researchers to engage in literature reviews, evaluate various experimental designs, and undertake design calculations prior to commencing their investigations and work towards mitigating the effective number of animals for the study.

Refinement

The concept of refinement underscores the objective of reducing the frequency or intensity of harsh methodologies employed in animal experimentation. Any alteration made to a methodology that reduces the level of distress experienced by animals is considered ethically acceptable. This encompasses the topics of humane endpoints, non-invasive monitoring, and implanted monitoring technology. Deliberate attempts should be made to reduce or eliminate pain and misery to the treated animals using anaesthetics and analgesics, appropriate animal care, habitat enrichment, and humane euthanasia. There is mounting evidence that emotional distress can have profound effects on an animal's psychology, biology, and immunity and that these can act as a compounding factor and give inconsistent experimental outcomes, undermining the validity and reproducibility of research. Considering this all facets of animal experimentation, from animal housing and care to the actual scientific techniques, needs to be focused and improved upon. More importantly ensuring that the animals are given with housing that allows the expression of species-specific characteristics is vital and examples of refinement.

Responsibility

This includes reducing the risk of animal suffering and improving animal welfare, preserving biological diversity, including when intervening in a habitat, openness and sharing of data and materials, the need for animal knowledge, and the obligation to treat animals with respect. Similar to other nations, India continues to undertake animal experiments and has a thriving research industry. We are a long way from being morally oriented toward the humane treatment of animals, despite the existence of ancient religions such as Hinduism and Buddhism that advocate a tolerant attitude and messages to preserve animals and treat them with respect, compassion, and dignity. In contrast, article 51A(g) of the Indian Constitution emphasizes that it is everyone's fundamental duty to preserve the nation's natural resources, which includes compassion for all other living things. In 1960, the Indian Parliament enacted the prevention of cruelty to animals' act. According to Section 15 of this Act, the Central Government of India establishes the Committee for the Control and Supervision of Animal Experiments (CPCSEA) [4].

Animal Experimentation -The changing facade

Many researchers breach ethical principles, neglect them, or give them little weight when doing study. Some brief examples of actual animal studies demonstrating ethical issuesIn a 2002 experiment on awake lambs, third-degree burns and significant lung injury were also seen. The researchers aimed to demonstrate that there are alternatives to the current treatments for respiratory failure [5]. For this 5-day blinded trial, 14 lambs were divided into two groups: those getting volume-controlled mechanical breathing and those receiving par corporeal prosthetic lungs. After a tracheostomy, thoracotomy, and venous cut-down, the animals were sedated. They were then burned along the flanks with propane, resulting in cutaneous burns covering more than 40% of their body surface area. To force smoke into their lungs, a modified bee smoker was utilized, which burnt as it entered. After then, the experimental lambs were woken while still getting artificial ventilation. ARDS, or acute respiratory distress syndrome, was diagnosed in the animals. It was standard practice to kill animals that were thought to be in pain. The Institutional Animal Care and Use Committee (IACUC) approved the research, and the researchers informed everyone that the animals were treated humanely in accordance with the Guide for the Care and Use of Laboratory Animals. The creatures' pain and suffering were beyond comprehension. The magnitude of the suffering was unimaginable, regardless of any potential benefits to human health from the study [6].

Challenges to Animal Experimentation and Research at an Ethical Level

Humans are endowed with intelligence and judgment capacity and are constantly confronted with decisions that put his moral compass to the test. Beecher correctly predicted that the number of animals used in trials would increase over time and according to estimates, more than 500 million animals are used in studies in the United States each year [7]. Using animals in experiments involves difficult moral quandaries and maintaining Brambell's five freedoms is a serious challenge. In animal care, the ability to eat and drink without limitation comes first. To preserve their health and vitality, all animals require simple access to clean water and healthy food. The absence of pain is a close second. It is critical to have a comfortable and secure environment. The third benefit is that you won't have to worry about things like discomfort, injury, or preventable diseases. The fourth fundamental right is the freedom to behave in a socially sanctioned manner. It necessitates proper habitat, adequate facilities, and the company of other creatures of the same kind. The goal is to be free of all concerns and pain.

Conditions and therapies are offered to lower the likelihood of mental anguish. When the five freedoms of Brambell are considered objectively, it is evident that many at times laboratory animals' rights and conditions have been infringed and unethically treated. Even though water can be given freely as needed, it is common for examinations to need the animals to have fasted for several hours. Even though the trials were approved by the Institutional Animal Ethics Committee (IAEC), the treated animals suffered greatly. Consensus (or lack thereof) is an ongoing problem that must be addressed.

In practice, there is either no assessment or an inadequate assessment of the animal injury. The possibility of zoonotic infection transmission in both directions cannot be ruled out and guidelines must be followed appropriately. When there are no benefits for the animals, it is unequally distributed, and attempts should be towards reducing this. In most cases, we cannot extrapolate observations from animal disease studies to human health. This is because factors beyond the laboratory's control may have a substantial impact on the study outcomes. Also, there could be significant differences between diseases modelled in animals and those modelled in people and the variations in the physiology and genetics between the two species can affect the study outcome [8]. Solving these difficulties necessitates persistent faith and moral reflection. There must be evidence to support undertaking this type of animal study. There must be a compelling rationale why this study is necessary, how it will benefit people or other species, and how the findings will improve our understanding of the disease and the therapeutic benefit. The researcher should be aware with the relevant literature and realistic alternatives to animal experimentation before proposing a study. The animals employed in the study must be the finest possible representations of the research's goals along with concern for the animals in accordance with moral values.

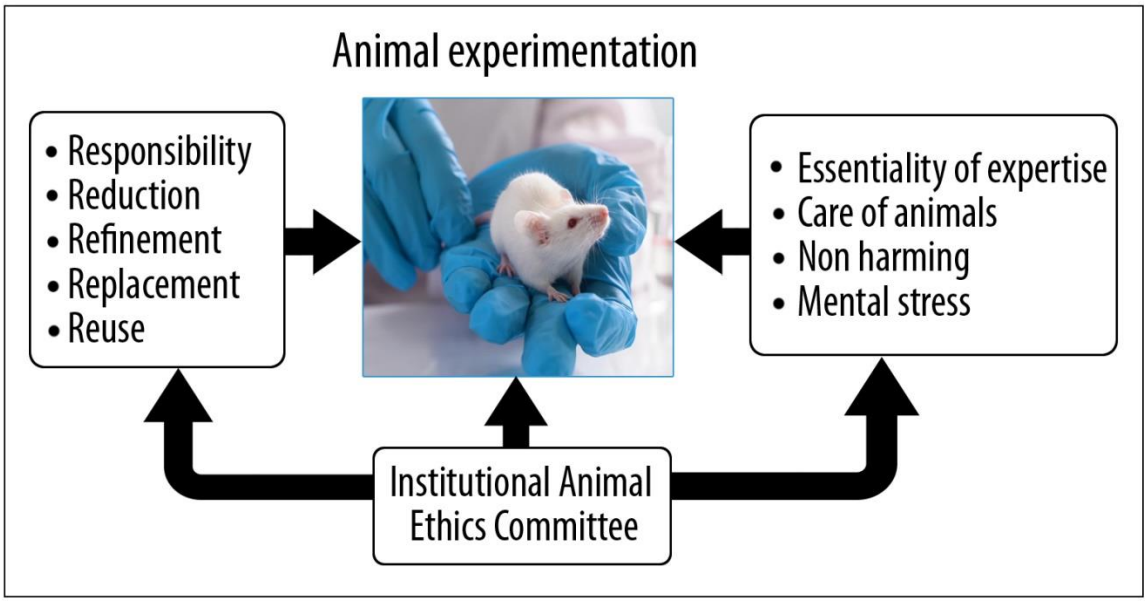
Before undertaking any study involving experimental animals, the Institutional Ethics Committee (IEC) and the Institutional Animal Ethics Committee (IAEC) must extensively review the procedure, need, and ethics of the study. When conducting the tests, it is critical to utilize humane techniques and adhere to the 3Rs principles. Providing an explanation for this would validate the use of animals in the study considering how the animal will feel and how much pain, suffering, and harm it will likely undergo. When an animal is used in a study, its behaviour must be closely monitored and subtle signs like the animal's cries, the presence or lack of protests, and resistance should be used to determine agreement or acquiescence. The investigator's primary objective should always be the welfare of the animals. There is a chance that animals will experience pain during therapies that humans would experience pain throughout. Everyone involved in the project should be conversant with animal welfare standards, have received proper training and any changes in behaviour that are unusual for their species could be signals of concern and analysed [9].

Conclusion

Animal researchers must raise their standards of conduct and assume responsibility for their actions if they are to prevent unfavourable outcomes. To establish and maintain ethical standards

in animal research, it is necessary to acknowledge the current unsatisfactory state of affairs and address the regulatory gaps that exist. By strictly adhering to norms and standards, it is possible to implement empathy and compassion for animals effectively. It is essential to enact laws that modify the existing rules, and it is also essential to punish those who violate these regulations. The imperative for the exploration of alternatives to animal experimentation must be emphasized. This strategy will uphold the right of animals to a decent standard of living and provide fair treatment.

Figure 1: Schematic representation of the ethical aspects, responsibilities and essentialities needed while using animals for research.



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Review Paper

A Critical Discussion of The International Bioethics Committee Ethical Directive on Surrogacy in the Light of The Universal Declaration of Bioethics and Human Rights

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ABSTRACT

In September 2017, the International Bioethics committee of UNESCO (hereafter IBC) established a working committee with the aim of focusing on the issue of reproductive technology and parenthood. In 2019, the IBC published a study paper entitled 'Report of the IBC on Assisted Reproductive Technologies and Parenthood' (hereafter RIAPT&P). Although the report pays attention to several matters, this article will focus on RIAPT&P's analysis, judgment, and advice regarding surrogacy. The purpose of this article is to determine the extent to which the advice of the RIAPT&P on surrogate motherhood aligns with the principles of the Universal Declaration of Bioethics and Human Rights (hereafter UDBHR). Additionally, the article will examine whether there are any challenges or issues associated with the RIAPT&P's guidance on surrogacy.
The RIAPT&P of the IBC rejects commercial surrogacy and indirectly accepts and recommends altruistic surrogacy based on three global principles as found in the UDBHR, namely autonomy, sharing of benefits and solidarity. In my opinion, it can be asserted with certainty that, when it is tested against the UDBHR, the IBC does ground their arguments in favour of altruistic surrogacy (indirectly) in the UDBHR. The recommendation of altruistic surrogacy by the RIAPT&P does pose problems, however, because it raises and unfortunately leaves unanswered critical foundational questions regarding the family, the best interests of the child and the status of the embryo, as demonstrated.

Keywords: Surrogacy, Universal Declaration of Bioethics and Human Rights, The International Bioethics Committee.
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The International Bioethics Committee (hereafter IBC) of the United Nations Educational, Scientific and Cultural Organization (hereafter UNESCO) was established in 1993. The IBC provides the only global forum for reflection on bioethics [1]. The committee played a major role in the development of UNESCO's Universal Declaration on Bioethics and Human Rights (hereafter UDBHR) [2-3].
This committee was appointed by the Director-General of UNESCO and consists of experts who aim at serving him or her with advice in their capacity as independent scientists. This advice reflects the best possible practice in the context of bioethics in response to pertinent global ethical questions. The Director-General subsequently offers this global bioethical advice to member states in the form of reports that can guide them around determining regulations and legislation. The

committee consists of 36 experts from a diversity of disciplines, namely genetics, medicine, law, philosophy, ethics, history, and the social sciences. This body does not represent member states, nor does it receive any instructions from them. The committee periodically creates smaller working groups that conduct research and prepare reports, each of which can be accepted or rejected by the IBC [1-2].

In September 2017, the IBC established a working committee with the aim of focusing on the issue of reproductive technology and parenthood. The committee worked on the report by means of email communication and physical meetings. The IBC approved the final report by email on 20 December 2019. In 2019, the IBC published a study paper entitled 'Report of the IBC on Assisted Reproductive Technologies (ART) and Parenthood' (hereafter RIAPT&P).

The RIAPT&P deals with a variety of assisted reproductive technologies (hereafter ART), namely gamete and embryo donation, the storage of gametes and embryos, mitochondrial donation, transplantation of the uterus, the use of artificial uteruses, gametes and after-death reproduction, surrogate motherhood, and genetic diagnosis [4]. Although the report pays attention to several matters, this article will focus on the RIAPT&P's analysis, judgment, and advice regarding surrogacy.

The report explicitly states that the UDBHR is very relevant to the discussion in the document and that it in fact forms the basis of the report. According to paragraphs 10 and 94 (of the RIAPT&P), the UDBHR offers a general framework with the purpose to provide an ethical answer to surrogate motherhood. Although the report acknowledges that the UDBHR serves as the ethical basis for its advice, the document only explicitly refers to the UDBHR once around its discussion of surrogate motherhood [4].

The purpose of the present article is to establish the extent to which the advice of the RIAPT&P on surrogate motherhood reflects the principles of the UDBHR. Given that there is only one direct reference to the UDBHR in the RIAPT&P, the advice presented in the latter will be examined to determine if there is compliance with the principles of the UDBHR.

Subsequently, the article determines whether the UDBHR *per se* truly serves as a framework for addressing and can give ethical guidance regarding global bioethical challenges: as centred, in this instance, on surrogate motherhood (art. 1.1, 2a-b) [3,5]. The secondary reason for the analysis is that, should its findings affirm that it does indeed serve as such a framework, the advice given to member states will be reinforced [2]. This would entail that the advice is based on human rights and global bioethical principles [6]. Simultaneously, the article will assess whether there are any challenges or issues within the RIAPT&P regarding their guidance on surrogacy. It should be noted that seven members of the IBC maintained a dissenting position regarding surrogacy, which was spelled out at the end of the report.

Description

In the paragraphs to follow, two matters will be discussed in brief, namely the RIAPT&P's understanding of that which surrogate motherhood embodies and the report's summary of arguments for or against the phenomenon. It is important to examine this information, because it provides the background against which the ethical analysis and advice of the report will be understood and discussed.

Surrogacy Explained

Under the sub-heading 'Technological And Scientific Developments (II,II.10)' of the RIAPT&P, the dynamics of surrogate motherhood is discussed comprising six paragraphs (48-52). According to the report, surrogacy is on the rise worldwide (par. 52). The *Oxford Dictionary*, used as reference in the report, defines surrogacy as a condition in which a woman has been impregnated by means of donor gametes or an embryo and gives birth to a baby on behalf of another couple or partners, while the baby is therefore relinquished to the commissioning parents (pars. 48, 50). The report distinguishes between 'traditional surrogacy', 'gestational surrogacy' and 'non-traditional surrogacy', albeit that it does not use the latter terminology.[4]

Traditional surrogacy takes place when the surrogate's ovum is fertilized with a male gamete from the commissioning couple by means of self-insemination or sexual intercourse. This was practised

until approximately 1978. After this, 'gestational surrogacy' was increasingly used. Surrogate motherhood is described in this way because there is no genetic link between the commissioning parents and the surrogate mother, while this is made possible by advanced medical technology such as the stimulation of ovulation and in vitro fertilization or other technologies (pars. 11-23, 48). According to the RIAPT&P, gestational surrogacy gives rise to various forms of parenting. The first possibility is the use of gametes that come from the commissioning parents. This entails a genetic link between the instructing legal/ social parents and the child (Par. 51a). A second possibility is where the female gamete comes from a donor and is fertilized with the gamete of the commissioning father (par. 51b). The third is where the gamete comes from the commissioning mother and is fertilized with the male gamete of a donor (par. 51c). Finally, there is the possibility where both the male and female gametes come from donors (par. 51d), which means that the child can have up to five different 'parents', namely the surrogate mother, the commissioning parents and the donor parents. 'Non-traditional surrogacy' takes place outside the context of traditional and gestational surrogacy where the parents are male and female (par. 48). This may involve homosexual couples or a single male/ female parent who wants to make use of surrogate motherhood (par. 20) [4].

Surrogacy Arguments

In paragraph VI.3 of the RIAPT&P, the arguments against and for motherhood are discussed.

The first argument against surrogacy is that most surrogate mothers make the decision under duress. Most women, especially in developing countries, are poor and illiterate and are (mis)used by commissioning parents and commercial intermediaries (par. 155). The second argument is the possibility that vulnerable women (as well as other women, however) do not function in a context of real informed consent. Women who enter the surrogate process cannot anticipate possible risks, such as the fact that they may form a strong bond with the child, experience resistance to giving up the child or the psychological struggle that this kind of pregnancy may well entail. (par. 156). The third argument is that surrogate motherhood is a form of commodification of the woman and the child, which degrades both to a means of trade, and therefore affects their dignity (par. 156) [4]. The fourth argument concerns the best interest of the child. Although there is a contract between the surrogate mother and the commissioning parents, there is no absolute control over the lifestyle choices of the surrogate mother, which may have a direct and potentially negative impact on the (health of the) child. Concomitantly, requirements set by the instructing parents can encroach on the time that is available for the surrogate: for instance, she may have to attend a clinic for long periods or may experience health problems centred on the pregnancy, and these may lead to physical and/ or psychological neglect of her own children. There is always the risk that the contracted child will not meet the expectations of the commissioning parents or surrogate mother and may be rejected at birth or later. Practices such as embryo selection on the basis of prenatal diagnosis or the selection of a donor can create the expectation among the commissioning parents that a 'perfect' baby will result, which can later lead to great disappointment and possible rejection (pars. 157-158) [4].

In the fifth place, this practice is an intrusion into the private life of the surrogate, because she is subject to the commissioning parents' preferences for her way of life (par. 157). The sixth argument centres on the health risks associated with surrogacy. Ovulation stimulation increases the risk of breast cancer and deep vein thrombosis, while multiple pregnancies may cause greater maternal morbidity and mortality (pars. 16, 21, 49). There are also dangers for the children in multiple pregnancies, including greater risk for prenatal and neural problems (par. 16). Babies born by means of in vitro technology have a greater risk of harm such as low birth weight, premature birth and birth pathology (par. 18) [4].

A final argument against surrogacy is that it affects the institution of the family (par. 159). Based on the Universal Declaration of Human Rights (UDHR, art. 16.3) [7] and International Covenant on Economic, Social and Cultural Rights (ICESC, art. 10.1) [8], the family is seen as a natural and fundamental unit of society that is changed by surrogacy. The institution of the family is harmed by the change of family roles when an aunt, a grandmother or sister acts as birth mother, while this adjustment can harm the interests of the child because, as stated in the judgment of the

European Court of Human Rights (case Frette v . France, 2002), 'it is not about giving a child to a family, but a family to a child' (par. 159). According to par. 5 of the dissenting opinion (RIAPT&P, p. 39), the latter proposition means that the best interests of the child must be given priority, which is understood that a child has the right to a natural or biological family. As a natural and fundamental unit between a man and a woman, the family centres on persons who must perform the basic family roles, and this is undermined by surrogate motherhood. The basic natural and fundamental parents are not the aunt, grandmother, sister, single parent, or lesbian couple, but the biological father and mother. In other words, a natural and fundamental family must be given to the child.[4]

The first argument in favour of surrogacy is of a medical nature. If a woman was born without a uterus or lost it due for medical reasons, or in a case where spontaneous pregnancy or pregnancy by means of IVF is repeatedly unsuccessful (pars. 52, 160), surrogacy offers a solution. The second, held by some utilitarian philosophers, is that the economy is market-driven, and that motherhood is a social construct that can be separated from pregnancy. Surrogacy is an autonomous and private matter (par. 161). The third is that new forms of parenting are made possible by genetically own children for homosexual couples or single men (par. 52).[4]

In conclusion, report states around these arguments that surrogacy 'raises a number of ethical challenges, which we will consider in Section VI.3' (par. 52).[4] This brings into focus the ethical advice of the RIAPT&P regarding surrogacy.

Analysis

Three positions

In Paragraphs VI.3.3., entitled 'Analysis', ethical aspects of surrogate motherhood are argued, and guidelines presented [4]. There are three sets of positions regarding surrogacy within the IBC as reflected in the RIAPT&P (par. 168). The first set of positions rejects altruistic and commercial surrogacy in its entirety on the basis of the arguments discussed above (pars. 157-159, 168) [4]. Along with this, two arguments are indirectly presented from the UDBHR against altruistic and commercial surrogacy (par. 168).

The first argument is grounded in human dignity (par. 163). Surrogacy affects the human dignity of the surrogate and the child. Although there is no direct reference to the UDBHR, it can be assumed that the IBC has in mind article 3.1 of the UDBHR, which is formulated as follows: "Human dignity, human rights and fundamental freedoms are to be fully respected".[3] The IBC interprets human dignity as a principle that is incompatible with the concept of all forms of surrogate motherhood, because a woman is used as a means to an end (par. 163, 168) [4]. However, the document does not explain why the employment of people to an end is automatically an infringement on human dignity.

The second argument against commercial surrogacy is based on the principle of vulnerability (par. 165). Article 8 of the UDBHR articulates this as follows: 'In applying and advancing scientific knowledge, medical practice and associated technologies, human vulnerability should be considered. Individuals and groups of special vulnerability should be protected, and the personal integrity of such individuals respected' [9]. Note that is the only article that directly refers to the UDBHR within the context of surrogate motherhood [3]. According to the RIAPT&P, women can be classified as persons with special vulnerabilities under certain circumstances. The report states that most women who consider acting as a surrogate are in dire financial need and are therefore economically defenceless. They can easily be exploited. Special vulnerability is defined in the report as the fact that, for some women, a greater risk of being harmed physically and psychologically exists. Such women have a greater chance of being deceived or forced into choices and disrespected (pars. 165-166) [4].

The second set of positions around the matter as found within the RIAPT&P rejects commercial surrogacy but accepts altruistic surrogacy as a method of creating a family. Here, reference can be made to the first and third arguments in favour of surrogate motherhood, as unpacked above in terms of infertility and alternative forms of parenting.

Altruistic surrogate motherhood, as discussed in the RIAPT&P, is based to my mind indirectly on three principles of the UDBHR, namely autonomy, sharing of benefits and solidarity (par. 164)

[4]. Once again, the report does not refer directly to the UDBHR, but simply offers a disappointingly vague and unreasoned reference to autonomy. It is not clear how the report understands autonomy within the context of surrogate motherhood, but a hesitant conclusion would be that the report links it to the concept of responsible liberty. In pars. 101 and 121 (which do not deal directly with surrogate motherhood) reproductive autonomy is explained as the right to make meaningful decisions regarding your life and health. The reference to autonomy in the report reflects article 5 of the UDBHR, which defines it as follows: 'The autonomy of persons to make decisions, while taking responsibility for those decisions and respecting the autonomy of others, is to be respected' [3]. Article 5 gives the instructing parents, couple, single parents, and the surrogate mother the right to an autonomous decision centred on participating in the technological reproduction process.

Article 26 of the UDBHR states that this declaration is to be understood as a whole and the principles are to be understood as of a complementary and interrelated nature. Each principle is to be considered in the context of the other principles, as appropriate and relevant in given circumstances [3]. In the light of the principle just mentioned (which is not mentioned in the report), in my judgment, the RIAPT&P determines that freedom of choice (autonomy) must be considered in the context of two other appropriate and relevant principles, each of which will subsequently be briefly discussed.

It can be assumed that altruistic surrogacy is also based on the principle of 'sharing of benefits' (par. 164). The report does not refer directly to the UDBHR but, instead, to the 'Report of the IBC on the Principle of Benefit Sharing,' which provides an interpretation of Article 15 of the UDBHR." [10]. In that sense, an indirect reference to article 15 does occur, which is formulated as follows: 'Benefits resulting from any scientific research and its applications should be shared with society as a whole and within the international community, in particular with developing countries. […] (g) other forms of benefit consistent with the principles set out in this Declaration.' (UDBHR, Art. 15g) [3]. Unfortunately, the RIAPT&P does not offer an extensive interpretation of the concept of 'sharing of benefits. A short sentence does state that the sharing of benefits can be carefully defined as the free provision of technological procreation services. This means that the surrogate mother must be freely willing to be part of a technological process without payment, in which she will be pregnant with the baby on behalf of the commissioning parents. Payment may be made, but only to cover the basic expenses of the surrogate mother (par. 164) [4].

The last principle on which altruistic surrogacy is founded is the concept of solidarity (par. 164) [4]. The RIAPT&P does not give a comprehensive description of the meaning of solidarity, though, but merely offers the following statement: 'Free provision of this kind strengthens the idea of solidarity among human beings, promotes the altruistic motivation'. The report therefore views solidarity as an act where people help each other free of charge and, in such a case, altruism is promoted. The report does not refer to the UDBHR, but the idea of solidarity does appear in article 13 and is formulated as follows: 'Solidarity among human beings and international cooperation towards that end are to be encouraged' (art. 13) [3].

The members of IBC who accept altruistic surrogacy believe that the technological practice may only take place under the following conditions (par. 169) [4].

a) The best interest and the rights of the child must be protected. This idea forms a nexus with article 7a of the UDBHR, which is however not mentioned in the report. According to article 7a, the best interests of persons without capacity (such as children) must be protected within the context of medical and technological practices. [3,11]
b) The autonomy and well-being of the surrogate mother and her family must be protected.
c) The successful involvement of all parties must be ensured, which entails that the surrogate mother and commissioning parents will undergo counselling and psychological assessment. The surrogate must also undergo regular medical tests. This condition dovetails with article 4 of the UDBHR, namely that, during the application of medical practices, the best interests of all parties must be promoted, and any harm must be prevented [3,12]. Also, as far as this principle is concerned, no direct reference is found in the RIAPT&P.

d) The report sets the condition that a family bond (or a close relationship) between the surrogate and the commissioning parents must exist or be formed, because this will cause the least problems. The reason on which this condition is based is not made clear. The only possible inference is that the condition is based on article 13 (which centres on solidarity and cooperation), especially article 24 (centred on international cooperation), which states in point 3 that states 'should respect and promote solidarity between and among States, as well as individuals, families, groups and communities...'.[3] This condition can be understood to promote solidarity among family members.
e) Surrogacy must be a financially neutral act. This is based on the principle of human dignity, as indicated.
f) Surrogate motherhood is only permitted where technological intervention is the only option for a couple to have their own child. It is unacceptable in situations where parents can conceive their own children. The principal basis of this condition is not made clear but make logical sense.

The RIAPT&P does not directly indicate that it supports and recommends altruistic surrogacy. But it is fair to assume that it does recommend altruistic surrogacy for consideration by States, based on inference, as indicated above. This inference is reinforced by the fact that, in its final recommendations (paragraphs VII), a request is made that commercial surrogacy should be prohibited, while governments should 'observe neutrality on different forms of family and parenthood chosen and not discriminate any of their citizens on the basis of their choice under the scope of each national legislation' (pars. 202c, f) [4]. This indirect recommendation in favour of altruistic surrogacy can clearly be related to the principles of the UDBHR, and therefore it can be stated the IBC report does comply with their statement that the UDBHR forms the framework of their thinking and advice.

The third set of positions adopted by the IBC also recognizes that altruistic surrogacy is acceptable in some cases, while there is doubt about whether the risks associated with altruistic surrogacy can in fact be avoided (see pars. 165-166, 168) [4].

Critical questions

In view of these considerations, the following critical questions arise. The first is that the report views family and parenthood as neutral phenomena and thus moves away from the belief that family is a natural unit. According to the UDHR (art. 16.3) [7] and ICESCR (art. 10.1) [8] as well as the IBC dissident group, the family is the natural unit for and is in the best interest of the child. On the one hand, one could claim that the concept of the natural family does not appear in the UDBHR but, on the other, the preface of the UDBHR states that the UDHR and ICESCR must be taken into account when applying the UDBHR. However, the ethical grounds on which the RIAPT&P bases its statement that the family is a neutral concept are not made clear.

The second critical comment to be made around the acceptance of altruistic surrogacy is that the IBC report considers the interests of the commissioning parents (autonomy) and the best interest of the child to be equivalent. Paragraph 200b states that 'the protection of rights of individuals involved in these new forms of parenthood must be balanced with the best interests of the child'. This thought conflicts with the UN Convention on the Rights of the Child, which clearly states that the best interest of the child will prevail over any other interest (art. 3) [13]. According to the preface of the UDBHR, this UN document must also be considered when it comes to the implementation of the principles of the UDBHR [3]. However, the ethical foundation on which the report bases its statement that the interests of the commissioning parents and the best interests of the child can be considered equal, is again not given.

The third critical comment around the acceptance of altruistic surrogacy is the fact that the report does not enter any debate about the status of the human embryo. RIAPT&P admits that 'the moral status of embryo is a fiercely debated philosophical problem' (par. 9) [4]. It is known that, in the surrogate process, several healthy and normal embryos are destroyed (par. 55, 58) [4]. The question arises whether Article 8 of the UDBHR, which centres on vulnerable human life, should not be held to be important around the debate about altruistic surrogate motherhood [14]. The global ethical idea of responsibility is an important part of the UDBHR, and the question arises whether

the responsibility to give guidance on important ethical issues is not being evaded (UDBHR, articles 2a-b, 5, 14) [3].

Summary

Indeed, one can agree with the minority group in the IBC report when they notice that the RIAPT&P 'is commendable in many respects: for its clear language; extreme precision and considerable rigor in argumentation; absolute correctness in the exposition of the different and controversial theses on the subject on the subject'.

The RIAPT&P of the IBC rejects commercial surrogacy and accepts and recommends altruistic surrogacy based on three global principles as found in the UDBHR, namely autonomy, sharing of benefits and solidarity. In my opinion, it can be asserted with certainty that, when it is tested against the UDBHR, the IBC does ground their arguments in favour of altruistic surrogacy (indirectly) in the UDBHR.

The recommendation of altruistic surrogacy by the RIAPT&P does pose problems, however, because it raises and unfortunately leaves unanswered critical foundational questions regarding the family, the best interests of the child and the status of the embryo, as demonstrated. Clearly the moral disengagement that goes along with this is problematic.

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Review Paper

Ethics of Genome Analysis and Testing in Sports Athletes - A Narrative Review

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ABSTRACT

The use of genetic testing in clinical medicine is beneficial. However, there are currently no scientific justifications for the use of genetic testing for enhancing athletic performance, sport selection, or talent spotting. Because direct-to-consumer genetic testing is not validated, is not replicable, and does not involve a medical professional, athletes and coaches should be discouraged from using it. We searched MEDLINE, EMBASE, Scopus, and Web of Science for English-language sources using the following keywords: review of the literature, narrative review, title, abstract, authorship, ethics, peer review, research methods, genetic testing, sports medicine, athletes, gene doping and counselors. Preference was given to the literature published after 2003. We searched the bibliographies of the retrieved articles written by experts in genetic testing and sports medicine. Medical practitioners should provide appropriate counselling and inform participants about the purpose, results, and potential ramifications. Rapid knowledge growth in human genomics has reduced costs and increased the availability of genetic testing. Genetic testing results should be interpreted by a medical practitioner with expertise to provide accurate health advice. Research conducted following the current guiding reference will enable the advancement of sport and exercise genomics in compliance with international data protection policies and best ethical standards, while also significantly reducing the risks associated with improper use of genomic information.

Keywords: Genetic Testing, Sports Medicine, Athletes, Gene Doping, Counsellors

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Introduction

Genetic testing has been valuable in clinical medicine, but there are no scientific grounds for its use in athletic performance improvement, sport selection, or talent identification. Genomics advances medical disciplines, including sport and exercise medicine, making genetic research, and testing more accessible. Over the past decade, genomics advancements have increased genetic testing availability, reduced costs, and reduced reporting times.

Direct-to-consumer genetic testing lacks validation, replicability, and medical practitioner involvement. This has led to increased research across medical specialties and improved understanding of genetic impact on health [1]. Genetic research and testing play a crucial role in various medical fields and therefor have led to the development of position statements such as Australian Medical Association (AMA) [2], Association of Genetic Nurses, and Counsellors (UK and Ireland) and National Human Genome Research Institute (US) on its management. The Australian Institute of Sport (AIS) has developed a position statement to address genetic advances and their impact on athletes' health and well-being. The AIS supports genetic research to

understand athlete susceptibility to injury or illness, but it must be conducted with ethical considerations and informed consent. The AIS focuses on athlete safety and well-being, ensuring scientific advancements without compromising sport integrity. The AIS will establish an ethical framework for genetic testing and research in sport, ensuring integrity, non-discrimination, privacy, and confidentiality, and guiding future focus [3]. Only after carefully weighing several ethical issues, including the provision of adequate informed consent, should genetic research be carried out. In the rapidly evolving field of genomic science, the AIS is dedicated to taking the lead in delivering an ethical framework that safeguards athletes' health and the integrity of sport. Therefore, the present study aimed to provide a comprehensive overview of the necessary advancements and ethical concerns required for the utilisation of genetic information for sports athletes.

Method of conducting the review

We searched MEDLINE, EMBASE, Scopus, and Web of Science for English-language sources using the following keywords: review of the literature, narrative review, title, abstract, authorship, ethics, peer review, research methods, genetic testing, sports medicine, athletes, gene doping and counsellors. Preference was given to the literature published after 2003. We searched the bibliographies of the retrieved articles written by experts in genetic testing and sports medicine.

Direct-to-consumer genetic testing for predicting sports performance and talent identification: Consensus statement.

Researchers studying sport and exercise genetics generally agree that genetic testing is not useful for identifying talent or customizing training regimens to maximize performance. Recent years have seen the emergence of a growing market for direct-to-consumer marketing (DTC) tests that claim that they can identify children's athletic talents, despite the lack of supporting data. Parents and coaches are the primary target market. The scientific community is concerned that the current state of knowledge is being exaggerated for profit. Legislation and generally acknowledged guidelines are still lacking for DTC testing about all types of genetic testing, not just talent identification [4].

European workshop on the genetic testing in Europe

The field of genetic testing has experienced exponential growth in recent years. Even greater opportunities and anticipated effects on care management are linked to more recent developments in molecular medicine. As these technologies are incorporated into healthcare system, it is crucial that their use be carried out within a conscientious framework of supporting actions and initiatives. As a result, policy discussions about genetic testing are now being held at various institutional and global levels to facilitate the prompt introduction of necessary requirements by decision-makers at all levels, the European Commission has arranged several initiatives that involve various services that approach the topic from different angles [5].

Genetic Counselling and the Ethical Issues Around Direct-to-Consumer Genetic Testing

Direct-to-consumer (DTC) genetic testing has drawn more attention in the last few years from the academic, medical, and public domains. DTC genetic testing businesses are met with a great deal of scepticism and criticism, especially from the fields of medicine and genetic counselling. This begs the question of what features of direct-to-consumer genetic testing cause genetic counsellors to feel both promises and concerns. To answer this question, this paper examines DTC genetic testing from an ethical perspective. We draw attention to the ethical issues brought up by DTC genetic testing companies by considering the two main ethical frameworks that influence genetic counselling: the ethic of care and principle-based ethics [6].

Genetic testing for screening Health-related disorders in Sports athletes

Literature suggests that genetic testing for health-related reasons is becoming more common in sports medicine, with tests like HLA-B27, C282Y, and being common[4]. Some genetic disorders, like Marfan syndrome, pose health risks for individuals engaging in strenuous activities.

Professional basketball and volleyball associations should consider Marfan syndrome when conducting preparticipation screening, and consider it when family history, symptom history, physical examination, or diagnostic investigations raise suspicions [7-8]. Genetic testing should only be conducted when clinically indicated by medical history and physical examination. Medical practitioners should provide appropriate counselling and inform patients about the purpose, results, and potential ramifications [9]. Rapid knowledge growth in human genomics has reduced costs and increased the availability of genetic testing. Direct-to-consumer services are available commercially without medical involvement, but some countries have legislation requiring medical practitioner involvement. Genetic testing results should be interpreted by a medical practitioner with expertise to provide accurate health advice. Athletes and coaches prioritize nutritional and training strategies, making them vulnerable to direct-to-consumer genetic testing. Accurate or nonH63DLiterature suggests that genetic testing for health-related reasons is becoming more common in sports medicine, with tests like HLA-B27, C282Y, and H63D evidence-based advice could harm athletes' health [10-12].

National Health and Medical Research Council. Principles for the translation of 'omics'–based tests from discovery to health care

The National Statement [13] guides consent for individuals in dependent or unequal relationships. Athletes should have the choice to participate in or decline genetic research, with no discrimination or penalty. Researchers should respect athletes' decisions without impacting their services. Privacy of genetic information is crucial for ethical practice, and the American Medical Association (AMA) recommends not disclosing genetic information to third parties without written consent. Athletes often sign a waiver of medical confidentiality when entering elite or professional sports programs, allowing medical personnel to share information with coaching and support staff. Athletes should have the right to withdraw from studies and request their information and samples destroyed. Researchers should ensure withdrawal does not negatively impact services or relationships, as genetic information is patient property. Children should not undergo predictive genetic testing until they reach consent, according to the American Society of Human Genetics (ASHG). They should also have the right to withdraw from studies and request their information and samples destroyed. Researchers should ensure withdrawal does not negatively impact services or relationships between service providers and athletes.

Gene doping and Genetic research

The World Anti-Doping Agency (WADA) [14] defines gene or cell doping as the non-therapeutic use of genes, genetic elements, or cells to enhance athletic performance. The 2015 Prohibited List prohibits the transfer of polymers of nucleic acids or nucleic acid analogues and the use of normal or genetically modified cells. While gene therapy has potential benefits, it is unlikely to confer a favourable benefit-to-risk ratio for improving sporting performance [15]. It is unethical to attempt genetic modification on elite athletes and unsafe due to the lack of clinical trials. Ethical genetic research in sport and exercise medicine can develop strategies for detecting gene doping and promote proactive researchers in the fight against doping [16].

Ethics of genetic research concerned with talent identification in Sports athletes

High-performance sports are competitive environments, and genetic testing is increasingly being studied to identify individuals with advantageous genetic characteristics [17]. Two genes, angiotensin I-converting enzyme (ACE) and α-actinin-3 (ACTN3), are associated with sports performance. The ACE gene has been linked to improved performance in endurance sports, while the ACTN3 R577X polymorphism results in a premature stop codon and a deficiency in α-actinin-3 protein. Research has consistently shown that ACE and ACTN3 genotypes influence human performance in sprint/power or endurance events. However, there is no scientific evidence for the predictive value of genetic profiling in sports performance, as most sports have a combination of sprint/power and endurance components, along with various genetic, physical, environmental, and psychological elements [18]. Genetic attributes are just one of many contributing factors to athletic success. Direct-to-consumer genetic testing offers predictions on athletic ability, primarily

based on ACE and ACTN3. However, concerns arise about the impact on individual athletes, especially children, as the lack of evidence-based interpretation may lead to inappropriate advice. Current genetic testing has zero predictive power and should not be used by sporting organizations, athletes, coaches, or parents. Young athletes may face limitations in their potential activities, and genetic research concerning performance is a new field of medical science, with misinterpretation of data being a real risk [19].

Ethics of Genetic Research Concerns Related to Sports

Athletes often experience injuries in various sports, with each sport having its injury risk profile. FIFA reports an injury rate of 2.6 injuries per match played, while the London Olympic Games saw 11% of athletes reporting an injury [20]. Running-related lower limb injuries have a higher incidence, with Achilles tendinopathy, IT band syndrome (ITBS), and Medial tibial stress syndrome (MTSS) being the most common injuries. Elite athletes face significant challenges due to injury-induced injuries, which can prevent training and competition progress. Research on genetic factors predisposing athletes to injury can help coaches customize training loads and administer preventive, evidence-based interventions to reduce injury. While studies have shown links between genetic variants and sports-induced injuries, more research is needed to replicate and interpret these associations [21]. Further research should be conducted in non-Caucasian populations and other populations. Delaying genetic testing in sports should not affect an athlete's position or selection to elite training programs. It is important to understand the issues surrounding genetic testing and not offer it to athletes under 18. Clear policy guidelines should be communicated to athletes and staff about accessing genetic information. Genetic information should be used for injury prevention and health management strategies, not for talent identification or high-performance programs. However, implementing genetic testing in sports without sufficient evidence is risky [22].

The Future of Genetic Research in Exercise Science and Sports Medicine

Every study involving human performance will be subject to standard regulatory procedures, including review by an ethical committee for human research to confirm that the proper security measures are in place. Because of the interest the media has exhibited in prominent elite athletes, privacy concerns are especially delicate when it comes to these people. The International Declaration on Human Genetic Data was adopted in 2003 by the United Nations Educational, Scientific, and Cultural Organization. This acknowledged the unique significance that human genetic data hold as it can be used to predict an individual's genetic predispositions. It can also have a significant impact on the family, including offspring, spanning generations and, in some cases, the entire group to which the individual belongs. It may contain information whose significance is unknown at the time biological samples are collected and finally, it may have cultural significance for individuals or groups [23].

It is hardly unexpected that the government, sports administrators, and ethicists are interested in the possible misuse of genetic information in sports. As an illustration, consider the comprehensive joint investigation conducted by the National Australian Health Ethics Committee of the Health and Medical Research Council investigating several facets of human genetics in Australia, ranging from medical to non-medical applications of genetic data [23].

ACTN3 genotype is associated with human elite athletic performance

There is mounting evidence that athletic performance is strongly influenced by genetics and that there has been an evolutionary "trade-off" between the development of performance traits for endurance and speed. We have recently shown that homozygosity for a common stop-codon polymorphism in the ACTN3 gene, R577X, results in the absence of the skeletal-muscle actin-binding protein alpha-actinin-3 in 18% of healthy White individuals. Alpha-Actinin-3 is particularly expressed in fast-twitch myofibers, which oversee producing force quickly. Alpha-actinin-2, a homologous protein, most likely compensates for alpha-actinin-3 deficiency, preventing the development of a disease phenotype. On the other hand, ACTN3's high level of evolutionary conservation indicates that it may have a function apart from ACTN2. This implies

that the ability of skeletal muscle to produce powerful contractions is positively impacted by the presence of alpha-actinin-3 [24].

Discussion

Genomic research faces challenges like informed consent, data storage, and privacy [11]. Australia's National Health and Medical Research Council (NHMRC) has released a document establishing principles for translating genomic research into practice, including reproducibility, collaboration, education, and interoperability. The four domains of test discovery, clinical validation, healthcare, and data management are essential for researchers to consider when developing and refining genomic techniques on athletes. Ethical concerns in genetic research apply to elite and recreational athletes, as well as other human health fields. It is crucial to inform potential participants about the research's nature, risks, and benefits. Informed consent is crucial in genomics research, as language barriers can hinder understanding [13]. Clear language and clear explanations of genetic information purposes are essential. Researchers should validate athlete comprehension by 'road testing' consent forms on athletes. A clear prospective agreement with patients is crucial for managing genetic test discoveries, and the ethics approval process must consider adverse discoveries. Elite athletes should be attributed their willingness to participate, not coaches or sporting organizations [14]. Precision medicine and gene therapy are predicted to become more commonplace due to the rapid advancements in genomics technologies, including high throughput DNA sequencing, machine learning algorithms for analysing large amounts of data, and gene editing methods. But this growth will bring up a lot of significant new challenges, such as moral, social, ethical, and privacy concerns. By using these cutting-edge technologies, the field of exercise genomics has also progressed. To enable the required developments in the field of sport and exercise medicine and safeguard athletes against any privacy invasion and exploitation of their genomic information, there is a pressing need for guiding references in sport and exercise genomics. To progress sport and exercise genomics without jeopardizing athletes' privacy or the work of international sports federations, healthcare professionals must possess a thorough understanding of ethics and data protection policies.

Conclusion

All areas of medicine, including sports and exercise medicine, are seeing tremendous advancements in the field of genomics. Numerous athletic organizations and individuals now have easier access to genetic research and testing because of technological breakthroughs and cost savings. Rapid knowledge growth in human genomics has reduced costs and increased the availability of genetic testing. Genetic testing results should be interpreted by a medical practitioner with expertise to provide accurate health advice. Research conducted following the current guiding reference will enable the advancement of sport and exercise genomics in compliance with international data protection policies and best ethical standards, while also significantly reducing the risks associated with improper use of genomic information.

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Original Research Paper

A Novel Training Program on Ethics of Artificial Intelligence to Empower Educators and Students of Health Professions Education and Engineering Education – An Exigent Need of the AI-Driven World

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ABSTRACT

Background: Ethics of AI in healthcare involves ensuring the responsible use of artificial intelligence to safeguard patient privacy and prevent biases in medical decision-making, promoting equitable and ethical healthcare practices. This study presents the outcomes of a novel training program aimed at addressing the ethical implications of AI integration in healthcare. It brought together professionals from various disciplines to foster knowledge sharing and address concerns such as patient privacy, data anonymity, and informed consent.
Methodology: This novel training program included presentations, group discussions, and debates. A pre-test and post-test assessed the participants' knowledge, and an online survey evaluated session effectiveness.
Results: Statistical analysis indicated a significant improvement in participants' understanding of ethical concerns in AI in healthcare, with p-values < 0.0001. Feedback highlighted increased confidence in addressing these issues.
Conclusion: The training program successfully enhanced the knowledge and preparedness of healthcare professionals in navigating the ethical challenges of AI in healthcare, indicating the importance of multidisciplinary collaboration in this field.
Keywords: Artificial intelligence, Data, Ethics, Health Professions, Multidisciplinary, Technology.

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Introduction

Artificial Intelligence (AI) has made remarkable strides in transforming the landscape of healthcare and technology [1]. From disease diagnosis to treatment planning and patient management, AI has demonstrated its potential to revolutionize clinical training and research. However, with this rapid advancement comes a myriad of ethical concerns that demand careful consideration [2]. The intersection of AI and healthcare presents both unprecedented opportunities and daunting challenges, making it essential for stakeholders to navigate the ethical frontiers of this technological frontier [3].

The integration of AI into healthcare has opened a new era of efficiency, accuracy, and accessibility. Machine learning algorithms can analyse vast amounts of medical data in seconds, aiding healthcare professionals in making faster and more informed decisions [4-5]. Diagnostic AI models can detect diseases at earlier stages, potentially saving lives, while predictive analytics can help in resource allocation and healthcare planning [6-7]. Moreover, AI-driven research accelerates drug discovery and personalized medicine, bringing us closer to tailored treatments for various medical conditions. These technological advancements are undoubtedly promising, but they also raise ethical concerns that need careful attention [8-9].

One of the primary ethical concerns surrounding AI in healthcare is patient privacy. As AI systems access and analyze patient data, ensuring the protection of sensitive medical information becomes paramount [10]. Another critical ethical consideration is the potential for AI to perpetuate biases present in historical healthcare data. If not properly addressed, AI systems can exacerbate disparities in healthcare outcomes, particularly affecting marginalized communities [11-12]. However, with these technological leaps come significant ethical considerations that need to be addressed. To bridge the gap between healthcare professionals and engineering professionals, a novel training program was conducted bringing together faculty members from diverse healthcare disciplines and engineering fields.

The training program aimed to foster a multidisciplinary dialogue that encourages collaboration and knowledge sharing among healthcare practitioners, educators, researchers, and engineers. By uniting these two seemingly distinct worlds, the goal was to explore the ethical frontiers of AI in healthcare, understand its implications, and work towards responsible and ethical AI integration in clinical training and research.

Methodology

Participants: The training program brought together 40 participants from a diverse group, including multidisciplinary healthcare professionals from Medicine, Dentistry, Ayurveda, Siddha, Unani, Homoeopathy, Nursing, Educators, Researchers, and Engineers. This multidisciplinary composition facilitated rich discussions and knowledge sharing.

Training Sessions: The training program followed a structured agenda, encompassing a range of themes and topics related to AI in healthcare ethics. The training featured multiple sessions, with expert speakers leading discussions and interactive activities. The methodology involved presentations, group discussions, and debate sessions, ensuring active participation and engagement.

Assessment: Prior to the training, participants underwent a pre-test consisting of 25 application-based questions to assess their baseline knowledge of AI in healthcare and its ethical dimensions. This pre-test included questions specifically focused on data anonymity and informed consent. After the training, a post-test was administered to measure the knowledge gained during the training period.

Evaluation: Each session's effectiveness and participants' confidence levels in addressing ethical concerns related to AI in healthcare were evaluated using structured online survey using validated questionnaire.

Statistical Analysis: The statistical package for social science (SPSS), version 17, created by SPSS Inc. USA for Microsoft Windows, was used to analyze all quantitative data. A significance threshold of $p < 0.05$ was applied. After determining the mean and standard deviation (SD) for each continuous variable, univariate statistics were used to perform a descriptive analysis. The T-test and Analysis of Variance (ANOVA) were then used to assess the differences between the mean

and SD. Both the Kruskal Wallis test and the Mann-Whitney U test were employed to look for differences in non-normal distributions.

Ethical Declarations: Ethical considerations were paramount throughout the training. Presenters and organizers adhered to ethical guidelines. Consent for data collection, assessment, and evaluation was obtained from all participants, and their anonymity was preserved.

Results

The results of the novel training program on the ethics of AI demonstrated a significant improvement in participants' knowledge regarding ethical concerns, particularly data anonymity and informed consent in the context of AI in healthcare. Statistical analysis of the pre-test and post-test results revealed a remarkable enhancement in participants' understanding, with p-values less than 0.0001, indicating highly significant changes. Furthermore, the evaluation reports provided overwhelmingly positive feedback. Participants expressed satisfaction with the training content and its ability to address complex ethical issues in AI-driven healthcare. The interactive sessions, including group discussions and debate sessions, were particularly well-received, allowing participants to actively engage with the material and their peers. The evaluation of the training is presented in Table 1.

Perhaps most notably, participants reported a substantial increase in their confidence levels concerning ethical concerns related to AI in healthcare. This newfound confidence was reflected in their ability to critically assess and address issues such as data anonymity and informed consent. The training effectively empowered participants to navigate the ethical challenges posed by AI, fostering a sense of competence and preparedness in the rapidly evolving field of healthcare technology. the increase in confidence level before and after the workshop is shown in Figures 1 and 2.

Table 1: Evaluation of Training Program

Evaluation Item	Strongly Agree (%)	Agree (%)	Neither Agree nor Disagree (%)	Disagree (%)	Strongly Disagree (%)
The session materials and discussions on AI ethics in healthcare were clear and understandable.	75	25	0	0	0
I actively participated in the discussions and activities during the session.	62.5	37.5	0	0	0
The session format, including group discussions and hands-on activities, promoted meaningful interaction among participants.	75	25	0	0	0
My understanding of AI ethics in healthcare improved because of this session.	66.7	29.2	4.1	0	0
The session influenced my attitudes / perceptions regarding the use of AI in healthcare positively.	79.2	20.8	0	0	0
I developed practical skills related to AI ethics in	50	45.8	4.2	0	0

healthcare and decision making during the session.					
The session facilitator was qualified and demonstrated expertise in the field of AI ethics in healthcare.	70.8	29.2	0	0	0

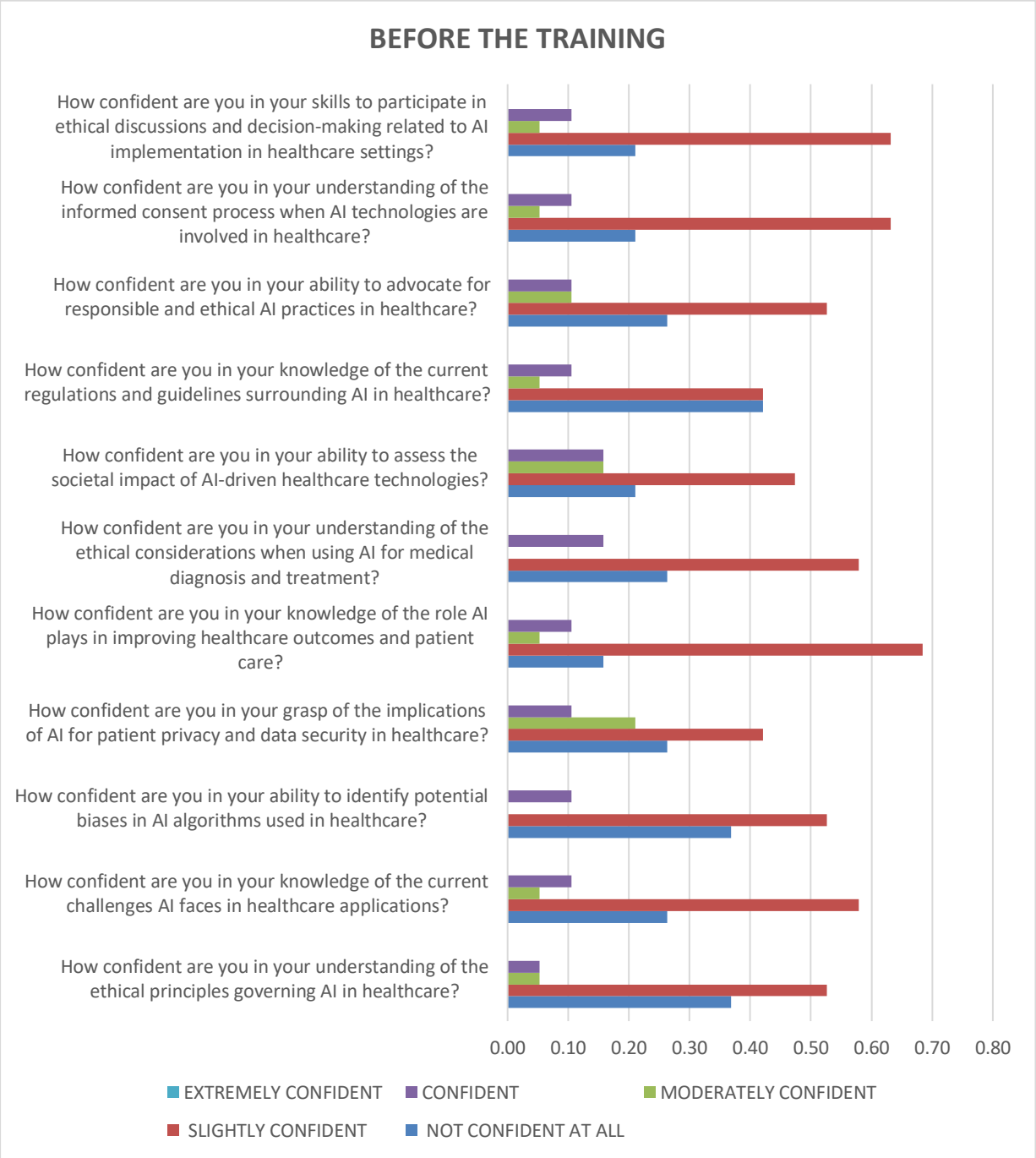

Figure 1: Confidence among participants before the training

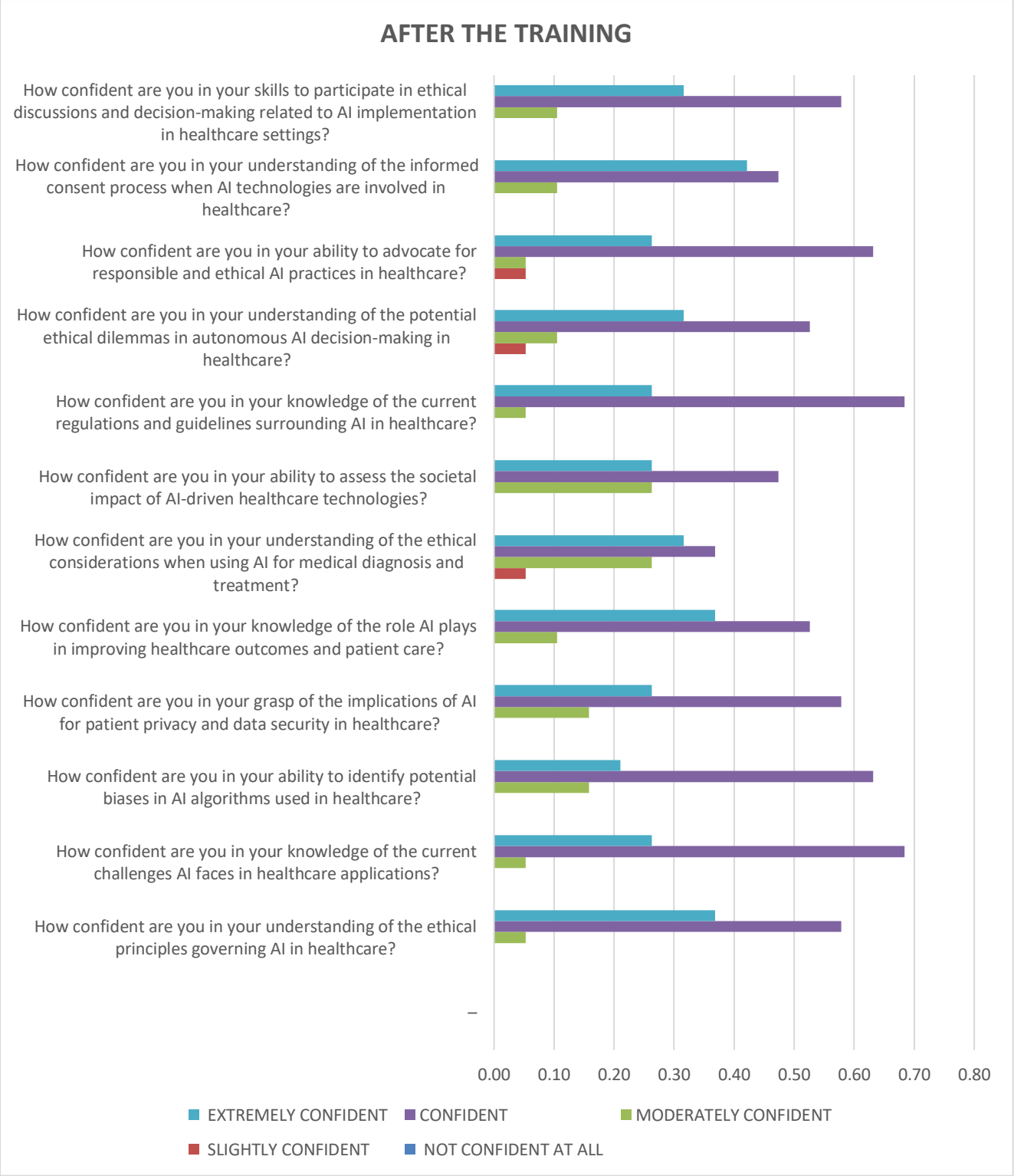

Figure 2: Confidence among participants after the training

Discussion

The success of the training program can largely be attributed to its comprehensive and multidisciplinary approach. By addressing the intersection of AI and healthcare ethics from various angles, the training provided attendees with a well-rounded understanding of the complex issues at hand. One key takeaway was the emphasis on the paramount importance of maintaining patient privacy in the era of data-driven healthcare [13]. With AI playing an increasingly

significant role in healthcare, it is crucial to ensure that patients' sensitive information remains secure and confidential [14]. Additionally, the training shed light on the potential risks associated with AI, such as perpetuating biases in medical decision-making. Participants recognized the need for rigorous ethical guidelines and oversight to prevent AI algorithms from inadvertently reinforcing existing disparities in healthcare. Moreover, the training underscored the urgency of integrating ethical considerations into AI implementations in clinical settings, emphasizing the importance of responsible AI deployment that prioritizes patient well-being.

The interactive format of the training program played a pivotal role in its success. By encouraging active participation and open discussions, it fostered a deeper understanding of the intricate ethical dilemmas posed by AI in healthcare. Attendees were able to engage with experts and peers, share their insights, and collectively grapple with these complex issues. This interactive approach allowed participants to explore real-world case studies and scenarios, enabling them to apply ethical principles to practical situations. Overall, the training not only provided a platform for knowledge exchange but also empowered attendees with the tools and insights necessary to navigate the ethical challenges inherent in the integration of AI into healthcare which is crucial for healthcare providers and technologists [15]. Thus, the training program's success can be attributed to its holistic approach, emphasizing patient privacy, addressing biases, and advocating for ethical AI integration, combined with its interactive format that facilitated meaningful engagement and understanding among participants.

Conclusion

The training program significantly advanced the knowledge and confidence of healthcare professionals in addressing the ethical challenges posed by AI in healthcare. It underscored the critical role of multidisciplinary collaboration and continuous education in ensuring the responsible and ethical application of AI in clinical settings, ultimately contributing to improved patient care and health outcomes.

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Original Research Paper

Enhancing the Ethical Competence of Artificial Intelligence in Healthcare: Outcomes of a Multi-disciplinary Collaborative Workshop

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ABSTRACT

Background: The integration of Artificial Intelligence (AI) in healthcare is transforming medical diagnostics, treatment personalization, and operational efficiencies, yet it introduces ethical concerns and demands multidisciplinary knowledge among healthcare professionals. To address this, the **CONNECT** with **AI**" (**C**ollaborative **O**pportunity to **N**avigate and **N**egotiate **E**thical **C**hallenges and **T**rials with **A**rtificial **I**ntelligence) workshop was organized to enhance understanding and address the ethical challenges associated with AI in healthcare.
Methodology: This study was conducted with multi-disciplinary participants who attended the workshop. Data were collected using pre-and post-workshop confidence level assessments and feedback on various workshop sessions. Statistical analyses of the data were performed using SPSS to evaluate the impact of the workshop on participants' confidence and understanding of AI in healthcare.
Results: There was a significant increase in confidence levels post-workshop across all domains,

particularly in understanding the ethical principles and informed consent processes involving AI technologies in healthcare. Feedback scores indicated high satisfaction with the quality of the presentations, level of interaction, and depth of content, emphasizing the workshop's effectiveness in addressing the complexities of AI applications.
Conclusions: The "CONNECT with AI" workshop significantly improved participants' understanding and confidence in applying AI in healthcare settings, while also highlighting the necessity of ongoing education in AI ethics and regulations. The findings advocate for continued interdisciplinary education to prepare healthcare professionals for the ethical integration of AI technology.
Keywords: Artificial Intelligence, Healthcare, Ethics, Interdisciplinary Education, Workshop Evaluation, AI Confidence.

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Introduction

Artificial Intelligence (AI) is a branch of computer science dedicated to creating systems capable of performing tasks that typically require human intelligence [1]. These tasks include learning, reasoning, problem-solving, perception, and language understanding. AI technologies, such as machine learning, natural language processing, and robotics, are increasingly pervasive across various sectors [2].

In healthcare, AI is revolutionizing the field by improving diagnostics, enhancing treatment personalization, and optimizing operational efficiencies. AI-driven tools can analyse complex medical data, assist in early disease detection, and predict patient outcomes more accurately [3-4]. Additionally, AI is integral to developing personalized medicine, enabling treatments tailored specifically to individual patients based on their genetic makeup and lifestyle [5].

However, the integration of AI in healthcare brings substantial ethical concerns. Issues such as data privacy, informed consent, and potential biases in AI algorithms must be addressed to prevent inequalities and maintain trust in healthcare systems [6-7]. Moreover, the accountability for AI-driven decisions in medical settings remains a critical challenge, as it involves determining the responsibility between human clinicians and AI systems [8-9].

Given the complexity and potential risks associated with AI in healthcare, there is a pressing need for multidisciplinary training. Healthcare professionals must be equipped not only with knowledge of AI technology but also with the ethical frameworks and legal considerations surrounding its use [10-11]. Interdisciplinary collaboration among technologists, ethicists, clinicians, and legal experts is essential to navigate the challenges posed by AI.

To address these issues, the "CONNECT with AI" (Collaborative Opportunity to Navigate and Negotiate Ethical Challenges and Trials with Artificial Intelligence) workshop was organized from April 2-4, 2024, at the SRM Medical College Hospital and Research Centre, SRM Institute of Science & Technology SRM Nagar, Kattankulathur, Chengalpattu District, Tamil Nadu, India. This 3-day event brought together experts from various disciplines. The workshop aimed to foster understanding and collaboration among professionals to effectively integrate AI in healthcare while addressing ethical concerns and promoting best practices.

Methodology

Study Design and Setting: This study assesses the "CONNECT with AI" workshop outcomes—a 3-day event aimed at navigating ethical challenges in AI, held at the SRM Medical College Hospital and Research Centre, SRM Institute of Science & Technology SRM Nagar, Kattankulathur, Chengalpattu District, Tamil Nadu, India.

Study Participants: Volunteers from various multi-institutional, interdisciplinary, and interprofessional backgrounds participated in this study. All provided informed consent, and their involvement was entirely voluntary. The professional backgrounds of participants included Medicine, Dentistry, Nursing, Allied Health Sciences, Engineering & Technology, and Law. The participants were organized into 10 groups, each consisting of one professional from each of the six disciplines mentioned.

Data Collection:

1. **Assessment of Confidence Levels:** To evaluate participants' confidence in applying AI across various fields, a 10-item validated questionnaire was administered before and after the workshop. This questionnaire used a 5-point Likert scale ranging from "1 - Not at all confident" to "5 - Extremely confident."
2. **Workshop Feedback:** Participants were asked to rate each session on a 10-point scale across five dimensions: quality of the presentations, level of interaction during the sessions, effectiveness of group discussions and activities, depth of content, and expertise of the speakers.

Data Analysis: The statistical analysis included descriptive univariate assessments of continuous variables, represented through their mean and standard deviation. T-tests and Analysis of Variance (ANOVA) evaluated differences among these variables. The Statistical Package for Social Sciences (SPSS, version 17) for Microsoft Windows, by SPSS Inc., USA, was the tool used for these analyses. A p value of less than 0.05 was deemed statistically significant. Qualitative analysis included thematic and content analysis of the recorded transcripts in Focus Group Discussions.

Ethical Considerations: The study was conducted following ethical guidelines approved by the institutional review board. Participants were informed about the study's objectives and purpose of data utilization. Their participation was voluntary, and confidentiality was assured with data anonymization. Written informed consent was obtained from all participants.

Results

Assessment of Confidence levels:

The confidence levels regarding the use of AI before and after the workshop were measured on a 5-point Likert scale, with 1 indicating "Not at all confident" and 5 indicating "Extremely confident." and the mean confidence scores were calculated. There was a significant improvement in their confident levels with $p<0.0001$. Figure 1 showcases the results of a survey assessing confidence levels. Before the workshop, the participants generally reported lower confidence across all areas, with scores ranging between 1.6 and 2.4. The lowest pre-workshop confidence is in "Knowledge of the current challenges AI faces in healthcare applications" (1.7). After the workshop, there is a noticeable increase in confidence across all domains. The mean scores range from 4.0 to 4.8, showing a significant improvement. The areas where participants felt most confident after the workshop are "Understanding of the informed consent process when AI technologies are involved in healthcare" and "Understanding of the ethical principles governing AI in healthcare," both scoring 4.8. The area with the lowest post-workshop confidence is "Knowledge of the current regulations and guidelines surrounding AI in healthcare," with a mean score of 4.0.

"CONNECT with AI" Workshop Feedback:

Table 1 presents feedback scores for various sessions conducted over a three-day workshop on the application of AI in healthcare and its ethics. Each session is evaluated across five dimensions: Quality of Presentation, Interaction during Session, Effectiveness of Group Discussions and Activities, Depth of Content Provided, and Expertise of Speaker on a 10-point rating scale. Overall, the consistently high ratings across all sessions underscore the workshop's effectiveness in addressing the complexities of applying AI in healthcare, facilitating engaging and informative discussions, and providing participants with a deep understanding of the subject matter from both a technical and ethical standpoint.

Discussion

The "CONNECT with AI" workshop, hosted at the SRM Institute of Science & Technology, served as a critical platform for facilitating interdisciplinary learning among professionals from various sectors, particularly healthcare. This study provided a rigorous evaluation of the workshop, revealing significant insights into the educational impact of such initiatives on participants' understanding of AI's ethical, legal, and practical dimensions.

Figure 1: Confidence levels of participants before & after the workshop

Table 1: "CONNECT with AI" Workshop Feedback

Day/Session	Quality of Session	Interaction during session	Effectiveness of group activities and discussions	Depth and Quality of Content	Expertise of Presenter
Day 1					
Introduction to AI	9.2	9.3	8.6	8.8	8.6
Introduction to Ethical Principles	9.5	8.7	8.5	8.9	8.6
Ethical Principles of AI in Healthcare	8.8	8.6	9.3	8.7	9.0
Case Discussions of Ethical Principles	8.7	9.5	8.9	9.6	9.5
Day 2					
Ethical Frameworks for AI Implementation	9.5	9.3	9.5	9.6	9.5
Debate session Human Vs AI Judgement	9.0	9.3	9.2	9.3	9.0
Ethical principles in development, validation and deployment phases	9.1	9.2	8.5	8.7	9.3
Case Discussion on Strategies for Responsible AI implementation	9.4	9.2	8.9	9.2	9.0
Day 3					
Regulations & Policies of AI in healthcare	9.4	9.6	9.5	9.3	9.2
Group Presentation & Discussion	9.2	9.5	9.6	8.7	9.1

Statistical analyses demonstrated a notable improvement in participants' confidence levels regarding the application of AI in healthcare post-workshop, suggesting that the workshop effectively addressed initial uncertainties and knowledge gaps. Initially, the lower confidence levels among participants could largely be attributed to the relatively new presence of AI in clinical settings and the inherent complexities of AI technologies. The significant rise in confidence post-workshop underscores the value of structured, interactive, and comprehensive educational interventions in demystifying AI and enhancing proficiency among healthcare professionals [12-13].

Critically, the workshop curriculum was not limited to theoretical knowledge but emphasized real-world applications, ethical dilemmas, and regulatory frameworks. This holistic approach ensured that participants could grasp the multifaceted nature of AI in healthcare, appreciating not only its potential to transform patient care but also the ethical considerations that it necessitates [14]. The emphasis on data privacy, informed consent, and the mitigation of algorithmic biases is particularly noteworthy, as these areas are fundamental to the responsible use of AI in healthcare. By equipping participants with a deep understanding of these issues, the workshop contributed to fostering ethical AI practices that prioritize patient rights and equity [15-16].

Feedback from participants further corroborated the effectiveness of the workshop. High ratings across various sessions concerning the quality of presentations, interaction levels, and depth of content reflected the workshop's success in meeting the diverse educational needs of an interdisciplinary audience. Such feedback not only highlights the participants' engagement and satisfaction but also supports the effectiveness of the workshop's instructional design and delivery [17-18].

Nevertheless, the persistence of lower confidence in understanding current regulations and guidelines post-workshop signals a critical area for further improvement. As AI technologies continue to evolve, so too must the regulatory frameworks that govern their use. This dynamic landscape requires ongoing educational efforts to ensure healthcare professionals remain adept at navigating future challenges. The need for continuous professional development is imperative to keep pace with technological advancements and regulatory changes.

Conclusion

The "CONNECT with AI" workshop not only enhanced participants' confidence in using AI but also played a crucial role in shaping their understanding of the ethical, legal, and practical challenges involved. The findings suggest that such interdisciplinary workshops are invaluable in preparing healthcare professionals for the ethical integration of AI into clinical practice. They also highlight the need for ongoing education and policy development to ensure that AI is used responsibly and effectively to enhance patient care without compromising ethical standards or equity in healthcare access.

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Viewpoint

Ethical Issues in Stem Cell Research Through the Prism of Various Religions of The World: A Memoir

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Stem cells, by definition, are a type of undifferentiated cell population that may divide indefinitely and replenish themselves. These appear to originate from a single parental cell (clonal) and then go on to differentiate into various cell and tissue types (potent). Different types of stem cell sources have different levels of efficacy. Pluripotent cells, the first type, are embryonic stem cells that originate in the inner cell mass of the embryo, while induced pluripotent cells are created when somatic cells are reprogrammed. Endoderm, mesoderm, and ectoderm are the three germ layers into which pluripotent cells can differentiate. The mesenchymal stem cells that give rise to adipose tissue, bone, and cartilage are examples of multipotent stem cells that can develop into tissues originating from a single germ layer [1]. Therefore, these stem cells are the basis for the development of all other cells, tissues, and organs in the body.

Stem cells are cells with the ability to differentiate into one or more cell types and at the same time keep replacing itself so as not to become depleted. Stem cells are broadly categorised into embryonic stem cells (ES cells) and adult stem cells. Embryonic stem cells are those obtained from pre-implantation embryos while adult stem cells are undifferentiated cells found among the differentiated cells, present in most adult tissues [1]. Stem cells can be further categorised based on their potency, or the number of distinct cells types they can give rise to. They can be totipotent (can each develop into an embryo and extraembryonic tissues), pluripotent (can differentiate into all foetal and adult cell types), multipotent (can differentiate into only some distinct cell types and monopotent (also termed unipotent or oligopotent- which can only develop into a single cell type).

In general, stem cells can self-renew and undergo differentiation through asymmetrical cell division [2]. The discovery of stem cells has unquestionably widened our knowledge of the etiology and pathogenesis of human disease. In recent years, stem cell therapy has emerged as a cutting-edge research frontier with the promise to revolutionize the treatment of a wide range of human health problems. Stem cells not only play a crucial role in the future of regenerative medicine, but also provide new insights into the intricate and crucial processes at work during human development [3].

Adult stem cells, which are accessible for research and development, are capable of differentiation only into a few specific cell types. However, pluripotent stem cells can be generated from differentiated cells through the process of "reprogramming" [2]. Two methods used for this includes Somatic cell nuclear transfer (SNCT) and induced pluripotent stem cells (iPSC). In SNCT, the nucleus of an adult cell is inserted into an oocyte with its own nucleus removed [3]. iPSCs are derived from adult cells which have been reprogrammed genetically to an embryonic stem cell-like state through the forced expression of factors essential for maintaining pluripotency in embryonic stem cells [4].

Stem cells have a variety of applications in medical therapy, understanding the pathophysiology of diseases and the development of new drugs. Currently the major applications of stem cells in therapy include cancer especially haematological malignancies, for tissue repair and regeneration like in case of spinal cord injury, tendon ruptures, retinal and macular degeneration. There is also the potential to overcome the effects faulty genes responsible for inherited diseases by targeting the adult stem cells involved in the condition in the specific tissues. Stem cells are being studied in connection to restoration of all or part of limbs in amputees as well as regeneration of failed organs such as the liver [2].

Modelling of diseases helps to identify new targets, assess new therapies as well as assess the potential of gene therapy in treatment. The use of organoids developed from iPSCs serve as better models to resemble the effects of newer therapies on target tissues. It also helps give a more detailed insight into diseases especially cardiac conditions such as for long QT syndrome as well as degenerative diseases like spinal muscular atrophy, Parkinson's disease, Huntington's disease, and Amyotrophic Lateral Sclerosis. There is however a myriad of challenges faced by stem cell-based therapy and is represented in Figure 1. There is always potential for an infection of the cultured cells with a pathogen which must be strictly monitored and prevented, as well as the potential for the de-differentiated cells differentiating into tumours once implanted back. The third major concern is an ethical one which requires strict regulations and their enforcement when stem cells are used in health and disease.

Stem cell Therapies

Five distinct types of stem cells have been identified. First, embryonic stem cells (ESCs), which originate from the inner cell mass of a developing embryo. Second, placental cells called amniotic epithelial cells (AECs) that line the amnion. Foetal stem cells (FSCs) are the third category, and they come either from embryonic cadaver tissue organs or from embryonic stem cells that have been specialized for use in a particular tissue. Umbilical cord epithelium (UCE) is the fourth type and is distinct from the epithelial amniotic membrane. According to research [4], this can provide pluripotent stem cells (PSCs). Adult somatic stem cells are the fifth and final type [2, 5].

Bone marrow transplantation, diabetes, age-related macular degeneration, neurological illnesses, and drug discovery are just some of the many ways stem cells have been used in recent years in the healthcare and medical fields [6]. The three most common stem cell-based therapies are the result of years of research. First, the transplantation of fully matured cells, such as insulin-producing cells for the treatment of diabetes, that have been grown and differentiated in the lab from the patient's own embryonic or somatic stem cells [7], second is initiating self-repair mechanisms by stimulating an individual's own endogenous stem cells [8]. Finally, stem cells are sent directly to the patient, where they begin colonizing and eventually differentiate into the appropriate cell type after being transplanted to the affected area of the body.

In addition, blood illnesses such haematological malignancies or congenital immune deficiencies are treated using hematopoietic stem cell transplantation (HSCT) taken from bone marrow or peripheral blood. Diseases in this category include non-Hodgkin's lymphoma, Hodgkin's disease, acute and chronic leukemia, Fanconi anemia, sickle cell anemia, and several others. Haematopoietic stem cell transplantation is also being studied as a potential treatment for rheumatoid arthritis, lupus, and other autoimmune illnesses [9]. One of the most thoroughly known types of tissue-specific stem cells is the haematopoietic stem cell (HSC) [3].

Patients with advanced cancer who are undergoing intensive chemotherapy may also benefit from a stem cell transplant to protect their bone marrow [2]. Stem cells are employed in cellular therapy to repair or replace malfunctioning tissues or organs [1]. Disease-specific cell lines can be manipulated for use in pharmaceutical research. Heart failure [10], spinal cord injury, and tendon ruptures are also treated with stem cell therapy.
Embryonic stem cells (ESCs) have found widespread application in the field of neurology. Diseases of the nervous system as Alzheimer's, Parkinson's, and stroke are treated by neuronal stem cells (NSCs). The science of Regenerative Medicine has also found uses for them. These findings have tremendous promise [2]. In addition to these applications, stem cells have shown promise in the treatment and eventual cure of a wide variety of congenital birth abnormalities.

Embryonic Stem Cells (ESCs)
Scientists from all over the world have been studying human embryonic stem cells for decades to better understand them and their potential for clinical application. Pluripotent cells that can differentiate into any kind of somatic cell within the embryo are called embryonic stem cells (ESCs). In 1998, scientists used cell lines to create these for the first time. These can be kept alive in culture media for a very long time if the right growth conditions and nutrients are met [11]. These ESCs have been identified as a potential resource for learning more about the very complicated mechanisms thought to underpin the development of specialized cells and the construction of organ structures. ESCs' capacity for self-renewal also paves the way for the in vitro generation of an infinite variety of cell types. This has prompted the development of cutting-edge hypotheses in regenerative medicine.
The ability to create neural cells from human embryonic stem cells (hESCs) opens the door to a novel resource for the discovery of drugs with therapeutic potential, particularly for illnesses affecting the nervous system [12]. Human embryonic stem cells (HESCs) show the most therapeutic promise for replacing diseased or damaged tissues in patients with a variety of degenerative disorders [13]. Human embryonic stem cells have also prompted substantial study in several medical subfields. Genomic and epigenetic studies, disease modelling, tissue engineering, and other applications have all found a place for embryonic stem cells [14].

Embryonic Stem Cells (ESCs) derivation
The term "embryogenesis" refers to the process through which a human embryo grows and forms, a process characterized by cell division and differentiation [15]. There are three primary locations where human embryonic stem cells are obtained:

- One, already-established lines of embryonic stem cells
- Embryos that fail to implant during in vitro fertilization.

Somatic cell nuclear transfer–created embryos are employed in scientific studies [16]. The blastocyst is the result of many cell divisions following fertilization and the production of the diploid zygote. Embryoblasts and trophoblasts are the two cell types that make up the blastocyst's inner and outer layers, respectively [17]. The trophectoderm, or outside cell mass, contributes to the development of extra-embryonic tissue. This results in the formation of the placenta, chorion, and umbilical cord. Therefore, the embryo forms from the embryoblast, also called the inner cell mass (ICM) [17]. In the future, this will be utilized to purify stem cells.

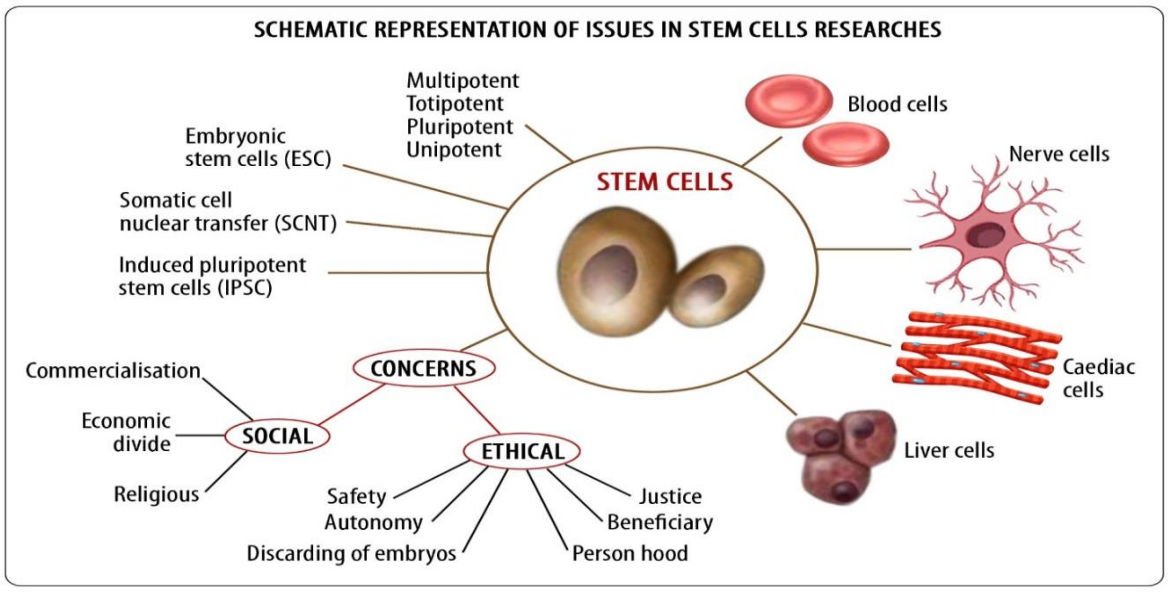
Social and Religious issues on the use of Stem cells
Ethical And Social Issues
Stem cell research has been linked to a wide range of ethical and societal concerns around the world, even though it has been shown to have great benefits in the field of regenerative medicine. Stem cell research has become a global hotspot for ethical debate [18]. However, ground-breaking research has resulted from the increasing drive to discover medicines for the treatment of severe illnesses. However, the use of embryos is controversial for a variety of moral and religious reasons, which hampers research. Furthermore, concerns have been made about the availability of pharmaceutical and diagnostic technologies and the protection of intellectual property rights around the world [18]. Therefore, it is important to be aware that the privacy of the embryos used

in research is protected. The public has also raised a number of concerns about the legitimacy, safety, and effectiveness of the treatments provided [19].
Stem cell production, which involves the utilization of extra fertilized eggs leftover following in vitro fertilization, raises ethical concerns about the use of stem cell research. These eggs are discarded after being used to harvest pluripotent stem cells [20]. At this point, ethical questions start to be raised. To begin, it cannot be acceptable to eliminate fertilized eggs, each of which has the potential to develop into a unique human being. Second, it is immoral to utilize these human embryos for any purpose. The biological sciences imply that a fertilized egg does not have a life for the first fourteen days because the formation of the embryo does not begin until after this time [21].

Ethical Issues on Somatic Cell Nuclear Transfer or Therapeutic Cloning
Somatic cell nuclear transfer (SCNT), often known as "Therapeutic Cloning," was the method utilized to create "Dolly, the sheep." The adult nucleus is transferred from a somatic cell to the nucleus-less egg during this procedure. The term "therapeutic cloning" refers to the practice of creating a stem cell line from an embryo that was first cloned. The patient's own somatic cell nucleus is used [16]. Therapeutic cloning is controversial for many reasons. Widespread adoption of therapeutic cloning could lead to erroneous advances in the direction of reproductive cloning.
Another risk associated with this treatment is the potential for less regard and worth of human life because of business pressures leading to greater research on embryos [16]. Furthermore, this raises the possibility that women will be exploited. Women's eggs or ova are required if the stem cells are to come from the embryos that die during in vitro fertilization [22]. Since more oocytes are needed for this operation, women are under increased pressure to produce and contribute more eggs [23]. This could be a degrading act. The need for ova grows in tandem with the frequency with which the procedure is carried out. As a result, it could diminish women's social standing. When women are used as a source of raw materials for therapeutic cloning, they may be subjected to commercialization and exploitation. The worst-case scenario is that it will lead to international sales of human ova (eggs) [24].

Religious issues on the use of Stem cells
Divergent opinions on stem cell research can be traced back to the world's greatly varied religious traditions. There is still substantial dispute over the nature of the afterlife, the nature of the soul, the origin and end of life, and the definition of life itself. This is shown again in divergent views across a wide range of religions and beliefs in different parts of the world [25]. Concerns have been voiced concerning the possible medicinal benefits of using embryos and aborted foetuses in research and treatment. Since the occurrence of fertilization and that the human embryo is equivalent to a human person, there have been ongoing debates about the nature and origin of human existence [26]. It is not an issue that embryos have a moral status [27].
Christian spiritual criteria refer to a human being who is created in the image of God, the creator, and who exists as an autonomous being from the moment of his or her conception [2]. This was the first religion to raise problems about the beginning of potential existence. However, Christian teachings diverge significantly from conventional medical practice. Embryonic stem cells, which are derived from embryos and used in medicinal methods and scientific study, have been met with opposition by the Roman Catholic Church [28]. There have also been recommendations to employ exclusively adult stem cells for this application [28].
Among Protestants, several debates have been held about the ethical use of stem cells. Theological and ethical considerations pose the greatest challenge. This starts with the idea that people are interconnected not only with God but also with one another and with themselves [29]. The concept that the developing foetus is a human being makes the use of stem cells completely out of the question and ethically incorrect, as stated by Walters [29].
The moral standing of embryos is a major factor in the Orthodox Church's stance on embryonic stem cell (ESC) research. Its basic tenet is the belief that the gift of life's inception comes from a transcendent and benevolent deity [30]. In their view, every single living thing is of inestimable

worth. So they are humans who are capable of reason [31]. The developing fetus is accorded the same respect and protection as a human being by the higher divine spirits.



The Orthodox Church also holds that God endowed all of His creations with perfect faculties and resources [30]. God also bestowed upon them the authority to put them to good use. This suggests that humans have been endowed with divine characteristics and skills, and that all scientific progress flows naturally from this divine gift [30]. The Church also recognizes the significance of somatic stem cell therapy. But there are moral and ethical concerns with employing Embryonic Stem Cells (ESCs) because they are obtained from embryos [32].

According to the Old Testament, Jews at heart hold the view that a foetus is fully human after it has reached the 40-day mark of development [33]. This warrants reverence and a feeling of safety on your part. Since the embryo before 40 days is not an entity with a real soul in it, Jewish people find nothing morally wrong with embryonic stem cell research.

Islam's holy book, the Quran, states that a foetus's bodily structure and individual appearance are fully formed by the end of the fourth month of gestation. Therefore, since that time, he or she has been treated as an individual with full legal capacity [34]. Since the unborn is not legally recognized as a human being, stem cell research is generally accepted.

For Buddhists, the use of embryonic stem cells is permissible only if the researcher guarantees and wants to do therapeutic research that is known to improve the lives of individuals suffering from various ailments [34]. In addition to this outlook, Buddhists also hold that research done for the sake of financial gain is immoral [28].

Destruction of embryos is considered immoral and unethical in Hinduism. Nonetheless, no unified policy exists regarding the study and potential application of embryonic stem cells [32]. According to Buddhist doctrine, all forms of suffering ought to be avoided at all costs [32]. However, it might be argued that research on embryonic stem cells can be conducted because the foetus does not sense pain until 14 days [35].

Conclusion

One of the greatest advances in medicine and science is the ability to employ stem cells to treat a wide range of congenital conditions. Isolating embryonic stem cells is a complex process that calls for a high level of experience and knowledge. Due to the needless loss of embryos, the use of embryonic stem cells is very contentious. In addition, adult stem cells are favoured over their younger counterparts for treating a wide range of illnesses [2]. Stem cells' potential varies from one type of tissue or organ to another. Furthermore, stem cell therapy for various illnesses can be

tailored to take advantage of their adaptability. Therefore, thanks to stem cells, regenerative medicine can reach new heights of success and growth.

Stem cell therapy has shown promise in recent years for the treatment of a variety of inherited neurological illnesses, and its use has spread to thousands of patients. It's no secret that scientists have found success in using stem cells to heal and even replace damaged organs and tissues. In conclusion, stem cells are studied and researched to learn more about human development and its problems. Additionally, it is among the most secure and well-established methods. However, there is still debate regarding how to get your hands on human embryonic stem cells. It's a central tenet of many worldviews, guaranteeing that discussions on the topic will rage on indefinitely. Though its therapeutic effects and significance in the treatment of permanent congenital defects are important, so is developing a more collaborative attitude towards its use.

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Ethical Viewpoint Paper

Equitable Use of Vaccines: A Pandemic Perspective

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Introduction
Coronavirus disease-19 (COVID-19), caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), started as an outbreak of atypical pneumonia in the Wuhan region of China in December 2019 and since then, has become a global pandemic [1]. The pandemic continues to cause a significant morbidity and mortality with multiple waves already hitting the globe with over four hundred eighty-three million cases and six million deaths reported as per latest literature [2]. The vaccination campaign for COVID-19, which is the biggest in the history of mankind, began on 13th December 2020 and brought with it hope and promise, albeit, not without ethical dilemmas. The global vaccination strategy by World Health Organization (WHO), which aimed to achieve 40% coverage of each country's population by end of 2021 and 70% by mid-2022, was established to ensure an equitable rate of vaccine rollout across the globe as well as prioritization of those at highest risk [3]. According to WHO data, as of 8th September 2021, about 5.5 billion vaccine doses were administered, though unfortunately about 80% in only high- and upper-middle income countries. While almost 90% of high-income countries had reached the 10% target, and more than 70% had reached the 40% target, not a single low-income country has reached either target [4]. In this paper, we discuss the fundamental characteristics of booster doses and vaccination of children and adolescents followed by the ethical conundrums related to them using the bio-ethical pillars of beneficence, non-maleficence and justice.

Booster Doses
Booster doses, as described by WHO, are "vaccine doses that are administered to a vaccinated population that has completed a primary vaccination series when, with time, the immunity and clinical protection has fallen below a rate deemed sufficient in that population" [5]. The main aim of this booster dose is to replenish antibody titres in the body from levels that are deemed no longer sufficient for providing protection. These are single doses given following a specified period after completion of the primary course (one or two doses depending on the type).

Need for booster
The concept of further decreasing the COVID-19 cases by augmenting immunity in already vaccinated people sounds appealing, but the same should be evidence-based and only after weighing the risk-benefit ratio at an individual and community level.

Data from various observational studies have shown a decline in vaccine effectiveness against COVID-19 as time elapses, the decrease being more significant in older age groups [6]. A recent meta-analysis across four vaccines showed similar results, with effectiveness against severe disease in all age groups decreasing by around 8% over a six month period from the last dose. A more significant reduction of 10% and 32% were noted in those over 50 years of age against severe and symptomatic disease respectively. This demonstrates the waning effect of protection against the clinically important forms of the disease [7]. Important factors that influence the degree of waning protection include type of vaccine, primary schedule used, variant of circulating virus, and extent

of community infection at the time of vaccination, though the contributory role of each cannot be quantified. Booster doses might ultimately be necessary because of waning immunity or because of newly evolving variants against which the available vaccines are ineffective, while children and adolescents may benefit from vaccine coverage, though, not without its clinical benefit being proven.

Children And Adolescents

During the pandemic, infection with SARS-CoV-2 has been reported in all age groups including neonates, infants, children, and adolescents. Unlike adults, children have different disease characteristics with respect to disease load, clinical presentation and community transmission.

Burden of disease in children and adolescents

Overall, the pandemic has seen a lower proportion of symptomatic infections as well as severe disease and deaths due to COVID-19 infection in children and adolescents as compared to adults. WHO data from 30 December 2019 to 21 March 2022 showed that of the total 483,556,595 cases and 6,132,461 deaths, children below five years of age accounted for 1.2% (5,756,585) of reported global cases and 0.04% (2,442) of reported global deaths. Among the older children and younger adolescents (5 to 14 years), 5.3% (25,410,148) was the reported global case load and 0.03% (1,735) represented reported deaths worldwide. Older adolescents and young adults (15 to 24 years) represented 7% (33,840,582) and 0.14% (8,649) of reported global cases and deaths respectively.(2) Initially it was postulated that infants (children below 1 year of age) might be at increased risk of a more severe clinical course [8], though it was subsequently discarded as infants, and even neonates, were also found to have predominantly mild or asymptomatic presentations [9-10]. Mortality for all age groups below 25 years comprised barely 0.2% of the number of reported global deaths [2]. A population-based study in Switzerland found that a significantly lower seroprevalence was observed for children aged between 5-9 years and adults over than 65 years, compared with those aged 10-64 years, highlighting the possibility of reduced burden of morbidity and mortality in children [11].

Milder illness

While adults were commonly affected by COVID-19, young children and adolescents were not spared. Children affected by COVID-19 were noted to have a clinical presentation that ranged from asymptomatic individuals to those with mild-moderate symptoms. A meta-analysis of early data reported that a fifth (21.1%) of all SARS-CoV-2 infections in children were clinically asymptomatic, and severe cases accounted for only 3.8% of them [12]. A similar meta-analysis published in April 2021 also found similar results with children having milder clinical presentations, better prognosis, and lower mortality rate compared with adult patients [13]. Milder or asymptomatic clinical presentations could eventually result in less healthcare seeking behaviour, reduced testing and under-reporting of cases. As a result, exact numbers of children affected during the pandemic are difficult to ascertain.

Lower Transmission Rates

It has been postulated that differences in the innate immune system of children leads to mounting of a better immune response, thus rendering them less susceptible to acquiring the infection [14]. Though the association of SARS-CoV-2 viral load and severity of symptoms is doubtful [15], patients with higher viral load have higher risk of transmission. The exact role that children play as a source of infection to adults, and particularly the highly vulnerable older relatives in the house, has not yet been determined. A study found a lower secondary attack rate and SARS-CoV-2 positivity rate among students compared to school staff thereby suggesting that children may not be as infectious as adults. National lockdowns and school closures which characterized the pandemic period had restricted the mobility of the children and thereby reduced the number of non-household persons meeting the children. However, with the opening of schools, summer camps and day-care centres, particularly when masking of children remains challenging, providing them with protection is essential to ensure their safety.

Beneficence

The benefits of vaccine doses on the level of protection attained have been extensively researched globally, though limited data is available on certain niche areas such as booster doses and vaccination in children.

i. Effectiveness And Benefits of Booster Doses

The beneficial value of the booster vaccination needs to be considered at two levels – individual and community.

a) **Individual protection:** An increasing number of studies have demonstrated a beneficial effect of booster doses in protection of the individual against infection, mild disease along with reduction in severe disease and death [16-18]. Though limited in size and duration of follow-up, they suggest that the booster would reduce the risk of the vaccinee contracting the infection and the severity of the illness should he/she fall sick, thereby improving overall outcomes. A recent study by Spitzer and colleagues has shown an increase in protection by around 7% after the booster dose [19]. Heterologous booster schedules were also evaluated and found to substantially increased protection, though this beneficial effect waned over a period [20].

b) **Community benefit:** At a community level, vaccination of individuals with booster doses, thereby augmenting their immunity, would appear to have a beneficial role though limited data is available. Booster doses reduce the viral load and as a result, the community transmission. As the infection rate would reduce, particularly in unvaccinated individuals, this would directly reduce the potential for mutations and formation of variant strains, leading us closer to the end of the pandemic. In addition, boosting immunity to reduce symptomatic and severe cases reduces the number of patients requiring admission to hospitals [21]. This prevents overburdening of the healthcare system allowing for better utilization of resources and health care personnel in other health promoting activities and services. Booster vaccination for healthcare workers would have an additional benefit of reducing the spread of virus from hospital to the general community. This evidence confirms that booster vaccinations significantly benefit not only the individual, but also the community at large.

ii. Effectiveness and benefits of vaccination in children:

a) **Vaccine efficacy:** Various trials have studied the effectiveness of COVID vaccinations in adolescents and children, though with methodological limitations. A case control study by the Overcoming Covid-19 Investigators analysed 445 case patients and 777 controls to identify the benefit of BNT162b2 vaccine in adolescents. The study reported an overall effectiveness of 94% against hospitalization for COVID-19, 98% against intensive care admission and 98% against receipt of life support [22]. A phase 2-3 randomized trial revealed that for children aged 5-11 years, the same vaccine had a 90.7% efficacy with a favourable safety profile [23]. However, despite these promising results, there remains a lack of robust scientific evidence on the efficacy of vaccines in these age groups.

b) **Other key benefits of vaccination in children:** The key areas in which children were disproportionately affected as compared to adults were related to closing of schools leading to disruption of educational services as well as increased emotional and psychological distress [24]. Prolonged confinement at home, reduced fellowship with peers, absence of school and extracurricular activities, increased sedentary habits, and increased reliance on media and electronic equipment to pass time, have all contributed to psychological and psychiatric symptoms. Though home should be the safest place for a child, there has been a significant escalation in physical, sexual, and psychological abuse [25-26]. An unpublished study in the Shaanxi province of China identified that the most common psychosocial and behavioural problems among 320 children and adolescents in the pandemic included inattention, clinginess, distraction and fear of asking questions about the pandemic [27]. This risk is further augmented in those children with pre-existing mental health conditions. Vaccination of children, thereby

allowing them to go outdoors and lead a relatively normal life without additional risk of infection, would help to limit these harmful effects of the pandemic and advance other highly valued societal goals. The long-term impact of these goals might play an important role in reducing psychological and mental illnesses.

Non-Maleficence

While use of vaccines for both booster doses and vaccination of children and adolescents has their definite benefits, the other side of the coin remains considerably less researched at the moment. In the available literature, adverse effects of the vaccine have been reported with increasing number of doses and younger age groups.

i. **Adverse effects of vaccine:** While the benefits of primary vaccination against COVID-19 clearly outweigh the risks, increased adverse events could be seen if boosters are introduced too early (without adequate safety data) or too frequently (reduced inter-dose interval). This is especially true for vaccines that could have immune-mediated side-effects such as myocarditis and Guillain-Barre syndrome. Myocarditis observed following m-RNA vaccine has been previously described, most commonly after the second dose [28]. A large meta-analysis of over 2100 individuals with post-vaccine myocarditis showed that it was more common among young males, most of whom had no comorbidities [29]. Though the overall risk of Thrombosis with Thrombocytopenia Syndrome (TTS) after adenoviral-vector vaccines was low, it was found to be higher in younger adults compared to older adults [30]. However, no data is available on the risk below 18 years. Guillain-Barre syndrome has also been associated with vaccination with adenovirus-vectored COVID-19 vaccines [31-32]. A collation of adverse events along with their frequency, severity, treatment and complications should be undertaken to improve the scientific knowledge on the same.

ii. **Effect on other vaccination programs:** Another long-term effect of premature booster dose roll-out is the negative implications that increased adverse effects are likely to have on overall vaccine acceptance beyond COVID-19 vaccines. A qualitative study in India in 2009 demonstrated how a similar intensified frequency of vaccination against polio in a bid to accelerate the eradication process was correlated with increased patients' doubt and fear in the efficacy of the vaccine [33]. This could result in a multitude of vaccine preventable diseases flaring up culminating in an even more overburdened healthcare system with severe morbidity and mortality particularly among children. This unseen pandemic could have catastrophic implications on the health care system in the years to come.

iii. **Rise of the mutants:** The pandemic is a global fight and victory cannot be achieved by countries on their own. The current situation of inequitable vaccine distribution across countries amidst globally limited vaccine supply has resulted in achieving high levels of protection in one nation with a simultaneous rise in cases in another. When scarce vaccines are used as boosters, rather than for primary vaccination of the unvaccinated, it allows the virus to spread, replicate and mutate, potentially creating variants of concern that undercut the vaccine-derived protection and allow the pandemic to propagate.

Justice:

When discussing the principle of justice, we need to look not only at the availability, but also at the utilization of the vaccines and the hierarchy of priority that should be followed when the vaccine doses are rolled out to ensure ethical and equitable distribution.

i. **Availability:** The production of COVID-19 vaccines has rapidly surged globally since their approval by the WHO and other regulating bodies. It had been projected that the global vaccine supply would be adequate for vaccination of the entire global adult population along with boosters for high-risk populations only by the first quarter of 2022 [3]. These projections also show that supply would be sufficient for extensive booster use in all adults only later in

the year 2022. This highlights the fact that inadequacy of doses for booster till the latter half of 2022 was anticipated. This was very close to reality as data from April 2021 concurs with this as 25% of population in high-income countries had been vaccinated as compared to a mere 0.2% in low-income countries. In a public address, WHO Director General Dr. Tedros Adhanom Ghebreyesus acknowledging this global divide said, "There remains a shocking imbalance in the global distribution of vaccines. On average in high-income countries, almost one in four people have received a COVID-19 vaccine. In low-income countries, it's one in more than 500". By September 2021, over 4 billion vaccine doses had been administered around the world with more than 80% having been given in high-income and upper-middle income countries, even though they make up less than 50% of the global population [4]. In view of the above, he called for a moratorium on booster doses, to enable more appropriate distribution of vaccine doses to the countries that were still struggling to vaccinate 40% of their population. However, as of December 2021, at least 126 countries had already issued advisories on booster vaccination with greater than 120 having started programmatic implementation. A majority of these countries were high-income, or upper middle-income, with no low-income country having yet introduced a booster vaccination programme [5].

ii. **Utilization:** While there is a strong ethical argument for delaying boosters, many people feel it is not strong enough to override a nation's duty to protect its own citizens. Some believe in adopting an "influenza standard, which is that governments may be justified in prioritizing their own citizens until the COVID-19 risks are like that of the influenza season. After that point, the governments would be expected to send vaccine supplies to countries with greater needs. Another justification for boosters and vaccination of children and against donation of vaccines to low-income countries was lack of infrastructure for the safe storage, distribution and utilization of vaccines. Many African countries encountered difficulties in maintaining proper storage of vaccinations leading to a huge number of doses being discarded. It was found that the acceptance rate of COVID-19 vaccines among a young adult population in Cameroon was barely 15% [34]. The major issues, as reported by the study participants, included anti-vaccine campaigns and confusing information on social media warning locals not to take the vaccines, negative perceptions of the vested interests of the pharmaceutical industry, concerns about the validity and efficacy of the vaccines, and economic burden to the individuals. The gross disparities noted between vaccine haves and have-nots violate the basic ethical principle of health equity. Equitable distribution of vaccines would thus also necessitate building of infrastructure to overcome these implementational difficulties.

iii. **Prioritization:** To optimize the impact of the available doses, it is essential to maximize vaccine coverage among the vulnerable and high-risk population. This population includes all those who are most likely to become severely ill such as older adults and immunocompromised individuals, as well as those who are essential for the functioning of the health care system and essential services. Using this logic, booster doses to senior citizens, immunocompromised individuals, health care and essential workers can be justified. However, opening booster doses to low-risk population seems like a gross waste of valuable life-saving resources. This needs to be viewed from a global perspective and not just at a national level with blinders on. When compared with each other, global coverage of primary schedule takes priority over selective booster vaccinations and these options must be weighed and prioritized carefully. Sadly, as of December 2021, globally around one out of five vaccine doses are used for booster or additional dose vaccination daily, defying all principles of equitable distribution [5]. Even if booster doses were shown to decrease the risk of severe disease, currently available vaccine supplies could save more lives (and reduce morbidity as well) if given to previously unvaccinated individuals than if used as boosters in vaccinated populations

In an aptly titled paper "Three for me and none for you? An ethical argument for delaying COVID-19 boosters", the authors vehemently argue the need for delaying booster doses until low-income countries can vaccinate a substantial proportion of their population [35].

Describing utility as showing equal consideration to the interests of everyone affected by a distributive policy, irrespective of place of residence and level of wealth or income, Jecker et al highlights the great divide in vaccination availability, need and distribution. The additional benefit of 7-10% protection with boosters is too small compared to the 85-90% benefit conferred on unvaccinated individuals after the primary vaccination is complete. Similarly, with children and adolescents, given the fact that the protection received by them is lower than that received by adults receiving primary vaccination, the latter must be prioritized, especially in resource limited and under-developed settings. Factors in low-income countries such as restricted access to medical facilities, lack of sanitation and isolation facilities, overcrowding, and non-availability of adequate personal protective equipment among health care providers stresses the importance of primary vaccination in these countries.

Future research needs:

Prior to the recommendation of booster doses to the general low-risk population and primary vaccination of children and adolescents, more data is required on dynamic factors such a burden of disease and its impact on the healthcare system, vaccine booster dose effectiveness, duration of protection, and comparison of heterologous versus homologous dosing schedules. Other aspects that need evaluation include the optimum timing of the booster dose, possibility of fractional doses for booster (dose-sparing) to ensure greater coverage, benefit of booster doses in recently infected individuals, in addition to improvement in the supportive framework to ensure feasibility and sustainability along with community demand for the vaccine. A predictive model could be developed based on available literature, taking all the above into consideration, to identify those at most need of the vaccination. This would ensure objectivity in the prioritization process and avoid inequity in the distribution of the few available doses. In addition to health benefits in the form of survival and hospitalization, quality of life and other indicators such as mental health and psychological impact should also be factored in.

Conclusions

The current trend of giving vaccines to enhance coverage in form of adult booster doses or as part of primary vaccination of children, while a large proportion of vulnerable adults in various parts of the world remain unvaccinated, poses an ethical dilemma that is bigger than even the debate over the two. Even if boosters and vaccination of children save lives and prevent severe disease, the benefit is far less than primary vaccination itself. The optimal strategy of vaccine coverage would include primary vaccination in countries lagging, with simultaneous building of infrastructure to facilitate the same. Booster doses could then be implemented in a phased manner among the high-risk groups depending on availability and priority. Adequate robust data is essential in children and adolescents, particularly about adverse effects, before their primary vaccination can be made a recommendation. The on-going profound inequities in global vaccine access need to be tackled at an international level, with developed countries coming forward and leading the way for a more united front against the worst pandemic of our time.

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Ethical Viewpoint Paper

A Comprehensive Analysis of the Ethical Implications of ChatGPT-4 in Healthcare: A Deeper Examination

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Introduction

The integration of AI systems like ChatGPT-4 into the healthcare industry brings about numerous potential benefits, such as increased efficiency, cost reduction, and improved patient outcomes. However, with these advancements come critical ethical considerations that must be addressed to ensure responsible and equitable implementation. This in-depth analysis delves into five key areas of ethical concern surrounding ChatGPT-4's use in healthcare: bias and discrimination, privacy and data security, disinformation and misinformation, autonomy and human interaction, and accountability and responsibility.

1. Bias and Discrimination: Ensuring Equitable Healthcare Outcomes

The presence of bias and discrimination in AI systems like ChatGPT-4 can lead to significant disparities in healthcare outcomes, disproportionately affecting marginalized populations. Addressing bias in healthcare AI systems necessitates a comprehensive approach that encompasses several key strategies:

1.1 Diverse and Representative Data

Ensuring that training data includes diverse patient populations is essential for creating AI systems that provide equitable care. Developers should account for factors such as race, gender, age, and socioeconomic status when collecting and processing data to avoid perpetuating existing healthcare disparities.

1.2 Algorithmic Fairness

Algorithmic fairness involves designing algorithms that account for fairness metrics, such as demographic parity or equalized odds, to minimize discriminatory outcomes in healthcare decision-making. Researchers should prioritize the development of fairness-aware algorithms to ensure that AI systems like ChatGPT-4 contribute to equitable healthcare outcomes.

1.3 Collaborative Input

Engaging healthcare professionals, patients, and interdisciplinary experts is crucial for identifying potential biases and developing strategies to address them. By fostering collaborative input, developers can leverage diverse perspectives to create AI systems that are more sensitive to the unique needs and challenges of different patient populations.

1.4 Fairness Evaluation and Monitoring

Developing robust methods for evaluating and monitoring fairness in AI systems is critical for maintaining equitable healthcare outcomes. Regular audits and assessments of AI systems should be conducted to identify potential biases and make necessary adjustments to minimize discriminatory impacts.

2. Privacy and Data Security: Protecting Sensitive Health Information

The use of AI systems like ChatGPT-4 in healthcare raises significant privacy and data security concerns, particularly regarding the handling of sensitive health information. Key considerations for ensuring robust protection of patient data include:

2.1 Health Data Regulations

AI developers must adhere to legal frameworks like the Health Insurance Portability and Accountability Act (HIPAA) and the General Data Protection Regulation (GDPR) to ensure compliance with data protection standards. These regulations provide guidelines for the secure handling, storage, and sharing of sensitive health information.

2.2 Privacy by Design

Integrating privacy and data security into every stage of AI development is essential for ensuring robust protection of patient data. By incorporating privacy by design principles, developers can create AI systems that prioritize data protection from the outset.

2.3 Transparent Consent Management

Empowering patients with clear and accessible consent mechanisms for data sharing and processing is vital for ensuring they maintain control over their health information. AI developers should prioritize transparency in their data handling practices and provide patients with the necessary tools to make informed decisions about their data.

2.4 Data Minimization and Anonymization

Implementing data minimization and anonymization techniques can help protect patient privacy while still allowing AI systems to draw valuable insights from health data. Techniques such as differential privacy can be used to add statistical noise to data, preserving individual privacy without compromising the utility of the data for AI systems.

3. Disinformation and Misinformation: Ensuring Accurate Health Information

In healthcare, combating disinformation and misinformation facilitated by AI-generated content is particularly important, as inaccurate health information can have severe consequences for patients. Strategies to address this issue include:

3.1 AI-generated Content Detection

Developing AI models capable of detecting and flagging content generated by systems like ChatGPT-4 is crucial for preventing the spread of inaccurate health information. By investing in research and development of advanced content detection technologies, stakeholders can help mitigate the risks posed by AI-generated disinformation and misinformation.

3.2 Collaboration with Healthcare Professionals

Partnering with healthcare professionals to verify AI-generated content and provide accurate health information to patients is essential. This collaborative approach can ensure that AI-generated content aligns with established medical guidelines, and any inaccuracies are identified and corrected promptly.

3.3 Health Literacy Education

Prioritizing health literacy and critical thinking in patient education programs can help foster discerning consumers of health information. By empowering patients with the knowledge and skills to evaluate the credibility of AI-generated content, the risk of misinformation negatively impacting their health decisions can be reduced.

4. Autonomy and Human Interaction: The Role of AI in Patient Care

Preserving human agency and the value of human interaction in healthcare decision-making is essential. Promoting a collaborative approach to AI integration can help strike a balance between the benefits of AI systems and the importance of human expertise:

4.1 Human-in-the-loop AI

Designing AI systems that involve healthcare professionals' input and oversight is critical for ensuring that human expertise remains central in patient care decisions. Human-in-the-loop AI can help maintain the integrity of clinical decision-making and safeguard against overreliance on AI-generated recommendations.

4.2 AI Augmentation, Not Replacement

Emphasizing AI's role in augmenting healthcare professionals' capabilities rather than replacing them is essential for fostering a collaborative approach to patient care. AI systems should be used as tools to enhance human decision-making and expertise, rather than as a substitute for human judgment.

4.3 Ethical AI Design Principles

Incorporating ethical considerations, such as patient-centeredness and shared decision-making, in AI system design from the outset can help ensure that AI technologies are developed and deployed in a manner that respects patients' autonomy and values human interaction. By embedding ethical principles into the design process, developers can create AI systems that prioritize patient well-being and align with the fundamental principles of medical ethics.

5. Accountability and Responsibility: Navigating the Complex Landscape in Healthcare

Establishing accountability and responsibility for AI-generated content and decisions in healthcare is a complex but essential undertaking. Key strategies for navigating this complex landscape include:

5.1 Cross-disciplinary Collaboration

Engaging legal scholars, ethicists, medical professionals, and other experts is crucial for developing comprehensive frameworks for AI accountability in healthcare. By fostering cross-disciplinary collaboration, stakeholders can create a more holistic understanding of the ethical implications of AI systems like ChatGPT-4 and develop strategies to address them effectively.

5.2 Clinical Validation

Ensuring AI systems undergo rigorous clinical validation processes is vital for establishing their safety, efficacy, and trustworthiness. Clinical validation can help determine whether AI-generated recommendations align with evidence-based practices and provide healthcare professionals with the necessary confidence in the system's performance.

5.3 Industry Standards and Best Practices

Encouraging the development of widely accepted standards and best practices for AI development, deployment, and auditing in healthcare settings can help establish a framework for accountability and responsibility. By promoting adherence to these standards, stakeholders can work together to create a more transparent and accountable AI ecosystem in healthcare

Conclusions

The integration of ChatGPT-4 and other AI systems into the healthcare industry brings both promise and ethical challenges. By examining these ethical implications in depth and adopting a comprehensive approach to address them, we can work towards harnessing the potential benefits of AI technologies in healthcare while minimizing potential harm. By fostering collaboration among stakeholders, adopting innovative solutions, and prioritizing ethical considerations throughout AI system development, we can create a responsible and equitable AI ecosystem that

enhances patient care, improves health outcomes, and supports healthcare professionals in their mission to promote health and well-being. As AI technologies continue to advance and become increasingly integrated into various aspects of healthcare, ongoing examination and adaptation of ethical practices will be crucial to ensuring responsible, patient-centred, and equitable outcomes.

RECOMMENDED READING

1. Wójcik S, Rulkiewicz A, Pruszczyk P, Lisik W, Poboży M, Domienik-Karłowicz J. Beyond ChatGPT: What does GPT-4 add to healthcare? The dawn of a new era. Cardiology J 2023;30(6):1018-25.
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1. Standard journal article: Seshadri L, George SS, Vasudevan B, Krishna S. Cervical intraepithelial neoplasia and human papilloma virus infection in renal transplant recipients. Indian J Cancer 2001;38:92-5.
2. List the first six contributors followed by et al.
3. Personal author(s): Ringsven MK, Bond D. Gerontology and leadership skills for nurses. 2nd ed. Albany (NY): Delmar Publishers; 1996.
4. Chapter in a book: Phillips SJ, Whisnant JP. Hypertension and stroke. In: Laragh JH, Brenner BM, editors. Hypertension: pathophysiology, diagnosis, and management. 2nd ed. New York: Raven Press; 1995. pp 465-78.

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