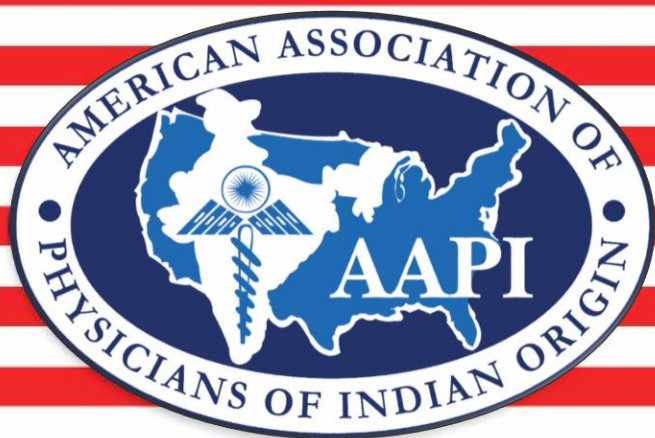


# JAAPI

Journal of the American Association of Physicians of Indian Origin

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“Wherever the art  
of medicine is loved,  
there is also a  
love of humanity.”  
- Hippocrates

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This Issue of JAAPI is Dedicated to  
**Katalin Karikó, Ph.D.**  
Nobel Prize in Physiology or Medicine 2023



Photo: Courtesy of Dr. Katalin Karikó

**The Nobel Prize in Physiology or Medicine in 2023 was awarded jointly to Katalin Karikó and Drew Weissman for their discoveries concerning nucleoside base modifications that enabled the development of effective mRNA vaccines against COVID-19.**

**– The Nobel Foundation**



## Pioneers in Medicine and Healthcare

# Katalin Karikó, Ph.D.

Adjunct Professor of Neurosurgery, Perelman School of Medicine,  
University of Pennsylvania, Philadelphia, PA

**Winner: 2023 Nobel Prize in Physiology or Medicine**

Photo: Courtesy of Dr. Katalin Karikó

*I don't consider myself especially smart. Over the years, I have met many people born with what seemed to be a photographic memory, a gift for learning effortlessly. One of my elementary school classmates could hear something once and remember it forever. That wasn't me; it has never been me. But even as a young child, I understood something critical: What I lacked in natural ability, I could make up for in effort. I could work harder, put in more hours, do more, and do it with greater care.*

- Katalin Karikó, [Breaking Through: My Life in Science](#)

**The Nobel Prize in Physiology or Medicine 2023 was awarded jointly to Katalin Karikó and Drew Weissman for their discoveries concerning nucleoside base modifications that enabled the development of effective mRNA vaccines against COVID-19" - The Nobel Foundation**

Dr. Katalin Karikó is a Hungarian American biochemist, who specializes in ribonucleic acid (RNA)-mediated mechanisms in relation to protein replacement therapy. The groundbreaking contribution of Dr. Karikó is laying the foundations for mRNA vaccines by overcoming the obstacles and thus proving that her skeptics were wrong. In 2006 Dr. Karikó co-founded RNARx and spearheaded it as CEO. From 2013 she was associated with BioNTech RNA Pharmaceuticals as its Vice President. Along with Dr. Drew Weissman, Dr. Karikó co-discovered nucleoside modifications that suppress the immunogenicity of RNA. Dr. Karikó and Dr. Weissman were co-inventors on United States patents for the application of non-immunogenic, nucleoside-modified RNA. This technology, which was licensed by the BioNTech and Moderna was used for the development of COVID-19 vaccines. Thus, the mRNA-based vaccines developed by Dr. Karikó have helped us to effectively and successfully fight against COVID-19 worldwide. The mRNA vaccine technology developed by Drs. Karikó and Weissman is finding its use in other infectious diseases, cancer, cardiovascular, metabolic diseases and ischemia.

Apart from the Nobel Prize in Physiology or Medicine, Dr. Karikó received more than 130 international awards and honors for her pioneering work that saved hundreds of millions lives during the worst pandemic of the 21<sup>st</sup> century. Dr. Karikó donated more than half a million dollars of the Nobel Prize money to her former alma mater in Hungary, the University of Szeged. Dr. Karikó was named in the 2024 Time 100 influential people in health, and BBC's 100 Women list. In November 2021, the US publication Glamour named Dr. Karikó a Woman of the Year.

Dr. Karikó is married to Béla Francia. Their daughter, Susan Francia, is a two-time Olympic gold medalist rower. Dr. Karikó's autobiography, titled *Breaking Through: My Life in Science*, published by the Crown Publishing Group in 2023, has been translated into 9 languages, and became the best-selling non-fiction book in Hungary.



Katalin Karikó, Nobel Prize in Physiology or Medicine 2023: Official Interview

Official Interview: Nobel Prize in  
Physiology or Medicine 2023



Scan the QR Code to Watch the Video  
in YouTube

Compiled by: **Bellamkonda K. Kishore, M.D.**

## From the Editorial Desk

# The Pandemic of Plagiarism and Use of AI in Journal Publications: JAAPI Policy on These Issues

Vemuri S. Murthy, M.D., MS  
Editorial Advisor of JAAPI

Anyone involved with contemporary journal publication who follows the guidelines of ethics of publication needs to be more vigilant in this day and age of the mushrooming of newer medical journals and the upsurge of plagiarism and use of artificial intelligence (AI) like the readily available Chatbots. The lapses in the quality and standards of publications as well as authenticity are of considerable concern to medical education, healthcare providers and organizations. The emerging pandemic of plagiarism and use of AI in publications impacts quality of medical education, patient care and outcomes in global health, in addition to the wastage of research efforts and funding.

Of late, JAAPI has been hit by both plagiarism and extensive use of AI in some manuscripts submitted by prospective authors, prompting us to write this editorial. Just like the mainstream reputed journals, JAAPI adopted a strict policy to ensure that articles published by it are devoid of plagiarism and are not generated by machines either fully or partially. JAAPI has tools to detect plagiarism and machine generated text and screens all submitted manuscripts for both.

**Plagiarism:** The American Medical Association defines plagiarism as "appropriating another person's ideas, processes, results, or words without giving appropriate credit." In other words, it amounts to "stealing" the intellectual property of the person/persons who contributed to the foundation of the original theory/idea. Several types of plagiarism are identified and classified, such as plagiarism of ideas, texts, collusion, self-plagiarism, and patchwriting. As the tools to detect plagiarism are recently available, plagiarism evaded detection for centuries.

**Use of AI:** Unlike plagiarism-detection tools, the tools to detect machine generated text are readily available in parallel to the Chatbots used to generate text for publications based on AI. While plagiarism steals someone else's ideas or data, the Chatbots are helping non-experts to project as experts. Journals like JAAPI publish review articles, commentaries, perspectives, opinions etc., by experts who have knowledge and/or expertise in the fields. If someone can use a Chatbot to generate such reviews, without any knowledge and expertise in the field, the very purpose of the publication is defeated. In such case, any medical student can prepare what looks like an advanced or authoritative review article on any subject. That is not for what the journals JAAPI are existing. Journals publish scholarly articles written by experts with scholarly knowledge in the field. We all need to respect this basic foundation of medical education, research and healthcare. In view of this, JAAPI has been returning articles with machine generated text. Some authors have been correcting the problem, while a few did not return to us. It is possible they might have published their papers somewhere else. But JAAPI is not compromising its quality of publication.

**Contributory Causes for Plagiarism and Use of AI in Manuscript Preparation:** Several causes were identified as contributing to plagiarism and/or use of AI in preparing manuscripts for publication. The significant among them are: 1. Requirements for publications for academic positions and promotions; 2. Grading of Medical College admission applications, giving credit to research publications; 3. Peer-pressure; 4. Securing Grants; 5. Professional recognition; 6. Lack of institutional guidance/due diligence of the supervising research guide; 7. Ease of publication in poor-quality medical journals, readily accepting any research article for survival or self-promotion; 8. "Publication-guaranteed" journals with hefty article publication fees.

Building research or contributing to a publication based on prior or existing knowledge is not considered plagiarism if the previous work is cited appropriately. As the famous quotation from Sir Isaac Newton goes, "If I have seen further, it is by standing on the shoulders of giants," explains the ongoing need to move up the tower of knowledge, building more



stories on the existing ones. However intentional or unintentional (due to lack of research or publication knowledge), plagiarism constitutes a "moral offense" as it erodes the integrity of scientific research and may cast doubt on a previously well-conducted authentic study by the same author. We are aware of the unpleasant retractions of some research publications by some of the top Medical and Scientific International Journals due to the lack of "due diligence" in the publication process at some stage. Of late, some of these retractions involved high profile or well-established investigators, which ruined their reputation in one stroke.

The general consensus (2024) is that plagiarism is noticed in around 17% of articles submitted to major academic journals and involves about 19% of publications submitted by medical students. However, this may be the tip of the iceberg, as not all publications from every country have been scrutinized thoroughly for plagiarism.

While several tools are available to screen plagiarism, there has yet to be a uniform consensus on how much plagiarism is acceptable in research publications. While the 0% Gold Standard is hard to achieve, most journals accept the 5-10% threshold, depending on the individual Journal's guidelines. While isolated plagiarized sentences here and there are not alarming, complete sets of plagiarized paragraphs are a serious concern to flag down. Plagiarism results in "erroneous meta-analysis," contaminating the data of evidence-based high-powered Randomized Controlled Trials (RCTs), which are the foundations for developing guidelines for all medical specialties by leading professional organizations.

This editorial would be incomplete without sharing some of the suggestions offered by various international organizations to combat the pandemic of plagiarism in medical research and journal publications. Citing the sources of the information with quotations, avoiding paraphrasing, following the citation guidelines, organizing a bibliography for ready referencing, and following the reviewer's suggestions for resubmission are crucial for a "clean" publication. The best way to overcome some of the plagiarism issues is to "cite when in doubt." It is also a display of gratitude and camaraderie in the medical and research profession.

When should we start the basic training in "Research and Publication"? Ideally, disseminating information about the value of sound ethical practices in medical research and publication needs to start at the Medical School level with a mandatory research education-oriented curriculum, and by providing grants for research projects for medical students, interns, and postgraduates through a dedicated research department and faculty. Currently available tools for identifying and quantifying plagiarism are helpful, but more important is the integrity and honesty of the team - i.e., the authors, reviewers, and editors working together contributing to a quality publication that will stand the test of time and serve its purpose through enhanced outcomes in healthcare.

**Quoting T.S. Eliot [The Sacred Wood]** *Immature poets imitate; mature poets steal; bad poets deface what they take, and good poets make it into something better, or at least something different.*

### **JAAPI Policy and Practice on Plagiarism and Use of AI in Submitted Articles**

- JAAPI does not accept articles for review that contain significant content of plagiarism or machine-generated texts.
- Any signal for plagiarism should be limited to isolated sentences or words, but not more than that.
- While sporadic machine-generated text can be ignored, complete paragraphs flagging as machine-generated text are not acceptable.
- In both the above cases, JAAPI will return the manuscripts to authors with a request to replace the highlighted text as plagiarism or machine generated. Only those manuscripts that comply with this request will be considered for peer-review. Others are not considered further.
- The Authors' Consent Form now has declaration that the manuscript is free from plagiarism and machine-generated text.

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## Scope of the Journal & Instructions to Authors

**Vision and Mission:** JAAPI is a peer-reviewed medical and healthcare journal published by the AAPI. In line with the vision and mission of AAPI, JAAPI is dedicated to facilitating physicians to excel in patient care, teaching, and research, and thus pursue their aspirations in professional and community affairs. JAAPI is open to contributions from physicians, healthcare providers, and scientists and technologists of all backgrounds and from all over the world. Membership in AAPI is not mandatory for prospective authors or reviewers of papers submitted to JAAPI.

**Scope of JAAPI:** JAAPI publishes a variety of articles, such as original research articles, clinical studies, reviews, perspectives, commentaries, case studies etc., covering all aspects of medical sciences, clinical specialties, and healthcare, including epidemiology, and policy, regulatory and legislative issues. Articles submitted to the JAAPI must be original and should not have been published or under consideration for publication elsewhere, except in abstract form in proceedings of conferences or meetings. Only manuscripts that meet professional and scientific standards will be accepted for publication. Review process is single fold blinded on the authors' side. But after acceptance of papers, the names of the handling Editors and Reviewers will be published on the front page of the article. This new trend started by some European journals is gaining momentum as it gives due credit to the Editors and Reviewers and ensures fair review process.

**Publication Model:** JAAPI is published as completely Open Access in electronic form (PDF). These will be archived on the AAPI website (<https://aapiusa.org/journal-of-aapi/>), and the link to URL for each issue will be emailed to AAPI Members when it is published. A few hard copies will be printed for promotional purposes and for displaying at AAPI Conventions and other professional meetings or for distributing to libraries or dignitaries. There will be no submission fee or publication charges to the authors. Although materials published are copyrighted by the AAPI, others can cite or reproduce figures, schemes and pictures published in JAAPI without paying fee, but by giving due credit to JAAPI. This does not apply for materials reproduced in JAAPI from other journals, which are copyrighted by the original publisher.

**Registration and Indexing:** JAAPI has met required criteria, and is eligible for applying for registration with MEDLINE. If successfully registered, JAAPI will be indexed in the PubMed operated by the National Library of Medicine. JAAPI will also be registered for indexing in other major bibliographic databases, such as SCOPUS (managed by Elsevier), EMBASE (Excerpta Medica Database), DOAJ (Directory of Open Access Journals), Ovid (Walter Kluwer Ovid Database) and BioMed Central Database. JAAPI is in the process of securing DOI (Digital Object Identification) numbers for its published articles, which will result in articles appearing in Google Scholar.

**Editorial Board:** The Editorial Board of JAAPI consists of one Editor-in-Chief, two Associate Editors-in-Chief, two Editorial Advisors, several Deputy Editors and Guest Editors covering different areas of medicine and health care, Editorial Board Members (Internal Reviewers). They will be aided by External Reviewers. The Editor-in-Chief and Associate Editors-in-Chief oversee the overall peer-review process, assign articles to Deputy Editors or Guest Editors, and accept or reject articles after peer-review. They also preview articles prior to peer-review process and determine whether they can be subjected peer-review process. The Editorial Advisors provide advice to ensure good performance and stability of JAAPI and to help in logistics, administrative and fiscal issues. The Deputy Editors and Guest Editors will handle review process of submitted papers assigned to them with the assistance of internal (Editorial Board Members) and external reviewers. AAPI membership is required for all Editorial Board Members, except Guest Editors, who are expected to promote the vision and mission of AAPI through JAAPI.

**CME Credits for Peer-Review Process:** After indexing by PubMed, working through AAPI, JAAPI will obtain CME Credit eligibility for its reviewers by the Accreditation Council for Continuing Medical Education of the American Medical Association.

**Journal Periodicity:** Initially, JAAPI will have three issues per year (Spring, Summer, and Winter). As the journal picks up momentum and article submissions increase, the periodicity will be quarterly. Sometimes, the issues may be combined.

### Types of Articles JAAPI Accepts:

- **Original Research Articles:** These describe original scientific or clinical research conducted on in vitro or animal models or human subjects after obtaining approval by the concerned institutional animal care and use committees (IACUC) or human subjects research review boards (IRB). The research should comply with the guidelines and regulations of US Public Health Service. The original research articles can be 3,000 to 4,000 words in length, excluding title page, abstract, legends and references. Maximum 7 figures or tables are allowed. Additional figures or tables need to be justifiable for the article. Supplemental Information (SI) containing data and text, such as methods, are allowed for deposition.
- **Review Articles:** The review articles can address any contemporary issue in medical or clinical sciences, or healthcare, including epidemiology, and policy, regulatory and legislative issues. The reviews should provide analysis of the topics but should not be just presenting catalog of information. The review articles should be balanced and should cite literature without bias. The review articles can be 3,000 to 5,000 words, excluding title page, abstract, references, and legends. Not over 7 figures and tables combined. There is no limit on the number of references, but they should be recent and relevant ones. Review articles exceeding these limits will be considered if they are justifiable and provide significant in-depth and useful information.
- **Clinical Studies:** Clinical studies can be observational or retrospective analysis of data or prospective randomized studies. All clinical studies should be conducted as per the regulations and guidelines, documenting informed consent, protection of research subjects, inclusion of minorities etc., following the guidelines of the US Public Health Service. Rigorous statistical analysis should be followed. Raw data should be provided for analysis if required. These articles can be up to 5,000 words, excluding title page, abstract, tables, legends, and references. The maximum number of figures or tables are 7 to 10 combined. Additional figures or tables should be justifiable for the study. Supplemental Information (SI) is allowed for deposition.
- **Brief Reports:** Brief reports of contemporary issues of high significance are accepted to disseminate information. These reports are up to 1,500 words in length, excluding title page, abstract, legends and references. About 4 tables or figures combined are permitted. Maximum 20 references are allowed.
- **Letters to the Editor:** Letters to the editors on topics of high importance or on the articles published in JAAPI are welcome. These should be focused and carry significant take home message, rather than a simple presentation of one's own perspective on the topic. These can be up to 600 words in length with 6 references, 2 small tables or figures maximum. The authorship should be limited to 2 or 3. No abstracts are allowed.
- **Articles on Diagnosis and Treatment Review:** Article describing latest methods, approaches and technologies in diagnosis and treatment can be up to 2,000 words, excluding title page, abstract, references, and legends. Figures and tables should be limited to five combined.
- **Case Studies or Clinical Challenges:** Case presentation with about 300 to 400 words, followed by discussion of 500-600 words, 1-2 small figures, and less than 10 references, are welcome. The authorship should be limited to 3 unless it involves trainees. Proof of patient consent should be provided, if needed.
- **Perspectives on Contemporary or Controversial Topics:** These should be thought-provoking with intuitive analysis rather than presentation of facts. Some speculation and hypothesis are permitted provided they are supported by rational analytical base. These articles can be up to 2,500 words, excluding title page, abstract, legends and references. Less than 3 tables or figures combined are allowed. References should be limited to the required ones.
- **Commentaries on Published Papers:** Commentaries on published papers are accepted if they provide a significant perspective or missed findings in the original publications. These can either positively or negatively affect the original publication. But the emphasis is how the original publication can affect clinical practice or evidence-based medicine. These can be up to 1,200 words in length with one or two figures or tables, and limited references. No abstract is allowed. Authors can provide bullet points of highlights. Authorship should be limited to one or two.

- **Bench-to-Bedside or Bedside-to-Bench:** Authors can take laboratory findings to clinical settings or bring clinical dilemmas to laboratory research. Special emphasis should be made on moving the subject from bench to bedside or vice versa. This type of articles can be up to 1,200 words in length, excluding title page, abstract, legends and references. Not over 3 tables or figures combined are allowed. References should be limited to the required ones.
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## **Call for Articles on AI and Medicine/Healthcare**



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Medicine and Healthcare are facing an unprecedented transformation by AI (Artificial Intelligence). The transformation is going to be phenomenal and essentially change the way physicians and healthcare professionals have been practicing. They have both excitement and fears as they are not aware of what is going to change and how to adapt to the change. To address this issue, which is Future of Healthcare & Artificial Intelligence, JAAPI is inviting articles on all aspects of AI that relate to medicine and healthcare for publication. All articles will be subject to peer review. Instructions for submitting articles can be found in this edition of JAAPI.

## Editorial Comment on AI in Healthcare

# To AI or Not to AI

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Since the dawn of time, humanity has been able to distinguish itself from the rest of the other lifeforms by its ability to observe, adapt, and strategize. Our creativity made us the "advanced species", allowing us to weather storms, plagues, pandemics, and more. Up until recently, only we, as humans, had this degree of ingenuity. That is, until the rise of the machines, as some would call it. We have found a way to give the ability to think and thrive to mindless machines that are merely a multitude of binary zeroes and ones.

Although this may excite our science fiction readers, is this something we should be weary of? Or rather, something we should embrace with excitement. Not so long ago, most of our hospital records were tediously documented and organized in paper charts and folders. These were attached to the principal aspect of dread, having to decipher a physician's calligraphy and trying to find meaning in the various scribbles and lines they called "orders". This of course, would prove a patient safety issue when medications like "ACETohexAMIDE" and "ACETazolAMIDE" were misread for each other.

Along then came the computer. A fascinating device that became the bane of the elder generation of doctors, struggling to type over five words per minute, and the salvation of the younger, not having to struggle with paper and pen. And with that came the revolution; one after the other, advancement after advancement was developed to improve the medical record system and make it more efficient.

Finally, with one bright idea came the thought, "what if there was a way I could automate this whole process?" and so Artificial Intelligence (AI) was born. The concept of an electronic assistant that would help with a multitude of "scut work", such as putting in orders, documenting encounters, triaging patients, etc.

Along with the sceptics came. If a cluster of computer coding could compile millions of medical facts and studies to formulate the most appropriate patient plan, what would the need be for the doctors? Per Sir William Osler, "*To study the phenomenon of disease without books is to sail an uncharted sea, while to study books without patients is not to go to sea at all.*" (Amedee et al, 2016). What this means is that medical knowledge from books and texts is valuable but is relatively moot if patient interaction is missing. This is where the physician takes the podium. Thus far, AI can simulate and mimic human behavior but cannot truly take it on and return it. Inflections in patients' voices indicate fear or excitement, subtle facial cues to indicate pain or fear; these can only be truly understood by other humans. This is also crucial in the sense that a physician can change his or her approach in medical education based on these cues. If they feel that a patient is becoming confused with the language they are using, they can then change their approach (ie, using visual examples, talking in more simplified ways, or other modifications in their communication approach) to improve their delivery.

In medieval times, medicine was run by guilds with a guild master at the head of each. Each guild focuses on an aspect of medical care (ie surgeons, apothecaries, and like) which can be akin to the various fields and specialties of medicine. As technology advanced, however, these guild masters were cast aside to be replaced by the dreaded "search" bar. Textbooks and AI searches became mentors in their stead.

Aside from the dreary picture it is sometimes portrayed as, AI has the astounding ability to combine experiences of countless physicians into one database. For example, a physician practicing in Alaska may not have much experience with malaria, nor would those in Sudan have much with frostbite. The beauty of AI is that it is a forever learning concept;

with each new experience, new information is added to its vast data bank making it all wiser. Not every whooping cough sounds the same, nor does every heart murmur, but with the compilation of hundreds of these the likeliness of picking them up increases exponentially.

Instinct is another important aspect that makes humanity unique and irreplaceable with AI. Almost every physician can tell you of an experience where they had a “gut feeling” despite labs and clinical presentation not lining up. A lot of times, these feelings prove accurate without a logical reason to explain. A trait, unfortunately, AI has no capability of as of yet.

Efficiency is a man’s best friend (figure of speech). The concept of “work smarter, not harder” is drilled into most of our heads as we grow. What better way to be more efficient than having a program that can generate data significantly faster than one person alone? The most obvious incorporations of AI are into fields that focus mainly on visual interpretation rather than reasoning. Pathology and Radiology are good examples. Scans and slides can be run through an algorithm that has a repository of thousands of imaging findings and pathology slides; after that, it becomes a simple matching game. This slide goes into the “Adenocarcinoma” bucket, and this image goes into the “lung nodule” bucket, etc. This makes it a lot more lucrative for hospital CEOs as one program can do the job of many employees at a much faster rate. Fewer employees mean fewer salaries to pay, and therefore more hospital revenue. There is also the option of sending reads across borders to be read by physicians/techs in less developed countries who would be willing to do it for a fraction of the cost.

To ease the burden of patient volume, the medical field has incorporated the help of nurse practitioners and physician assistants to share the load while still under the physician's observation. Similarly, many surgical procedure anesthesia will be run by CRNAs with an Anesthesiologist on standby for help if needed. This distribution of work burden can help significantly slow down the approach to physician burnout. In the same way these medical professionals can help physicians, so to can AI by helping with documentation. Ambient AI is a fantastic example which can decrease the burden of countless notes to type; it can generate them autonomously by just being present in the room without interfering with the patient interaction. This also improves patient care by allowing more time focused on the patient as opposed to jotting down key aspects of the encounter.

Overall, AI can be both a blessing and a curse. It has the potential to be a great aid, making work more streamlined, efficient, and accurate. It also has the chance to replace many employees; especially those whose careers do not involve much patient interaction. There has been an exponential growth of AI in the preceding years with no sign of slowing down. In the right hands, this can be a remarkable tool to improve patient care and outcomes.

**Reference:**

- Amedee RG, Seoane L. From the Editor's Desk: Sailing Osler's Uncharted Sea with Innovation and Collaboration at the Helm. *Ochsner J* 16(1):1-2, 2016. PMID: 27028013

In this issue of JAAPI, BK. Kishore and Sraavya Pinjala present a “roadmap” for the transformation of evidence-based medicine to precision medicine soon. Although it may sound like fiction to some physicians, the authors present compelling evidence or argument in support of their roadmap. It may be hard to ignore their roadmap at this stage, given the historical record of the transformative power of science and technology. After all, who could imagine in the 1970s and 80s that one day there will be a small gadget called smart phone in everyone’s hands, which would connect them to any person on the globe and give instant access to knowledge on any subject by stroking a few times on the screen of the gadget? We can be skeptical about technology, but we should not underestimate its transformative power. Ultimately, what matters is, as Steward Brand aptly said *Once a new technology rolls over you, if you're not part of the steamroller, you're part of the road.*

## In-Depth Review

# Transformation of Evidence-based Medicine to Precision Medicine by AI: A Roadmap

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### Abbreviations Used:

**5G** – 5<sup>th</sup> Generation Wireless Technology; **AI** – Artificial Intelligence; **ANN** – Artificial Neural Networks; **EBM** – Evidence-based Medicine; **CME** – Continued Medical Education; **CNN** – Convoluted Neural Network; **CRO** – Contract Research Organization; **CT** – Computed Tomography; **DALYs** – Disability Adjusted Life Years; **DL** – Deep Learning; **EIA** – Enzyme Immunoassay; **ELISA** – Enzyme Linked Immunosorbent Assay; **EQ** – Emotional Quotient; **FDA** – Food and Drug Administration; **FNN** – Feedforward Neural Networks; **HIPAA** – Health Insurance Portability and Accountability Act; **HMO** – Health Management Organization; **IQ** – Intelligence quotient; **miRNA** – micro Ribonucleic acid; **ML** – Machine Learning; **MNN** – Modular Neuronal Networks; **MRI** – Magnetic Resonance Imaging; **NCD** – Non-communicable Diseases; **NP** – Nurse Practitioner; **PA** – Physician Assistant; **PET** – Positron Emission Tomography; **RCT** – Randomized Clinical Trial; **RNA** – Ribonucleic Acid; **RNN** – Reverse Neural Networks; **T2DM** – Type 2 Diabetes Mellitus

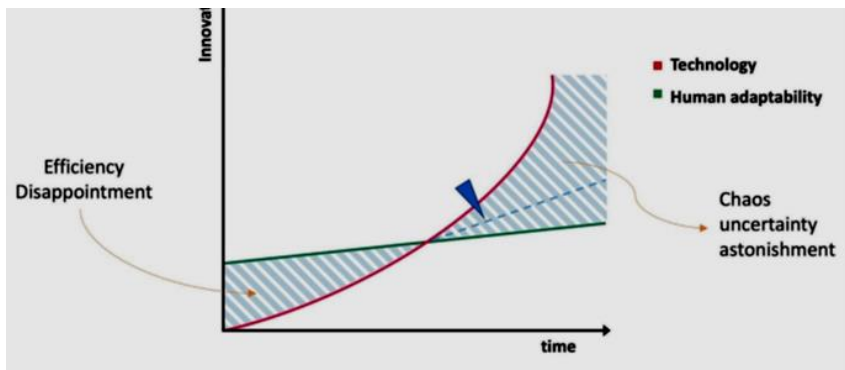
**Abstract:** Artificial Intelligence (AI) is a reality, no longer science fiction. For the first time during evolution, humans are encountering machines that compete with them intelligently and with capability. Regarding the applications of AI, there is nothing like healthcare. Apart from medicine being a complex science, by dealing with life-or-death situations in healthcare, AI touches humans more than in any other field it is applied. With the advent of AI, high-tech healthcare and big data have a boost to transform the current evidence-based medicine (EBM) into precision medicine. This effectively makes diagnosis and treatment predominantly molecular, big data-driven, and high-tech in nature to the extent that only machines can handle data from different sources, integrate and interpret the results of analysis for physicians. In other words, AI has the power to take “central role” in diagnosis and treatment traditionally held by physicians. Ironically, even in advanced countries like the United States, neither the practicing healthcare providers nor the budding physicians in the medical schools are prepared to face the approaching tsunami of AI poised to hit the beaches of the healthcare soon. Conversely, the \$5.47 trillion healthcare industry in the United States is attracting the high-tech corporations, big pharmaceutical companies, as well as large pharmacy chains to become stakeholders in the transformation of healthcare by AI and thus play a major role in future healthcare delivery through AI. This will impact on how physicians practice medicine and deliver healthcare. Obviously, they need to adapt to interact with other stakeholders in the industry on the one hand and the machine outputs on the other hand to continue to be the leaders of emerging precision medicine. This in depth and comprehensive review will present: (i) how AI differs from the current technologies used in medicine and healthcare, (ii) how AI transforms diagnosis and treatment into high-tech and big data-driven molecular science and its impact on primary care and family medicine, (iii) who benefits and who are impacted adversely, (iv) the pros and cons of AI in healthcare, (v) the timeline for the maturation of AI technologies to complete takeover of healthcare delivery, and (vi) ethical, legal and privacy issues related to patients data and liability. When fully matured in its applications like the 5G cell phone network, AI has the potential to flatten the world in healthcare delivery, just as smart phones did in communications, thus ultimately benefiting the patients enormously.

**Key Words:** Artificial Intelligence; Machine Learning; Deep Learning; Algorithms; Precision Medicine; Disruptive Technology; Molecular Diagnosis; Molecular Therapy; Big Data; Molecular Medicine



**Prologue:** The advent of mobile or cell phones essentially made landline phones obsolete. Not only that, eventually the cell phones transformed into powerful smart phones, which killed about 27 gadgets or apps in use in 1990s and early 2000s. The beneficiary of this transformation is consumers, the end users. Similarly, today, medicine and healthcare are on the verge of a major technological explosion driven by AI. Like mobile phones, AI is also a disruptive technology, eliminating several technologies or apps in use today in healthcare, and replacing them with new ones that are more powerful and beneficial to patients and healthcare providers (1-6). Thus, AI has the potential to transform the healthcare system as it is today to a new and versatile platform that is beneficial to both patients and healthcare providers (7). According to Satya Nadella, CEO of Microsoft, *AI is perhaps the most transformational technology of our time, and healthcare is perhaps the AI's most pressing application*. However, like any new game-changing technology, AI has both pros and cons, with the pros outweighing the cons. The earliest mobile phones were primitive with problems like dropping calls or lack of coverage areas, and it took 15 years or more for them to develop mature 5G network. Similarly, AI is also destined to develop and mature in stages. Until that

time, there may be issues which need to be fixed or managed. So, it is important for physicians and healthcare providers to accept AI in a positive sense and grow with it, just as they did with electronic health records and digital technologies in the clinic (8). However, it should be noted, unlike our smart phones, which work for us as per our choice, the AI has cognitive power and learning capabilities. So, *AI works with us, like a colleague*. So, physicians and healthcare providers must learn to work with machines that do not hesitate to correct them if needed. Obviously, “managing the interface of healthcare providers with machines” is a new skill one must learn and master to succeed (9). Finally, we are living in a time where the pace of progression of technological innovation is far ahead of the pace of progression of human adaptability (Fig 1). This means, in the future, what determines success in any profession is not just IQ or EQ or hard and soft skills, but the ability to adapt to the rapidly progressing technological innovation. This means the ability to work comfortably in the shaded area marked Chaos in Fig 1 determines success in any profession. No wonder, Charles Darwin aptly said “It is not the strongest of the species that survives; nor the most intelligent that survives. It is the one that is most adaptable to change.”



**Fig 1:** Graphical depiction illustrates the progression of technological innovation in relation to human adaptability. The evident divergence emphasizes the accelerated rate of technological advancements compared to human capacity for adaptation, leading to potential areas of disparity and unpredictability. Such observations necessitate a considered approach to technological developments to ensure alignment with human evolutionary pathways. (Figure and legend reproduced from Montomoli et al, Journal of Clinical Monitoring and Computing, 2024 (10), and Open Access publication under Creative Commons Attribution 4.0 International License).

## Introduction:

**What is AI?** AI is a computer system able to perform specific tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making, and language translation. AI combines three disciplines – *math, computer science, and cognitive science* – to mimic human behavior through various technologies (11).

**Computers vs. AI:** AI uses computer systems, but it is much more than that. Computers work based on coding. Coding is a sequence or set of instructions in a programming language for a computer to execute. Coding can be changed by the programmer only. On the other hand, AI works through algorithms. Algorithms are a set of rules or guidelines to be followed in calculation or in problem

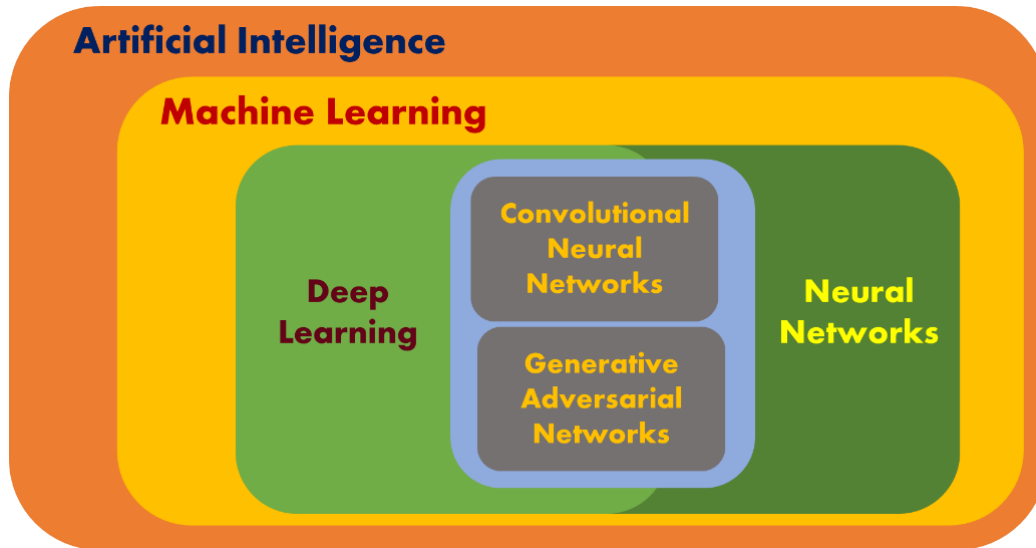
solving operations. AI works on the guidelines with freedom to learn and adapt (12).

**Components of AI:** There are several components of AI, each with its distinctive properties as follows (Fig 2).

- **Machine Learning (ML)** is a self-learning system based on the algorithms provided. Using algorithms, machine learning analyzes data, detects patterns and learns how to make predictions and

recommendations. In healthcare, machine learning can analyze data and thus improve diagnosis and treatment (13).

- **Deep Learning (DL)** is a type of machine learning capable of processing a wide range of data (images, texts, audio, etc.). Deep learning uses artificial neural network (ANN) to process data in a way that mimics human intelligence (13).



**Fig 2:** Different components of Artificial Intelligence.

- **Neural Networks** are AI system modeled on the human brain and nervous system. Neural networks process data in a way that mimics the human brain. There are different types of neural networks, such as Convolutional Neural Networks (CNNs), which are good at finding patterns in images and in recognizing objects; Recurrent Neural Networks (RNNs), which process sequential data or time-series data, and thus can forecast events; Feedforward Neural Networks (FNNs), which process data in one direction only, and which are used in tasks like facial recognition or computer vision; Deconvoluted Networks, which are similar to Convolutional Neural Networks, but run in reverse direction, which find use in recovering lost signals or features; and Modular Neural Networks, which represent assembly of several networks, each working independently of each other (14).
- **Generative AI** is capable of producing various types of new content, such as text, images, audio, synthetic data (e.g., fake videos on social media) (15).
- **Autonomous AI** performs tasks independently without the need for humans (e.g., airlines autopilot, self-driven cars) (16).

### Disruptive Technologies and AI:

The term "disruptive innovation" was coined by Harvard Business School professor Clayton Christensen in 1995. Disruptive technology is an innovation that significantly changes how businesses, industries, or consumers operate. Disruptive technologies often create new sectors and business models, radically change how products and services are consumed, or replace existing systems or habits with superior attributes (17). Two best examples of disruptive technologies used by most of us are Uber and Amazon. Uber disrupted the traditional taxicab system. Although Uber eliminated ownership of cabs by

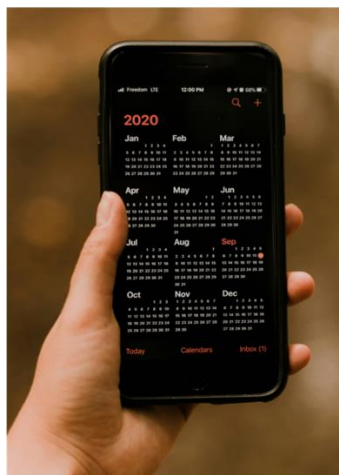
companies or individuals, in the long term the drivers were happy as their earnings improved and they need not struggle to find customers. The customers are happy as they can get a cab within minutes and there is no hassle in payment. Most importantly, Uber, currently \$31 billion business, is projected to grow to \$220 billion by 2031. It is boosting Google maps, and electric and hybrid car industries.

Similarly, Amazon, which disrupted the traditional brick and mortar shopping malls and book publishing, is proving beneficial to the consumers in many ways. For example, consumers can buy commodities on Amazon at a lower price due to direct shipment and ease of return from their homes, thus saving precious time. Small size industries and merchants are able to directly market to consumers on Amazon platform. Amazon self-publishing platform and Kindle empowered authors to directly publish their books

without a penny upfront expense, while they can earn 70% of the profit from sales of their books thanks to print-on-demand model. Today, about 67% to 83% of all books are sold on Amazon platform depending on their method or type of publication (18).

Another practical example of disruptive technology is smart phones, which almost every one of us use. Smart phones disrupted at least 27 gadgets or apps existing in the late 1990s or early 2000s. Yet, no one feels their loss, as smart phones provide all those lost services in one gadget, which is easier to carry wherever one goes and operates with ease (Fig 3). Similarly, as readers can see through this review, AI is poised to markedly improve the healthcare system to benefit both patients and physicians, without causing losses due to disruption of certain current practices.

Cameras  
MP3 Players  
Wrist Watches  
GPS Devices  
Data Organizers  
Palm Pilot  
Pagers  
Rolodex  
Alarm Clocks  
Barcode Scanners  
Thermostats  
TV Remote Controls  
Measuring Tape



USB Thumb Drives  
Books  
Newspapers  
Camcorders  
Landline Phones  
Photo Albums  
Voice Recorders  
Pocket Flashlights  
Notepads  
Portable Video Players  
Webcam  
ATM/Debit/Credit Cards  
Credit Card Scanner

**The Ultimate Beneficiary is the End User**

**Fig 3:** Technologies or apps or gadgets that were disrupted and/or vanished due to smart phones (Royalty-free photo of cell phone: Courtesy Priscilla Du Preez CA on Unsplash)

## AI in Medicine and Healthcare:

There is no branch or field in medicine and healthcare, where AI cannot penetrate and impact. Virtually all areas of medicine and healthcare are affected by AI to varying degrees. In the biomedical field, AI affects basic research, drug design and development among others. Fig 4 shows areas in healthcare, where AI can exert significant impact. This review article focuses on the impact of AI on Precision Medicine.

At this stage, it is imperative to know that at least now certain areas of medicine and healthcare are impacted by AI more than others. The areas most impacted by AI are those that depend on imaging technologies, such as radiology (diagnostic), pathology (diagnostic and prognostic), dermatology (diagnostic), ophthalmology (diagnostic and prognostic), followed by oncology

(diagnostic and prognostic), cardiology (risk prediction) and nephrology (management of chronic kidney disease and dialysis). Thus, at present AI cannot be applied equally in all areas of medicine and healthcare.

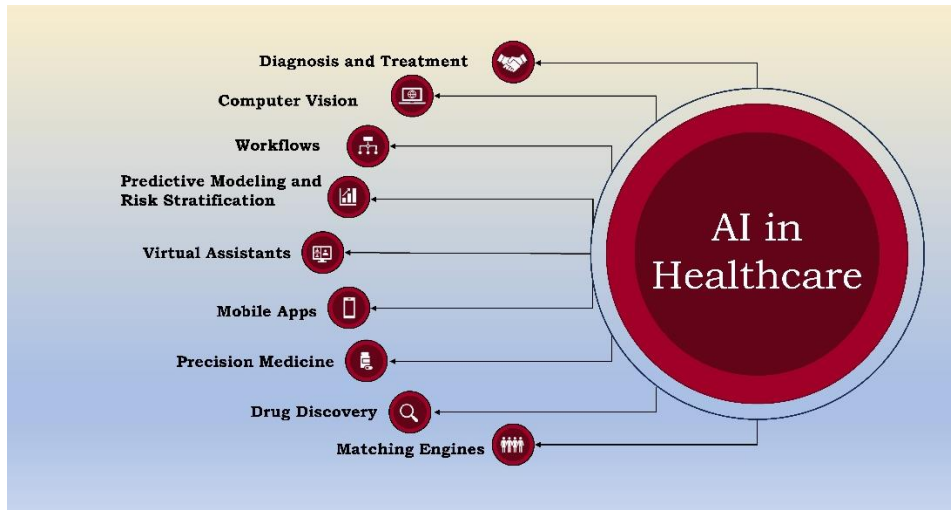


Fig 4: Areas of Healthcare Impacted by AI

## Impact of AI on Precision Medicine:

**Evidence-based Medicine (EBM):** The current system of Evidence-based Medicine was formally introduced into healthcare literature in 1992. In 1991, Gordon Guyatt and his associates at the McMaster University coined the term Evidence-based Medicine to shift the emphasis in clinical decision-making from “intuition, unsystematic clinical experience, and pathophysiologic rationale” to scientific, and clinically relevant research (19, 20). EBM is based on two pillars, namely peer-reviewed scientific publications, and randomized controlled trials (RCT). It should be noted that many classical medical journals were not strictly peer-reviewed until the first half of the 20<sup>th</sup> century. For example, the Lancet adopted peer-review process in 1976. The first randomized controlled study was conducted in 1946. So, EBM is not an old method. For about three decades, EBM helped to integrate the experience of clinicians with the best available scientific evidence and thus guided decision-making in the best interest of the patients. Despite its superiority over the older approaches of intuition and unsystematic clinical experience, of late EBM has been the target of criticism for various reasons. For example, critiques argue, EBM denigrates clinical expertise and ignores patient’s values and preferences; promotes a “cookbook” approach to medicine; and is simply a cost-

cutting tool (21, 22). However, there are counter arguments for this line of criticism (23). To overcome these critiques and downsides, we are now turning to Precision Medicine (24). This approach, which can help with precise diagnosis and treatment regimen in each patient, will be a paradigm shift in healthcare, as it will be enabled by the AI as we see in the following. The transition from EBM to Precision Medicine will not be as seamless as the transition from intuitive medicine to EBM in the early 1990s. Practicing physicians will face challenges they need to overcome with some conscious effort. It should be noted, although the terms precision medicine and personalized medicine are often used interchangeably, they are different. Personalized medicine is the “art” of managing a patient’s care holistically. But precision medicine is a paradigm shift in the “science” of evidence-based medicine.

**Precision Medicine:** Unlike EBM, which is based on generic or collective data obtained from peer-reviewed research papers and randomized controlled trials, precision medicine uses environment, lifestyle, and “**omics data**” of individual patients to prevent or diagnose or treat diseases. Omics data are large-scale datasets generated by comprehensive analysis of DNA (genomics), RNA (transcriptomics), proteins (proteomics), lipids (lipidomics) and metabolites (metabolomics) (25, 26). Together, these



provide a holistic view and approach of the individual patients at the molecular level. Although the tools needed for precision medicine have been available in research labs and large teaching hospitals for more than a decade, integrating the information generated from them and analyzing it to deliver the much-needed messages to clinicians was not possible until now. But the advent of AI solved that problem.

### Challenges in Primary Care & Family Medicine:

Today, physicians in primary care and family medicine are facing these challenges. And AI will help solve them.

- **Early Detection of Non-Communicable Diseases:**

According to the World Health Organization (WHO), non-communicable diseases (NCDs) account for 74% of all death globally or 41 million deaths each year (27). In addition to the huge healthcare costs associated with treating NCDs, which are often chronic, they also cripple the economies due to significantly high DALYs (Disability Adjusted Life Years). In 2019, NCDs accounted for 1.62 billion DALYs, which is 63.8% of total DALYs that year (28). So, early detection and treatment of NCDs will save substantial money in healthcare costs, in addition to mitigating human suffering associated with them.

- **Accurate Diagnosis of Diseases:** Although many advancements are made in technology associated with diagnosis, about 30-33% of medical malpractice lawsuits are due to misdiagnosis or wrong diagnosis (29). Several reasons have been attributed to the misdiagnosis of diseases, such as inexperience or overconfidence by the physician, lack of time with patients, improper testing, complexity of medical conditions, systemic issues, and lack of awareness.

- **Precise Treatment:** Despite randomized controlled trials (RCT) and the availability of proven medicines, precise treatment even for common conditions such as diabetes mellitus or hypertension is not possible always. There are two main reasons for it. First, the amount of data required to be collected and analyzed is increasing steadily. It is also becoming expensive, technically demanding and labor intensive, thus often resulting in prioritizing the options. Second, in most RCT the efficacy of the drugs is around 70% or even

less (30). That means, only 7 out of 10 patients respond to the drug, thus leaving 3 out of 10 patients non-responsive. Added to that, in recent years, there has been a rising placebo efficacy rate in RCTs (31, 32). Increased patient awareness, study design changes, patient selection bias, and ethical considerations are some causes attributed to the rising placebo efficacy rates in RCTs. Interestingly, the rising placebo efficacy rates are unique to the United States and is not observed in other countries (33). Direct advertisement to patients, and compensation of subjects in clinical trials are some reasons why rising placebo efficacy rates are observed in the United States only. Whatever may be the reasons, this issue creates problems for physicians while depending on the results of RCTs.

- **Workforce Shortage:** There is workforce shortage in primary care and family medicine in the United States (34). Many patients, especially in non-urban areas, cannot find primary care physicians who can accept new patients. Increased primary care needs for the aging population, high burnout rate among primary care physicians, and lack of role models for residents and trainees are some factors contributing to the workforce shortage (35 - 37). It is relatively easier to find role models among specialty physicians as compared to among primary care or family medicine physicians. Although sustained and increased investments in training of new physicians appears to be the solution, apparently it is not working.
- **Dwindling Access for Patients:** Several factors are operating for this, such as urban vs. rural areas, type of health insurance coverage the patients may have, and shortage of primary care or family medicine physicians (demand vs. supply) (38).
- **Physician Burnout:** Physician burnout results from accumulated long-term stress due to causes like difficulty in maintaining work-life balance, lack of control over work, being undervalued by colleagues or the organization, frustrations with issues of reimbursements, and professional liability concerns (39). Physician burnout is often manifested with one or more symptoms, such as emotional exhaustion, depersonalization, decreased engagement, cynicism, difficulty in concentrating, irritability, physical ailments

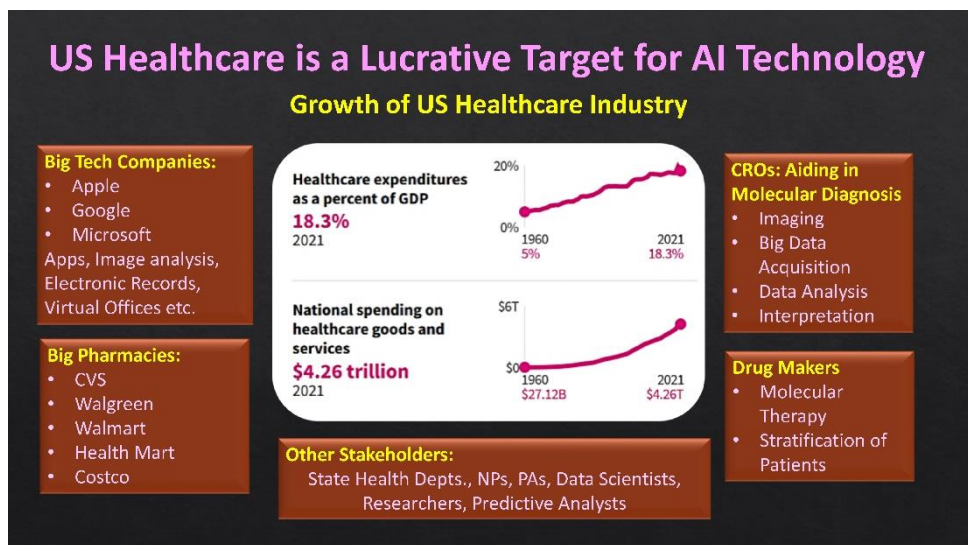
(headache, gastrointestinal issues or insomnia) or substance abuse (40). A survey conducted by the American Medical Association in 2023 revealed that 48.2% of physicians reported experiencing at least one symptom of burnout down from 53% in 2022 (41).

During the COVID-19 pandemic, the reported physician burnout rate was the highest at 63% in 2021 (42).

## US Healthcare is a Lucrative Target for AI Technology

Among all the developed countries, the United States spends the maximum amount on healthcare, both in terms of dollars and as percent of GDP. In 1960, the USA spent 5% of its GDP or \$27 billion on healthcare. It reached 18.3% of GDP or \$4.26 trillion by 2021, which equaled the GDP of Germany in that year (43). At present, healthcare

expenditure of the United States is about 20% of the GDP or about \$5.47 trillion. Thus, the healthcare industry is the most lucrative target for emerging AI technology, which has many stakeholders as shown in Fig 5. So, the incentive for transformation of healthcare by AI is strong and it is non-stoppable as follows.



**Fig 5:** With its multi-trillion-dollar expenditure, the United States healthcare is a lucrative target for AI technologies with several stakeholders as show in the boxes around the central graph. Central graph reproduced from USA Facts <https://usafacts.org> (43) licensed under the Creative Commons Attribution-ShareAlike 4.0 (or higher) International Public License (the "CC BY-SA 4.0 License")

As shown in Fig 5, there are several stakeholders of the multi-trillion-dollar healthcare spending in the USA. These include big tech companies such as Apple, Google, Microsoft, etc. which develop AI tools and AI technology; big pharmacy chains such as the CVS, Walgreen, Walmart, Health Mart and Costco which will establish contract research organizations (CROs) to generate molecular big data; drug makers who will stratify patient’s data for molecular therapy; and state health departments, Nurse

Practitioners (NPs) or Physician Assistants (PAs), Data Scientists, Researchers, and Predictive Analysts assist in bridging the gap between the AI and patients through physicians. The roles these entities or personnel play in precision medicine are described below. According to the Markets and Markets, “the global AI in healthcare market is projected to grow from \$13.82 billion in 2022 to \$164.10 billion by 2029 at a CAGR of 42.4% (44).

## Transformation of Physician’s Workspace by AI: From Physician-centric to AI-centric

### The Primary Care Physician’s Workspace Today:

As shown in Fig 6, today, the primary care or family medicine physician sees the patients in his/her clinic or office. After taking history, and doing physical

examination, the physician may order for lab tests or imaging or send specimens to pathological examination. Based on the information obtained from the above services, using his/her accumulated knowledge and

experience, the physician arrives at a diagnosis and prescribes medicines or vaccines. The patient's health insurance company or HMO or Medicare pays the physician for his/her services and covers the costs of lab tests, medications and vaccines. In this prevailing model, the physician is the center of the workspace and is in full control of the diagnostic process and treatment options.

The advent of AI will disrupt this workspace and introduce a new type of workspace. Although this transformation may take gradually over years, the physicians need to be prepared for it from now onward by knowing the new workspace. This review article provides a glimpse of the future healthcare workspace for physicians.



Fig 6: A Physician's Workspace today.

### Primary Physician's Workspace when AI Takes Over:

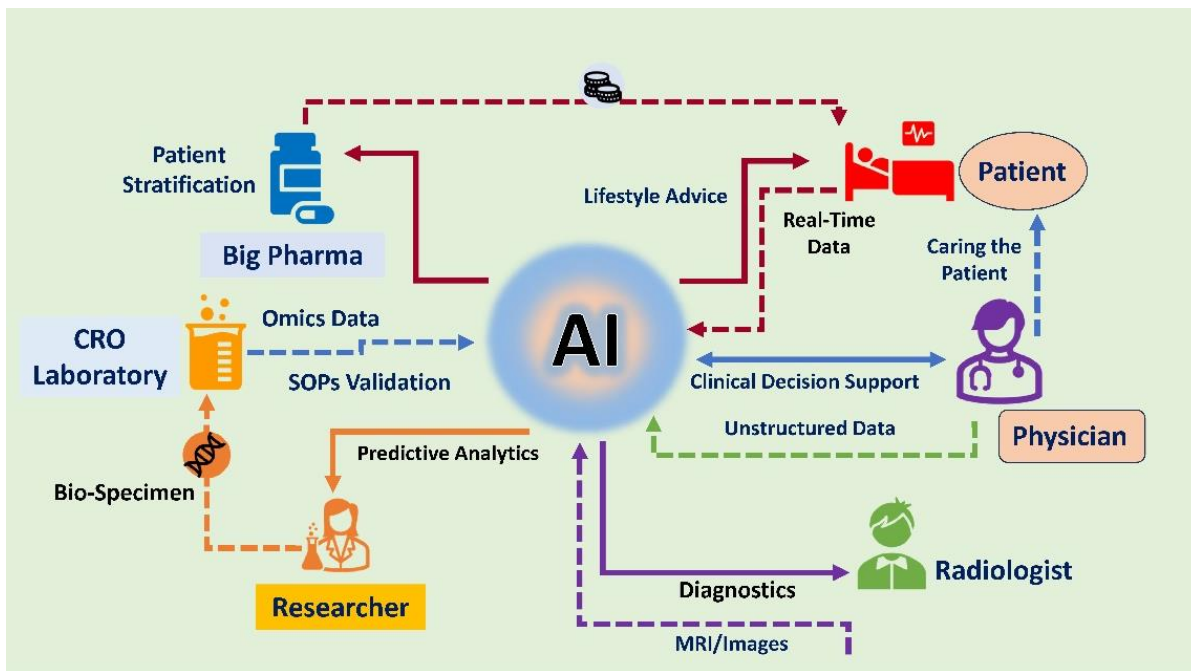


Fig 7: Physician's Workspace when AI Takes Over

Fig 7 depicts the physician's workspace when AI takes over and reaches a mature level like the 5G cell phone network. The most prominent feature in this transformed workspace is the AI, not physician, the center of the workspace. Having taken the center place, AI interacts with various services run by the stakeholders in Fig 5, in addition to interacting with the physician, who will treat the patients. The roles of

the various services shown here are discussed under the molecular diagnosis and molecular therapy described below. Molecular diagnosis and molecular therapy necessitate this transformation, putting the AI in the center of the workspace, because of the complex nature of the diagnosis and therapy as described below.

## Molecular Medicine

The old dictum in medical education was "as is our pathology, so is our practice". The new dictum is "as is our molecular medicine, so is our practice". Molecular Medicine is an emerging subject with independent departments or divisions in medical schools across the United States that offer programs leading to master's degree and/or Ph.D. Molecular medicine emphasizes cellular and molecular phenomena and interventions rather than the previous conceptual and observational focus on patients and their organs (45, 46). Multiple medical boards offer certification in subjects that fall under the umbrella of molecular medicine. These are the American Board of Medical Genetics and Genomics (ABMG), the American Board of Pathology (ABP), and the American Board of Clinical Chemistry (ABCC).

The power of AI in healthcare comes from its ability to: (i) usher AI-assisted molecular diagnosis; (ii) usher AI-assisted molecular therapy; (iii) augmentation of capability of physicians; (iv) provision of real-time big data; (v) streamlining tasks; (vi) saving time and resources; and (vii) reducing physician burnout.

**AI-assisted Molecular Diagnosis:** There are three factors for the advent of AI-assisted molecular diagnosis. These are: (i) the development of advanced molecular technologies which are fast at affordable price; (ii) ability to collect and analyze big data; and (iii) capability to integrate big data with clinical observations and investigations using the power of AI. We will examine these factors in the following.

- **The Development of Advanced Molecular Technologies:** The imaging technologies available today in hospitals and clinics, such as CT scans, MRI, PET etc., are the latest technologies, as they are relatively easier to install and operate efficiently and

generate data that can be interpreted by trained physicians. However, that is not the case with laboratory analysis of biological samples, such as blood, urine or body fluids or tissues as they are done today. These are performed using outdated technologies. The phlebotomist in a typical clinical laboratory draws several tubes of blood, each about 5 ml. Clinical labs also collect over 100 ml of urine from each patient. When the lab reports arrive, they contain test results mostly in numbers, which even patients can understand whether or not they are within normal limits. Most routinely performed lab tests are chemical or biological profiles. These are performed on huge, automated machines which are technologically older, but are expensive to run. They also need larger sample sizes to analyze, and they take considerable time to generate the results. In contrast, research laboratories which study small rodents, such as rats or mice, work on less than one ml of blood per animal and analyze dozens of parameters in them using very sensitive modern technologies such as ELISA or EIA on microplates, which require microliters of samples to analyze, often after dilution with saline. The samples in microplates are read on microplate readers, which are about the size of an office laser printer, and cost from \$10,000 to \$20,000 each (Fig 8A). The running costs associated with ELISA or EIA on microplates are much smaller as compared to the costs of the huge analyzers currently in use in hospital clinical laboratories. It is like a few dollars per test. In parallel, using Mass Spectrometry (MS), research labs obtain protein, lipid or metabolite profiles in plasma or body fluids or biopsy samples (omics data; Fig 8B). The number of data points generated from analysis of each category of omics are often in hundreds, providing deep insights. All these analyses are done for a low-price tag. While our current molecular technology capability

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is like 2024 Model Tesla car, what we are offering in the clinic to our patients is like 1960s Oldsmobile. Unless a lab test is mandatory to perform a therapeutic procedure, the technology is not the latest one. Such examples are automated blood cell counters for

chemotherapy, and plasma electrolyte analysis to treat disorders of electrolytes in critical medicine. This is mostly due to the barriers in translating the advanced molecular technologies into routine clinical use. As we see below, AI will break those barriers.



**Fig 8A:** Typical microplate reader used in research labs. It has the footprint of an office laser printer. Using 96-well microplates tailored for different types of assays, one can determine the levels of biologicals such as insulin, cholesterol etc., in a few microliters of samples accurately within minutes. Image: Licensed under the Creative Commons Attribution-Share Alike 3.0 Unported.

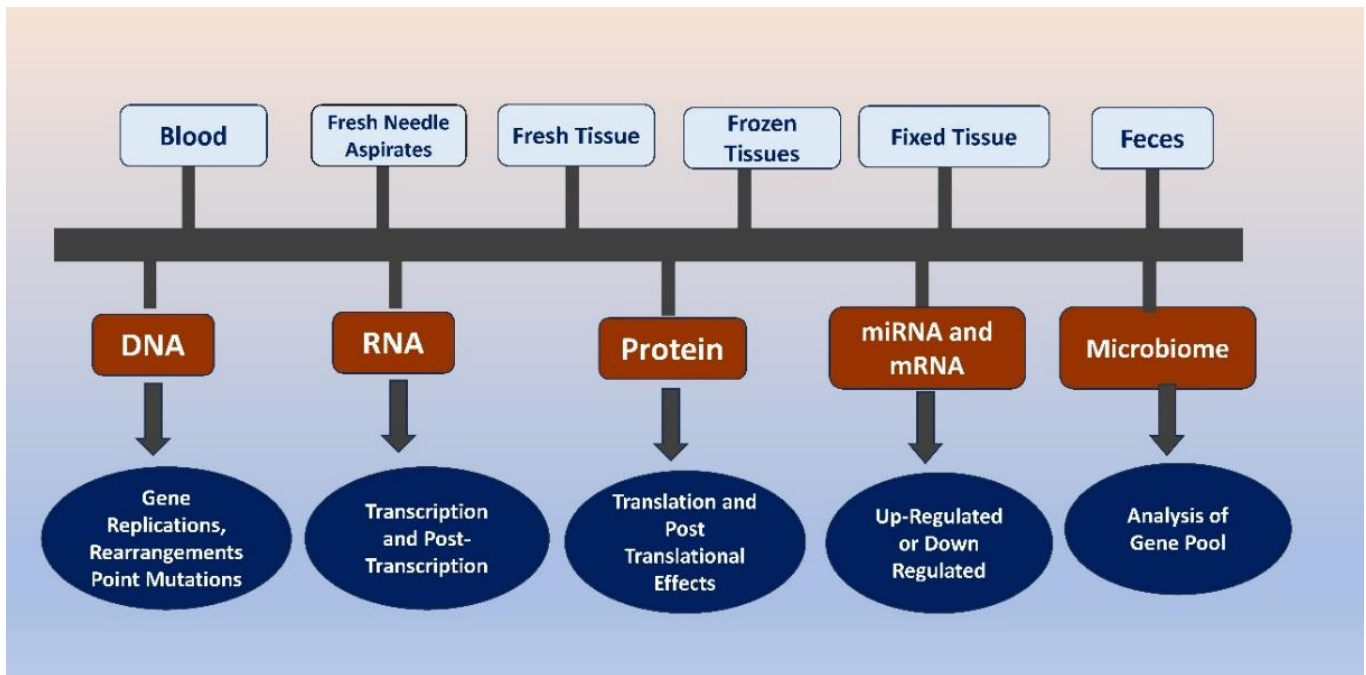


**Fig 8B:** Typical Mass Spectrometer used in research labs. It has a footprint smaller than a household washing machine. With 10 to 100  $\mu$ L of samples, it can determine glycomic, proteomic, metabolomic or lipidomic profiles within a short period. Image: from Thermo Scientific website.

- **Generation of Big Data:** Big data has three components large volume, high velocity in collection, and variety of information generated, with an impact that was not possible before (47, 48). All three components are essential to be designated as big data. This obviously needs new methods of processing the data, optimization of processed data, and enhanced decision-making capability. Currently, these are not within the capacity of human brain and need the use of AI. The high-tech molecular big data that will be collected for molecular diagnosis when AI takes over healthcare are shown in Fig 9.

As shown in Fig 9 below, each patient will be analyzed to obtain his/her genome (DNA), RNA transcriptome, proteomics (protein), microRNA and messenger RNA profile, as well as gut microbiome using appropriate

biological samples. Analysis of these parameters, computation of the enormous amount of data (running into several thousands of data points), interpretation and integrating the data obtained from different types of analysis to derive clinically meaningful conclusions is beyond the scope of clinics or hospitals or healthcare professionals. These require high-tech methods and equipment, in addition to using AI. So, Contract Research Organizations (CROs) with the capability and capital to undertake these tasks will be established. It is expected that the big pharmacy chains, such as CVS, Walgreen, Walmart, Health Mart, and Costco will invest and build chains of these CROs across the country which will analyze biological samples sent from different hospitals and clinics and provide the results in a ready-to-use form without the need for interpretation by physicians or healthcare providers (see Fig 5).

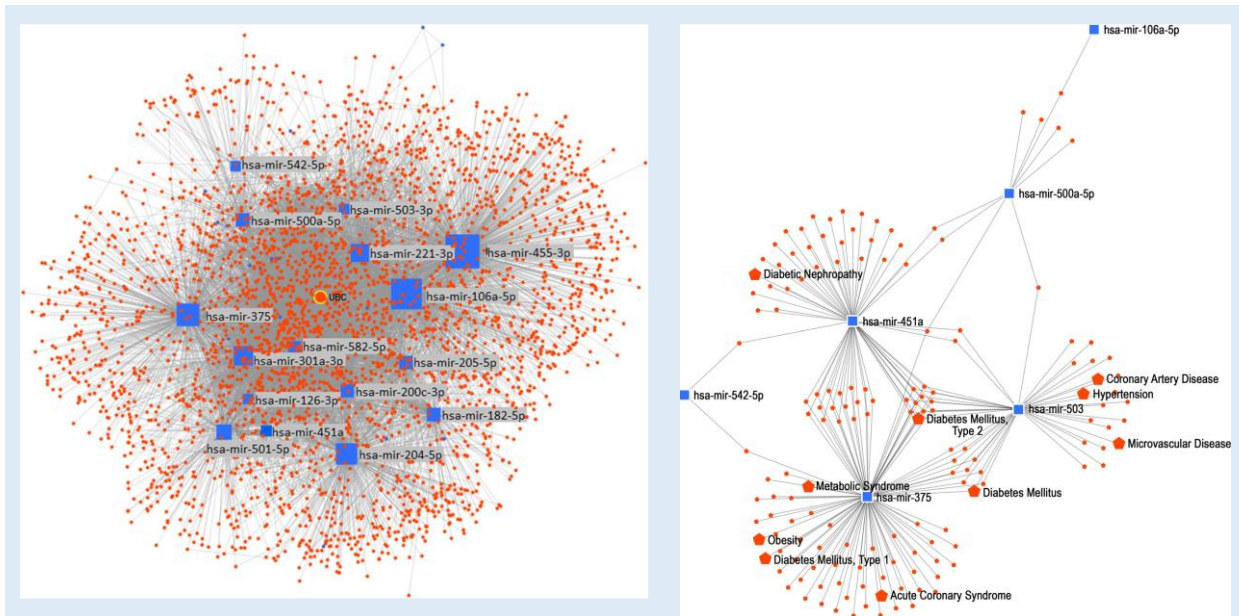


**Fig 9:** Big Data Collection for Molecular Diagnosis when AI Takes Over Healthcare.

The CROs will establish AI with algorithms to generate the final reports. These reports are not as parameters with numerical data with a normal range indicated, as we see now in lab reports. The results are often processed by cluster analysis, which is a powerful tool for data mining, and presented as such with interpretation in text form. For example, Fig 10A shows the complex regulatory network of genes – miRNA, which is impossible to map or interpret without the aid of AI with its complex algorithms. Fig 10B shows the cluster analysis of up- and downregulated miRNA associated with type 2 diabetes mellitus (T2DM) pathomechanisms and related diseases. The cluster analysis in Fig 10B is from only one parameter in Fig 9, namely microRNA (miRNA) and messenger RNA (mRNA). Each parameter in Fig 9 produces its own cluster analysis. Then AI will integrate the data generated in each cluster analysis and produce a master cluster analysis which should pinpoint the molecular disease in the patient. This is the ultimate goal of the evolving application of AI in molecular diagnosis.

Complex molecular data generated as above by the CROs will be fed into the AI system for analysis and interpretation by the machines. The results obtained thus will be shared with physicians who treat the patients, and with researchers for predictive analysis (see below for predictive analytics). Based on clinical history, physical examination findings, and molecular data collected, AI will provide the diagnosis to physicians, and the predictive analysts assist the physicians in issues related to the interpretation of molecular data. Thus, although the physician is still the one who makes the final clinical decisions and treats the patient, he/she is heavily influenced by the big data generated by the CROs and the interpretations made by the AI. The physician is also assisted by predictive analysts and researchers. This is a major shift in the workspace of the physicians when the AI takes over and matures.

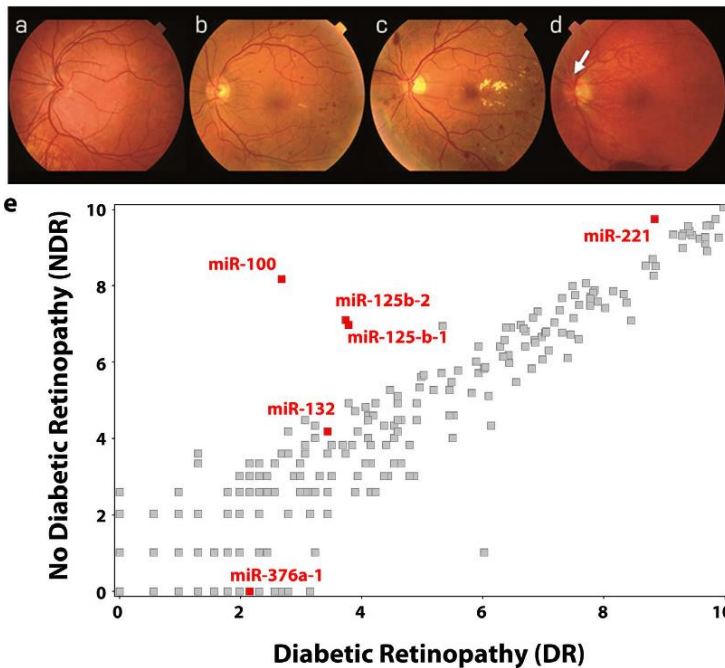
Another example of the power of AI in molecular diagnosis is in diabetes management platform using data obtained from retinal images and circulating microRNA signature for diabetic retinopathy as shown in Fig 11 (50).



**Fig 10A:** Genes – miRNAs regulatory networks. The blue squares are miRNAs, and the red spots are mRNA targets. The edge connecting two nodes indicates regulation. The more oversized shape indicates the highest target biological relevance of the miRNAs identified.

**Fig 10B:** Up- and downregulated miRNAs associated with T2DM pathomechanisms and other related diseases. The blue squares are miRNAs, and red spots represent miRNA targets. Red pentagons indicate pathomechanisms related to diseases.

**Source:** Images and legends are reproduced from Zapala et al, *Pharmaceutical Research*, 2023 (49) under the Creative Commons Attribution 4.0 International License.



**Fig 11:** A circulating microRNA signature for Diabetic Retinopathy (DR). Fundus photographs showing the clinical spectrum of DR: (a) a normal retina—no DR; (b) mild non-proliferative DR, with hemorrhages, microaneurysms and hard exudates; (c) non-proliferative DR; (d) proliferative DR, at the optic disc (white arrow) and pre-retinal hemorrhage in the inferior retina. (e) MicroRNAs consistently identified in plasma of age and gender matched diabetic individuals with or without DR following analysis of smallRNA sequencing (see text). The miRNAs that constitute part of the DR biomarker signature are displayed in red. (Image and legend reproduced from Farr et al, *Nature Scientific Reports*, 2015 (50) under Creative Commons Attribution 4.0 International License).

microRNA (miRNA) is a class of small non-coding RNA molecules that regulate gene expression in cells. They are ubiquitous in the body and play critical roles in physiological functions and in pathophysiology of disease

processes (51). The importance of miRNA in molecular diagnosis and therapy are increasingly becoming evident (52). The 2024 Nobel Prize in Physiology or Medicine was jointly awarded to Victor Ambros and Gary Ruvkun “for the

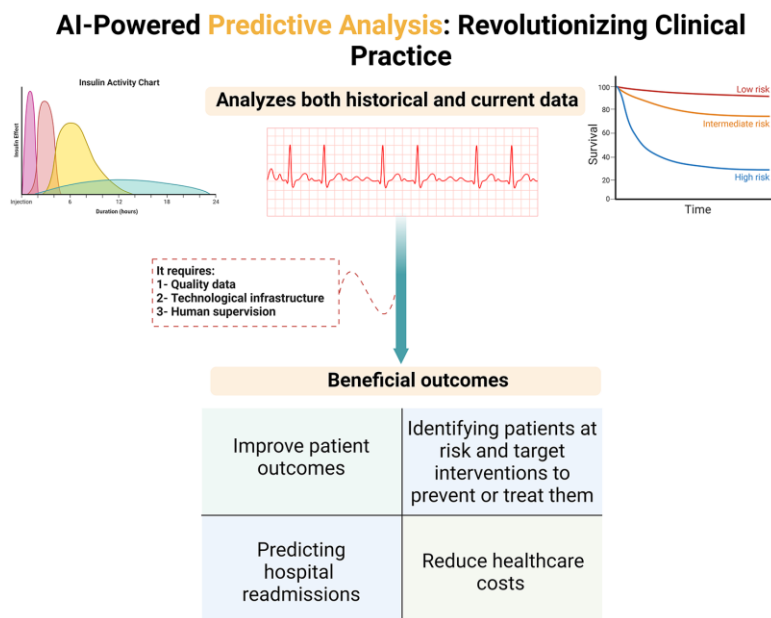
discovery of microRNA and its role in post-transcriptional gene regulation” which is an indication of emerging importance of miRNA in medicine and healthcare (53).

As shown in Fig 11, a combination of fundus images such as those obtained using Google Fundus camera (54) and analysis of circulating miRNA profile in diabetic patients

**The Power of Predictive Analytics:** As shown in Fig 7, one of the components of AI-driven molecular diagnosis is predictive analytics. This is a powerful tool that allows healthcare providers to predict future health outcomes of the diseases, including acute episodes, or complications or

can provide information and data that are not possible until now with classical approaches of fundus imaging alone in the clinics. Obviously, the use of AI integrates the data obtained from fundus images and circulating miRNA profile, thus empowering the physicians with molecular diagnosis (50).

lack or response to procedures or treatment etc. This involves a complex process of analysis of patients’ history, statistical modeling, machine learning and other approaches (55). Fig 12 shows an example of the process of predictive analytics using AI.



**Fig 12:** Unlocking the power of patient data with AI-driven predictive analytics. (Image and caption from Alowais et al, 2023 (5) under Creative Commons Attribution 4.0 International License)

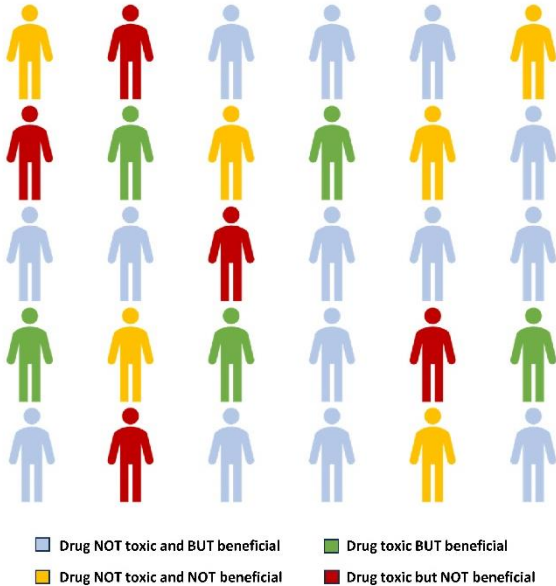
**AI-assisted Molecular Therapy:** As stated above under general description of evidence-based medicine, the efficacy of most FDA-approved drugs is about 70% or even less, leaving the rest of the 30% patients with no effect of therapy. Almost all medicines have adverse effects, which might manifest in every patient. The adverse effects may manifest more severely in some patients as compared to the others. These factors result in combination of different outcomes in clinical trials with new drugs for the same underlying disease. Fig 13 shows these combinations.

The data in Fig 13 indicate that the effect of a drug in a particular disease or in a particular patient is

unpredictable until the drug is administered. So, the physician may have to go by trial and error in some patients until the right drug is found based on the clinical outcomes. This approach may be fine if the underlying disease is not life-threatening over a short period, such as diabetes mellitus or hypertension or rheumatoid arthritis etc. If the underlying disease is life-threatening over a short period, such as advanced cancer or severe cardiovascular or cerebrovascular disease, this approach does not work. In such conditions, it will be a great help for physicians to have a mechanism or system to find the right drug the very first time it is used. AI-assisted molecular therapy helps us to achieve that goal.

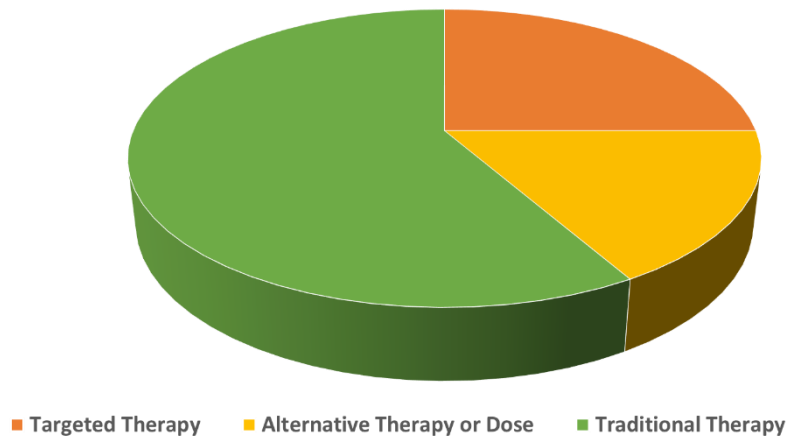


### Same Diagnosis, Same Prescription



**Fig 13:** Outcome of clinical trials for the same drug for the same disease in a cohort of patients. As shown, there are four possibilities in the patients. The drug had beneficial effects in about 63% of patients. Of these, 47% did not have adverse effects, and 16% had adverse effects. In about 17% of patients, the drug was not beneficial but had adverse effect. In the rest 20% of the patients, the drug had no beneficial effect and no adverse effect.

**Molecular Profiling:** The AI-assisted molecular therapy is based on molecular profiling to identify which patients will respond to which available drug before starting the therapy. This will prevent trial and error in arriving at the right medicine in a patient.



**Fig 14:** Individuals with the same diagnosis, but different responses to treatment. Molecular profiling of patients will allow us to differentiate who will respond to traditional therapy or targeted therapy or alternative therapy.

### Stratification of Patients Leading to Precision Medicine:

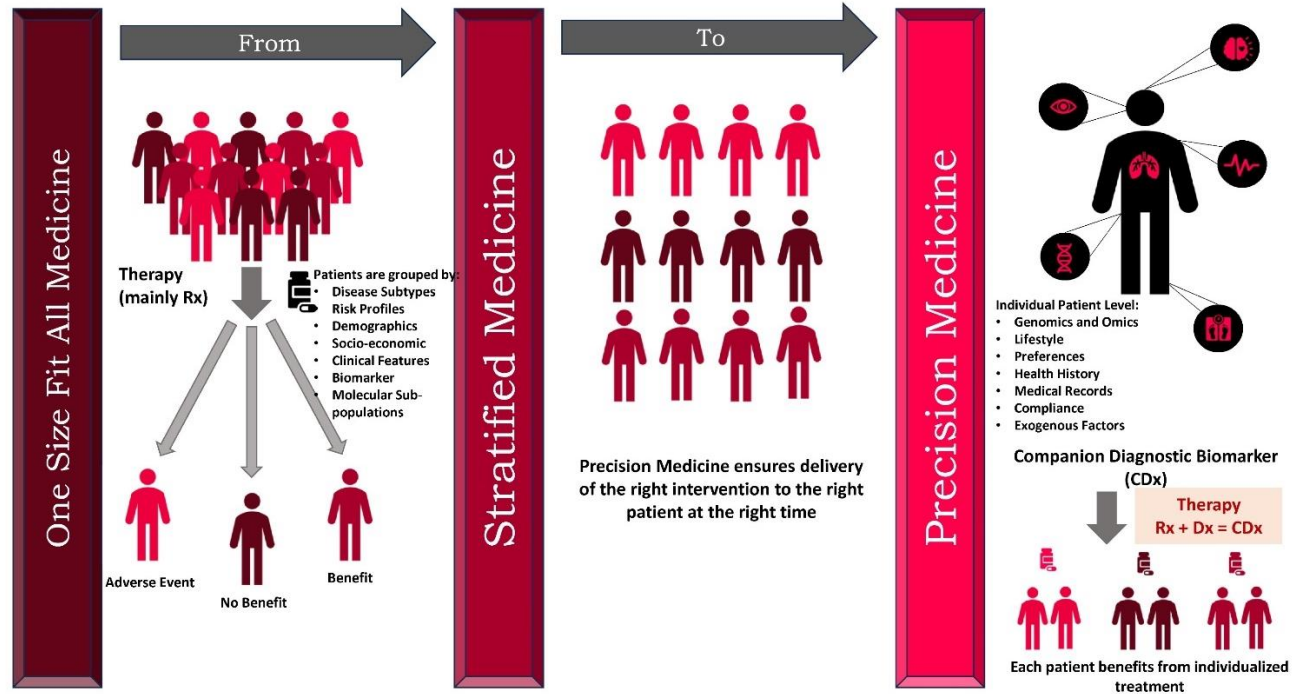
Molecular profiling combined with patient characteristics and signs and symptoms recorded by the physicians will allow stratification of patients leading to the transition of evidence-based medicine to precision medicine as shown in Fig 14. As we described above, in the evidence-based medicine or one-size fits all medicine, the physicians encounter mixed results from therapy with the same medication in the same disease condition. In the first phase of stratification, patients are grouped by disease subtypes, risk profiles, demographics, socio-economic

conditions, clinical features, and subgroups based on biomarkers. In the next step of stratification, individual patients are further differentiated based on the big data obtained from molecular analysis, such as their omics profile, in addition to their lifestyles, and other factors. By analyzing innumerable data points obtained from each patient and integrating them with the application of AI and predictive analytics, the right medicine that will be effective in individuals with no or least side effects will be identified. Obviously, this involves complex analysis of thousands of



data points from each patient, which is not possible so far without AI. AI has the power to not only handle and analyze the big data, but also to interpret the big data using the vast amount of knowledge available on the web in real time. This is where AI outperforms the human brain.

The human brain depends on its accumulated knowledge and experience, with individual limitations. The human brain cannot access the vast amount of knowledge available on the web.

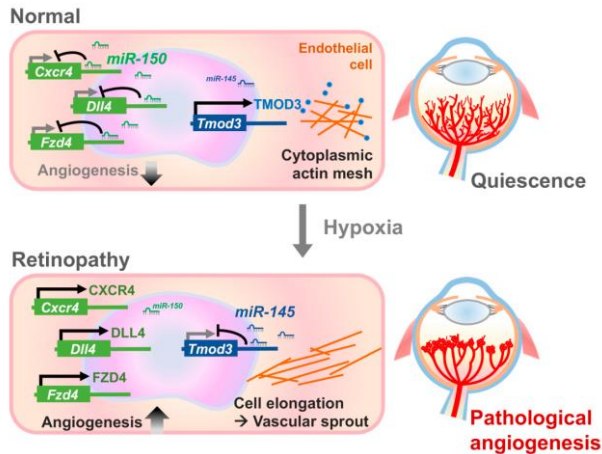


**Fig 15:** Stratification of patients based on individual characteristics and big molecular data generated will allow precision medicine by identifying the right medicine or therapy for each patient before actually starting the treatment. Thus, there is a shift from "one-size fits all" to "precision medicine tailored to individual patient" using multi-level patient stratification. Thus, in the precision medicine  $Rx + Dx = CDx$ , where Rx stands for the prescription drug, Dx stands for diagnostic test, and CDx represents "companion diagnostic", which identifies the right type of drug to which the patient most likely responds as therapy. This is made possible by the power of AI. (Image built based on the information in Frost & Sullivan website <https://frost.com> (56)).

Because of the power of AI to provide molecular diagnosis and molecular therapy and to interface with various services and individuals involved in the diagnosis and treatment of patients, its position in the center of the workspace is justified. It is believed that stratification of patients leading to precision medicine will be developed and serviced by big pharmaceutical companies through a network of processing centers throughout the country.

A good example of effectiveness of precise molecular therapy is illustrated in the treatment of vascular eye diseases using the right type of microRNA as shown in Fig 16. In normal retinal blood vessels, abundance of

microRNA-150 (miR-150) and low levels of miR-145 suppress the expression of angiogenic genes. In retinopathy, decreased levels of miR-150 alter this ratio between these two miRNAs and cause pathological neovascularization (57). This can be prevented by methods that result in an increased expression of miR-150. Thus, molecular therapy aided by AI has vast potential to introduce individually tailored treatment protocols for disease conditions that are not possible until now.



**Fig 16:** Targeting miR-150 in experimental retinopathy. High levels of miR-150 and low levels of miR-145 in normal retinal vessels maintain quiescence. In retinopathy, decreased levels of miR-150 causes pathological neovascularization. So, methods to raise miR-150 in the eye by intraocular administration may prevent neovascularization in pathological angiogenesis. (Image reproduced from Liu et al, International Journal of Molecular Science, 2020 under an open access Creative Commons CC-BY license).

### Stages and Timeline of Adoption of AI by Healthcare:

The above-described technological progress will take place in three distinctive stages over 10 to 15 years or more as follows (58). The projected timeline may shrink due to the added effect of technologies developed along the course. It is like snow balling effect as individual technologies pile up, they have synergy, just as we have witnessed in development of smart phones, which gained momentum from 1G to 2G, and then to 3G etc.

- **Stage #1: Short-term 0-5 Years:** During this period several pieces of technology will be developed, such as gadgets, wearables, visual assistants, precision imaging (e.g., retinal camera) in the clinics. In the labs, tools that help in molecular diagnosis and precision therapy will be added. These will result in reduced time taken for several tasks in the clinics, especially for the repetitive tasks. Precision in diagnosis will improve considerably. This phase is comparable to the early-stage cell phones, with no touch screens, and with a keypad, and an antenna to be pulled out while talking. Reception may not be even in all places. Yet they were better than the landlines fixed at home or office, and which could not be taken while going out. Net connectivity is 1G or 2G level. So, this stage should not be confused as the *summum bonum* of AI in precision medicine even though it appears to be considerable technological progress as compared to what we have today.
- **Stage #2: Mid-term 5-10 Years:** During this period, the cognitive power of the AI tools used will improve considerably, and physicians start feeling virtual assistants in their offices. Imaging technologies will

show scale-up, precision therapeutics will advance to the next higher level. Multi-modal datasets will drive precision therapeutics. Robotics will enter clinics assisting physicians in various ways. Physicians feel they have much needed assistance with cognitive power to execute some of their critical tasks with little or no supervision. This phase is comparable to the cell phones with an internal antenna, with reception even at most remote places, and there is touch screen with text and early-stage graphics and games etc., batteries need not be charged often, and net connectivity is 2G or 3G level.

- **Stage #3: Long-term 10 to 15 Years or More:** This phase will see predictive and anticipatory care. Several autonomous virtual assistants in the clinics and hospitals, including the operation rooms will assist the physicians. These will also assist in emergency rooms with accurate “triage” capability and may predict unexpected outcomes in serious patients. In hospitalized patients, the AI will help in predicting prognosis and impending problems. Application of AI will change the way physicians manage patients in critical care units, in palliative care and in labor rooms. Molecular diagnosis and precision therapeutics will reach newer heights. This phase is comparable to smart phones with various capabilities, and 5G network capacity. This will keep on progressing to higher capability and versatility until physicians feel like pilots in the cockpit of an advanced airplane interfacing with autopilot. AI will eventually take healthcare to this level of sophistication.

## Role of Blockchain in AI-assisted Precision Medicine:

As we have seen above, AI will boost the advent of precision medicine and takes it to a higher level by integrating personalized health data and lifestyle of patients with high-tech molecular diagnosis and therapeutics not used so far in healthcare. These involve several personnel apart from physicians and healthcare workers, such as data scientists and predictive analysts, as well as external CROs that provide molecular diagnosis, and the pharma industry that stratifies patients etc. These developments take out the patients' health information and data from the silos of traditional doctors' offices or

hospitals and spread them across a much wider space. These create new challenges regarding preserving privacy and security of patients' data as per the HIPAA and keeping track of who is having access to sensitive data and when. To overcome these issues, eventually blockchain will be installed and it becomes an integral part of the precision medicine (56-59). A platform called "PrecisionChain" has been proposed for combined clinical and molecular data analysis and sharing across participating services and collaborating institutes (60). Fig 17 depicts how blockchain can be integrated into precision medicine simply.

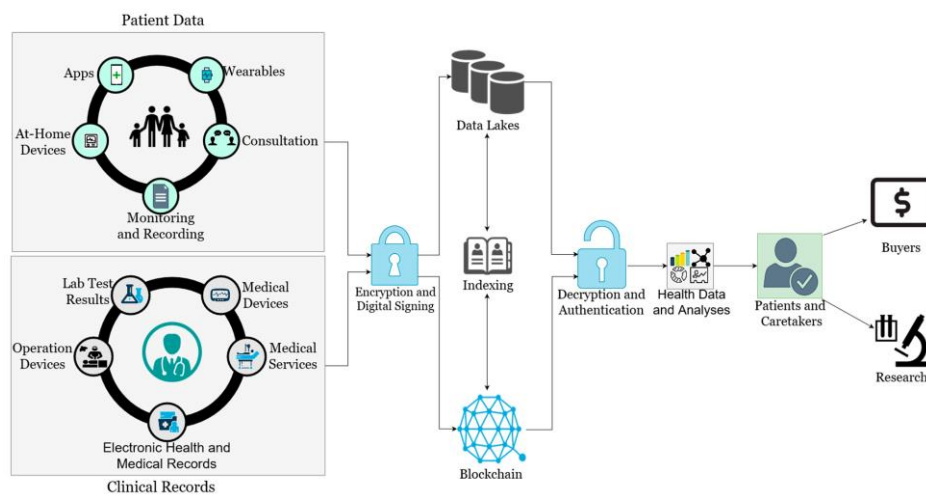


Fig 17: How blockchain can be integrated into precision medicine.

(Image reproduced from Shuaib et al, 2019, under Creative Commons Attribution CC-BY License)

## Ethical and Legal Issues Related to AI-assisted Precision Medicine:

Obviously, the current ethical and legal regulatory framework cannot encompass the new wave of AI-assisted precision medicine with its wide net of stakeholders and analysis and decisions made by machines with little or no input from ethically and legally bound humans. Hence the ramifications of AI in precision medicine are vast and complex. Legal and ethical experts, lawmakers and the tech-companies that design the AI tools and the stakeholders who participate in molecular diagnosis or

therapeutics need to come together, discuss and arrive at consensus to put a new framework in place. For want of space, this topic is beyond the scope of this review article. Readers can refer to published reviews for information (61-64). It is noteworthy, the European Parliament has conducted a study on ethical and societal issues impacted by the use of AI in healthcare and published the study results (65).

## Benefits to the Healthcare Professionals:

AI-driven precision medicine will benefit physicians and healthcare professionals in several ways as follows.

- **Real-Time Data/Analytics:** With AI-driven healthcare, doctors and healthcare professionals can leverage

immediate and precise data to expedite and optimize critical clinical decisions.

- **Streamline Tasks:** AI will enable healthcare facilities to streamline tedious and meticulous tasks.

- **Save Time and Resources:** The more critical processes are automated, the more time physicians and healthcare professionals will have to take care of their patients.
- **Reduces Physician Burnout:** The most significant contributing factors for physician burnout are the

### Current Limitations of AI in Medicine and Healthcare:

AI as we see today has limitations, which need to be overcome with advancements in technology as well as our understanding of AI.

- **AI needs human surveillance,** especially during its development. Poorly designed systems can misdiagnose. Algorithms trained on data sets that reflect cultural biases will incorporate those blind spots.
- **The interface of AI with humans is a critical factor.** It needs to be developed properly by training physicians and healthcare professionals. AI may be an intelligent virtual companion, but it lacks human touch or nature. Because of this, AI may also overlook social variables, such as patient needs. Programs that learn as they go can produce a raft of unintended consequences once they interact with unpredictable humans.
- **AI can be biased.** Since AI works based on algorithms, if there are biases in algorithms, AI can perpetuate them. For example, if the algorithm is based on data biased against a certain race or gender (e.g., salt-sensitive hypertension more prevalent in African

patient load and the nature of the profession itself. Physicians will experience less of these as AI can assist with more time-intensive operations, such as accurate diagnosis and precision therapy, as well as streamlined tasks.

Americans), AI may continue to make biased decisions based on that data. This can be overcome by programming algorithms to evaluate genomic data than considering skin color or race as risk factors for diabetes or salt-sensitive hypertension or cardiovascular diseases or different cancers. According to Dr. Isaac Kohane, Chair of Harvard Medical School's Department of Biomedical Informatics, "Getting diversity in the training of these algorithms is going to be incredibly important, otherwise we will be in some sense pouring concrete over whatever current distortions exist."

- **AI can be exploited for making profits.** AI designed to both heal and make a buck might increase – rather than cut costs.
- **The Black Box problem.** Finally, it is possible, at early stages of AI deployment, the "Black Box" problem akin to the Boeing 737 Max incident. The system kept on showing that the plane was going up, but the pilot saw it was going down and could not override the on-board computer, which is making a wrong interpretation, resulting in crash of airplanes (66).

### Potential Benefits of AI in Healthcare:

AI will make it possible to bring all knowledge to bear in service of any case, anywhere in the world – for example, access to AI-driven consultations. Properly designed AI has the potential to make healthcare systems more efficient and less expensive and ease the paperwork burden for physicians. AI will fill the gaping holes in access to quality care in the world's poorest places. AI will serve as a non-

blinking watchdog on lookout for medical errors. About 795,000 Americans become permanently disabled or die annually across care settings because dangerous diseases are misdiagnosed. Just 15 diseases account for about half of all serious harm (67). The costs involved in these errors run into several billions of dollars with no clear estimates.

### AI is a Double-Edged Sword:

AI is reshaping the landscape for physicians, nurse practitioners (NPs), and physician assistants (PAs) by providing diagnostic support, personalized treatment,

administrative assistance, remote monitoring or telemedicine, continuous learning and decision support among others. While doing so, AI is also narrowing the

knowledge and other gaps between physicians and NPs/PAs, which can eventually lead to displacement of physicians by NPs/PAs wherever possible. The 2021 US Bureau of Labor Statistics predicted that the 10-year job outlook for physician growth as 3%, NPs at 46%, and PAs at 28% (68). Currently, Alaska, Washington, Oregon, Rhode Island, New Hampshire, Arizona, and New Mexico are

allowing NPs to open their own practices with few restrictions. Other states may follow the suit to reduce healthcare costs and to provide access to healthcare to all sections of people and at all locations. This will force physicians to move to higher elevations professionally. This is one aspect of AI likely to exert pressure on physicians.

## AI Training Courses for Physicians and Healthcare Providers:

Since AI is a transformative and impending reality, it is prudent for physicians and healthcare providers to undergo formal training in the fundamentals of AI in healthcare, which they can expand further by reading, watching videos and with actual hands-on experience. Here is the list of a few online courses on AI for practicing physicians and healthcare providers.

- American Board of Artificial Intelligence in Medicine (ABAIM) – Offers Several Types of Courses
- ChatGPT Essentials for Clinicians – Free Course
- University of Illinois AI in Medicine Certificate - \$750 fee

**Conclusion:** AI in healthcare is a reality with which physicians and healthcare providers must make friends and learn how to co-exist. Because of its cognitive power and ability to learn, rather quickly, AI is not like computer systems (e.g., electronic health records). AI is more like an intelligent or smart virtual companion. Due to its ability to access vast knowledge on the web in real-time, and its huge and fast computing power, AI can absorb big data, analyze them, and present solutions to physicians in a nutshell for use. These and other characteristics of AI, such as ability to interact with different stakeholders simultaneously, and the power of predictive analytics, it is no wonder that AI will take the central position in healthcare space. Physicians should not be concerned about it. Instead, they need to consider AI as an elephant, which when tamed properly can empower them to accomplish much more. Thus, understanding AI and its characteristics and adapting to interfacing with AI and getting the best out of AI are essentials. Future physicians need to be like pilots in the cockpit of a commercial jet plane. By adapting to the systems like the autopilot in the cockpit, physicians can get maximum work done very

- Harvard University AI in Health Care: Concepts and Applications - \$2,600 fee
- American Academy of Family Physicians - AI in Family Medicine: Transforming Your Practice – Free Course
- University of Florida - AI Based Medicine Technical Expertise CME - \$200 fee
- Stanford Artificial Intelligence in Healthcare - \$79 Monthly Subscription
- MIT's Online Short Course on AI in Healthcare
- AMA EdHub Artificial and Augmented Course in Health Care

efficiently. It is achievable and a must for the next generation of physicians and healthcare professionals. There is no other way to move forward.

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**Disclaimer:** This comprehensive review article on roadmap is based on the information available on AI in public domain at the time of preparation. Hence, it is meant to be informative or educational for healthcare professionals with no assurances made or implied.



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## Call for Review of Books Authored by AAPI Community

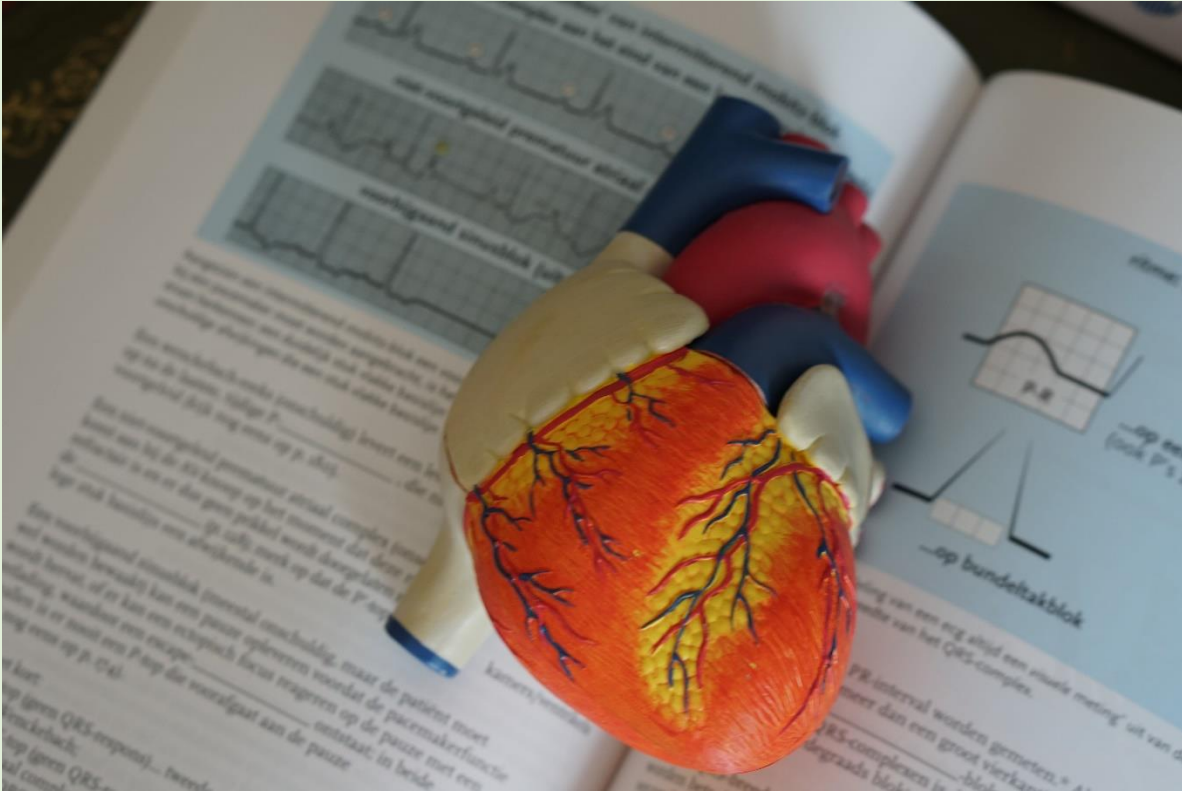


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As many AAPI Community Members are authoring and publishing academic books, to provide them a visible platform, JAAPI launched a new section on **Review of Books Authored by AAPI Community**. This will be limited to books on topics related to medicine and healthcare, but not to books on other topics. Both printed and eBooks published by traditional publishers or on self-publishing platforms and bearing ISBN number will be eligible for review. The review of the books should be written by an expert in the field, not by the author. More details can be found in the Instructions to Authors section of this edition of JAAPI.



## Opinion Paper

# Combating HIV-related Stigma and Discrimination: A Crucial Imperative in India

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**The Context and Background:** The continuing persistence of stigma and discrimination related to HIV poses a formidable challenge. Despite significant strides in HIV and AIDS awareness and treatment, individuals living with HIV grapple with prejudice, social marginalization, and egregious violations of their fundamental human rights. This pervasive issue is not confined to specific region but is a global phenomenon. Stigma and discrimination against people living with HIV (PLHIV) are rampant in general population, family and peers, within institutions and social constructs and ranges from verbal and physical assault to disenfranchisement, breach of confidentiality and denial of essential health services. Loss of employment due to HIV status highlights the devastating economic repercussions of stigma and discrimination. In India, where the HIV epidemic is concentrated among key populations such as female sex workers, men having sex with men, migrant men, transgender individuals, and injecting drug users, stigma and discrimination cast a long shadow over efforts to combat HIV.

**Key Words:** HIV, AIDS, Stigma, Discrimination, Combating HIV

**Introduction:** HIV-related stigma and discrimination is a reality in every part of the world, although it may look unique to countries like India (1). To effectively tackle this multifaceted issue, it is imperative to delve into the intricate dynamics of HIV-related stigma and discrimination. Only through a comprehensive understanding of the underlying factors driving stigma and discrimination at workplace, community, healthcare and educational settings, can meaningful interventions be designed and implemented to dismantle barriers. At the global level, significant strides have been made through initiatives such as the Global Partnership for Action to Eliminate All Forms of HIV-Related Stigma and Discrimination was launched in 2018 under the auspices of UNAIDS and other key partners (2). This partnership globally bolsters the

implementation of stigma-reduction programs across six pivotal settings: healthcare, education, workplace, justice, humanitarian, and emergency contexts. By fostering collaboration and collective action, this initiative dismantles the barriers of stigma and discrimination that impede progress in the fight against HIV/AIDS.

Within India, the National AIDS and STD Control Programme (NACP) Phase V, 2021-26 has taken proactive measures to integrate stigma reduction as a central tenet of its strategy (3). Through targeted interventions, the NACP endeavours to combat stigma and discrimination by fostering awareness, empathy, and inclusivity. These efforts encompass a range of activities, including sensitization trainings for healthcare providers, provision of legal aid services for

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individuals living with HIV, community mobilization, empowerment initiatives for key populations, and media campaigns aimed at dispelling myths and challenging misconceptions surrounding HIV/AIDS. To foster the vision of a world free of stigma and discrimination, much needs to be done. Here we describe strategies to build an inclusive and just world for everyone. Through holistic approaches, our endeavours should be to dispel myths regarding transmission of HIV and build a supportive environment that promotes community acceptance and understanding. This will contribute to better health outcomes and a decrease in fear and discrimination faced by PLHIV.

**Understanding HIV-related Stigma and Discrimination:** The United Nations Programme on HIV/AIDS (UNAIDS) defines 'HIV-related stigma' as the negative attitudes, beliefs, and prejudices directed towards individuals living with HIV/AIDS or are perceived to be at risk of HIV infection (4). Stigma often leads to social rejection, isolation, and marginalization of affected individuals and communities. It can manifest in various forms, including verbal abuse, social exclusion, and denial of healthcare services. 'HIV-related discrimination' involves the unfair or unequal treatment of individuals based on their HIV status. It encompasses actions, policies, and practices that violate human rights and denial of opportunities for people living with HIV/AIDS. Discrimination may occur in healthcare settings, workplaces, educational institutions, and within communities, leading to profound social and economic consequences for affected individuals.

Stigma and discrimination can affect the emotional wellbeing and mental health of people living with HIV/AIDS. Negative self-perception occurs if the stigma encountered is internalized for example regarding fear of discovery of their HIV status. Self-stigma or internalized stigma can evoke feelings of shame, hopelessness and fear of social isolation. These emotions can be detrimental for individuals to come out and seek care and treatment (5). For mitigation of internalized stigma, it is important that there is an open dialogue about HIV/AIDS and awareness is spread through use of multi and mass media as street plays, posters, hoardings at bus/train stations, wall paintings, newspaper, radio, social media etc that gives opportunity to dispel misconceptions and spread the

correct information about HIV/AIDS so affected individuals are empowered to acknowledge their health needs and reach out for right care, support, diagnosis and treatment.

**Critical Settings of HIV-related Stigma and Discrimination:** Healthcare professionals may deny care for HIV patients due to their own myths and beliefs related to HIV/AIDS which largely stems from their fear to contract the disease. Inadequate education and discriminatory policies at workplace and educational settings are the main cause of harassment of HIV positive individuals leading to many missed opportunities to pursue their preferred education streams or employment. Misconceptions in HIV transmission and labelling them as people with immoral character leads to social ostracism and exclusion of HIV positives in community-based settings.

Zero Discrimination Day observed annually on March 1st is committed to end discrimination in societies and across geopolitical borders for the HIV community and is embedded in the ethos of human rights for everyone to lead a meaningful live with respect and dignity. Yet, the UNAIDS report still mentions 46 countries that impose restrictions on entry and residency based on HIV status (6).

The Government of India's NACP V emphasizes countering stigma and discrimination against people living with HIV across healthcare facilities, educational institutions, workplaces and communities (3). Rendering non-discriminatory care and support services within healthcare settings is the key mandate achieved by trainings healthcare professionals to deliver non-stigmatizing care. Education emerges as a pivotal tool in dispelling myths and misconceptions surrounding HIV/AIDS and fostering empathy and understanding towards affected individuals. NACP recommends that all educational institutions should incorporate comprehensive HIV/AIDS education to foster acceptance and inclusivity among faculty and students.

Workplaces are encouraged to adopt non-discriminatory policies and provide workplace education programs to foster a supportive environment for employees living with HIV/AIDS. The community-level interventions carried out as a part of NACP activities are designed to challenge misconceptions about HIV transmission, promote empathy, and

encourage social integration of affected individuals and families (3). In our experience, internalized stigma is often experienced by women who got infected by the virus from their spouse. They suffer depression and live in shame and fear of social exclusion. Furthermore, our social hierarchy and patriarchy blames women for harbouring and spreading the infection when the virus gets diagnosed first during antenatal clinics before the husband is tested. Gender biases and social constructs make it difficult for women and adolescence girls to seek the right information about their sexual and reproductive health due to taboos around the topic. Female sex workers often solicited into unprotected commercial sex live in fear of losing their source of income if they contract the infection and the positive status is disclosed. This self-stigma prevents them from seeking the right care and support. Stigma and discrimination can be dispelled by educational material and communication tools that highlight “no discrimination” based on HIV positive status. Such a communication campaign #AbNahiChalega has been developed by SHARE INDIA with support from NACP’s Information, Education, and Communication (IEC) Division.

Through coordinated efforts across these four settings, NACP seeks to mitigate the repercussions of HIV-related stigma and discrimination while upholding the rights and dignity of all individuals affected by HIV/AIDS in India (3). Effectively addressing HIV-related stigma and discrimination necessitates a comprehensive approach that considers societal attitudes, promotes human rights and ensures access to equitable healthcare and support services. Additionally, legal frameworks must be strengthened to safeguard the rights of individuals living with HIV and eradicate discriminatory practices in various settings.

**Navigating Change with Triumphs in Combating HIV-related Stigma and Discrimination:** The HIV and AIDS (Prevention and Control) Act, 2017 published through a Government of India Gazette notification safeguards the rights of people living and affected with HIV/AIDS. NACP has published a handbook and created e-trainings tools to offer valuable insights and practical examples to mitigate stigma and discrimination related to HIV/AIDS. The Handbook on Prevention & Management of Stigma and Discrimination Associated with HIV and AIDS (2022) addresses various stakeholders including government,

non-government bodies, civil society, private entities and advocacy groups to adopt strategies for prevention and addressing stigma and discrimination associated with HIV/AIDS (7). The handbook is tailored to counter stigma and discrimination at workplace, healthcare facilities, educational institutions, and communities. The role of media and Faith-Based Organizations (FBOs) in building support systems for individuals affected by HIV/AIDS is exemplified through the handbook (7). The hallmark of the handbook is to understand key provisions outlined in the HIV and AIDS (Prevention and Control) Act, 2017 to dispel stigma and discrimination associated with HIV. The Act not only provides a legal framework to uphold rights and dignity of individuals living with HIV/AIDS but also delivers a robust grievance redressal mechanism (7).

Another feather in NACP’s cap is the enactment of the HIV/ AIDS Policy for Establishments, (2022) as a mandate under the Act to protect rights of individuals against workplace discrimination related to HIV (8). Also aligned with Global Sustainable Development Goal 3 for Health, the policy raises awareness on prevention and HIV transmission. Equity, inclusiveness and dignity is promoted in workplaces by adopting safe, non-stigmatized and non-discriminatory behaviour. Maintaining confidentiality regarding HIV status further propels voluntary disclosure by employees thereby freeing them of the fear of discrimination and/or being fired. The policy fosters re-designing and re-engineering workplace culture to build safe non-discriminatory environment that actively discourages discrimination related to HIV.

In the realm of opinion, mobile applications serve as valuable complements to community-based interventions aimed at combatting HIV-related stigma and discrimination, enriching outreach efforts and support services for those living with HIV/AIDS. "NACO AIDS App" and the "Positive Peers" App developed by the University of North Carolina at Chapel Hill, exemplify the transformative potential of technology in addressing stigma and discrimination while bolstering support networks for affected individuals (9).

The "NACO AIDS App" complements community intervention efforts by providing access to accurate information to dispel myths, stigma and discrimination related to HIV/AIDS, counselling services, and virtual support networks, thereby bridging gaps in reaching

remote or marginalized populations, fostering solidarity among users and reducing stigma. Similarly, the "Positive Peers" App empowers individuals to connect with others, access educational resources, and adhere to treatment regimens through features like peer support forums and appointment reminders. Research findings have demonstrated that digital interventions like "Positive Peers" play a significant role in enhancing health outcomes and alleviating feelings of isolation among individuals affected by HIV/AIDS (10). These results underscore the critical importance of innovative strategies in addressing HIV-related stigma and discrimination while enhancing support networks.

**Quantifying Stigma and Discrimination:** It is important to quantify stigma so that effectiveness of anti-stigma initiatives can be deciphered. Quantifiable indicators support data to drive policy changes by identifying successful anti-stigma interventions across different contexts, population and geographies (11). Despite launch of multiple campaign on stigma reduction by NACP, fear of infection through casual contact with a PLHIV persists among the general population and healthcare workers (12). In an Indian study conducted across three states, it was observed that 47% hospital staff feared touching sweat of an HIV-positive person (12). The healthcare workers were reluctant in measuring blood pressure, changing clothes and bedpans of HIV-positive patients. Even more horrifying was to know that two-thirds of healthcare workers believed people living with HIV should feel shame and 28% thought men who have sex with men do not deserve treatment (12). Focused group discussions with female sex workers showed that 50% believed PLHIV should be socially excluded and expressed reluctance to share meals with those who are HIV positive (12). The study highlighted the need to bust stigma by using multi-pronged approaches that not only countered internalized stigma experienced by PLHIV but also by improving behaviour, practices and attitude of health workers and general population towards HIV positive patients (12).

**Conclusions:** Combating HIV-related stigma and discrimination is vital for ensuring the rights and dignity of individuals living with HIV/ AIDS worldwide, including in India. Despite advancements in awareness and treatment, stigma persists, resulting in marginalization and human rights violations. Initiatives like the Global Partnership for Action and India's NACP

Phase-V are dedicated to reducing stigma across various settings, emphasising the significance of education and empathy. Success stories, such as the "HIV is Not a Crime" movement and innovative mobile applications like NACP and "Positive Peers," exemplify effective approaches in combating stigma. The "Handbook on Prevention & Management of Stigma and Discrimination" and the "HIV and AIDS Policy for Establishments, 2022" offer vital guidance for stakeholders, emphasizing importance of legal frameworks and workplace policies. As we pursue change, collective efforts, heightened awareness, and supportive interventions play a crucial role in combating HIV-related stigma and discrimination, ensuring equitable access to healthcare and advocating for dignity among all individuals affected by HIV/AIDS. We can endeavour towards a future where individuals living with HIV/AIDS are treated with dignity and compassion by embracing a multifaceted approach that encompasses education, advocacy, policy reform, and technological innovation. Raising awareness and advocating for the engagement of institutions, communities, families and general population will create an enabling social environment to foster long lasting change in knowledge, attitudes and practices against PLHIV. It is only through collective action and unwavering commitment we can create a world where all individuals can live their lives free from fear and judgment.

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## Call for Articles on Asian American Healthcare Issues



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It has been well documented that Asian Americans, especially the South Asians, have higher prevalence of cardiovascular diseases and face higher cardiometabolic risk. This is attributed to several factors, including genetics. On May 10, 2022, the Newsroom of the American Heart Association pointed out that “one-size-fits all” is flawed for assessing cardiovascular diseases risk among Asian Americans. In view of the above, starting from Spring 2022 Edition, JAAPI has a section dedicated to **Asian American Healthcare Issues**. We welcome articles on all aspects of Asian American or South Asian healthcare under this section.

## Perspective on Healthcare

### Current Status of Kidney Care in India

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**Abstract:** The status of kidney care in India has advanced remarkably over the past 60 years. The field of nephrology was first introduced in the mid-1950s, and for nearly four decades, it battled to meet the high demands. However, in the past two decades, the specialty has seen phenomenal growth despite the immense challenges of delicately balancing the social sanitation needs, improving treatment options for communicable diseases and supporting the growing needs of non-communicable diseases. The prevalence of chronic kidney disease in India is estimated to be approximately 16% (115 million) of the total global burden (~850 million) and remains largely underestimated due to lack of a robust national registry. The extrapolated national estimates from regional studies have revealed a 5.12% increment in the disease prevalence in the past decade. The prevalence ranges from 7.2% - 16.74% for the Southern, Western, Northern, Eastern and Central zones with least reported data from the North-Eastern zone. Diabetic nephropathy is the major etiological factor identified in 31% of the patients with chronic kidney disease (CKD), while CKD unknown (CKDu) and chronic glomerulonephritis account for 19% and 14%, respectively. Chronic interstitial nephritis secondary to non-steroidal anti-inflammatory drug (NSAID) abuse, unregulated non-traditional medications and an uncommon disease called "CKDu Uddanam Nephropathy" pose unique challenges to providing optimal CKD care in India. Overall, the burden of kidney disease remains largely unknown in the most populous country and the challenges to reign-in the economic costs while providing standardized care across the entire spectrum of kidney disease remain profound. The multifold challenges to improving the existing kidney care program include: access to care, limited workforce, urban-rural divide, limited penetration of deceased donor kidney transplant program, lack of national donor allocation system and many more. The most ideological strategy would require targeting education of all stakeholders, prevent development/progression of kidney disease by controlling risk factors and building an infrastructure to effectively treat those with advanced kidney disease. In the past decade, India has made significant progress in managing these barriers following support from several governmental and non-governmental organizations, improved overall national economy and slow but steady improvement in health awareness amongst the general population. The current review provides an insight into the journey over the last six decades and the bright future aligned with the economic, technological and industrial growth of India.

**Key Words:** Kidney disease, Epidemiology, Dialysis, Transplantation, Government funding, India, global disease burden, CKDu

## Historical Aspects and Current Status:

Nephrology is a relatively young specialty in India, introduced by the late Professor K. S. Chugh when he performed the kidney biopsy in 1956. Subsequently, in 1961, the first hemodialysis (HD) treatment was successfully completed at the Christian Medical College, Vellore. The Indian Society of Nephrology was established in 1969, which currently has approximately 2,800 members (reviewed in 1).

For many decades, hemodialysis was only offered to patients with acute kidney injury, but by 1978, though limited, was available as a maintenance therapy in larger cities. In the past two decades with increasing healthcare awareness, availability of resources and economic growth, maintenance hemodialysis is available in Tier 2 and Tier 3 cities (2). However, rural areas continue to remain largely underserved. As of 2022, India had about 12,881 dialysis centers, with approximately 211,738 patients on maintenance hemodialysis. Peritoneal dialysis (PD) remains underutilized with approximately 7500 patients being treated with this modality. Annually, an average of 9,000 - 10,000 kidney transplants are performed: 97% from living related donors with 75% of those being close relatives (3). The practice of deceased donor organ donation remains underutilized due to lack of awareness along with social, religious and resource limitations.

## Disease Burden and Epidemiology:

Kidney disease poses a major public health challenge in India, characterized by high rates of morbidity and mortality. The Million Death Study reported a 50% rise in deaths caused by chronic kidney disease (CKD) between 2001-2003 and 2010-2013 (4). According to recent estimates, CKD affects > 850 million people worldwide, which means 1 in 10 has chronic kidney disease (CKD), which is the 7<sup>th</sup> most common cause of death. The Global Burden Disease Study 2017 reported 115 million patients with CKD in India, accounting for 16% of the global disease burden (5). The pooled prevalence of CKD from regional community reports from India reflects the burden to be twice the global prevalence (26% vs 13%) (6, 7). In the last decade, the burden has increased by 5.12% from 11.12% (2011 -2017) to 16.4% (2018 -2023) (8).

The variability in the prevalence of CKD across India is partly because of the lack of a national registry and partly from extrapolation of data collected from small regional studies. Talukdar et al., in their systemic meta-analysis of

85,791 patients with CKD, classified India into different administrative zones to analyze regional prevalence of CKD (8). The prevalence reported from the Southern zone (Andhra Pradesh, Telangana, Tamil Nadu, Kerala and Karnataka), Western zone (Maharashtra, Rajasthan and Gujarat), Eastern zone (Bihar, Jarkhand, West Bengal, Orissa and Meghalaya), Northern zone (Delhi, Jammu & Kashmir, Uttar Pradesh, Haryana, Punjab, Uttarakhand and Himachal Pradesh) and Central zone (Madhya Pradesh, Chattisgarh) was 14.78%, 15.27%, 8.58%, 7.2% and 16.74%, respectively (8). There is limited data on the prevalence of CKD from the North-Eastern region.

In India, approximately 200,000 to 250,000 people develop kidney failure each year, with renal replacement therapy available to less than a quarter (25-30% treated with dialysis and 5-10% receive a kidney transplant). Not surprisingly, the general awareness around kidney health is lacking with merely 7-20% being diagnosed with chronic kidney disease and most do not receive guideline directed therapy to prevent progression. The burden of CKD in India is not only due to traditional risk factors like diabetes and hypertension but also non-traditional factors such as maternal malnutrition (9), exposure to nephrotoxins, tropical infections and heat stress. Diabetic kidney disease (DKD) was identified in 31% of patient with CKD by the National CKD Registry and 25% by the Indian Chronic Kidney Disease (ICKD) study (10 -12). Other etiological factors identified were Chronic Kidney Disease Unknown (CKDu) (19%), Chronic Glomerulonephritis (CGN) (14%) (12). In the ICKD study, DKD, CKDu and chronic interstitial nephritis (CIN) emerged as the leading causes of CKD. Several risk factors were identified and include high levels of silica and other heavy metals in the drinking water, agricultural work-related heat stress, exposure to pesticides and prolonged dehydration resulting in repeated episodes of acute kidney injury (AKI) eventually advancing to CKD (10, 13). Sporadic reports of increasing number of patients with CKDu amongst agricultural groups from Andhra Pradesh and Odisha have been reported (14, 15). Over the past decade, in the rural area of Andhra Pradesh, approximately 34,000 people were found to have a special form of CKDu called "Uddanam" nephropathy (16).

An easy access to non-steroidal anti-inflammatory drugs (NSAID) and the common practice of using unregulated non-traditional medications contribute significantly to the high incidence of CIN (17, 18). The contribution of these non-traditional risk factors needs to be better understood

to develop targeted prevention and early detection programs (5, 6).

## Key Challenges with Providing Kidney Care in India:

### *Access to Care:*

The access to adequate kidney care remains limited by factors that are not unique to India. The lack of awareness, paucity of health screening programs along with financial and social disparities, delays early diagnosis and prevention of CKD (19, 20). The urban-rural divide (10.65% vs 15.34%) was identified as a major barrier to care (7). The number of trained nephrology physicians is estimated to be around 2,800 in the most populated country in the world. Additionally, a heavy concentration of nephrology workforce in the cities further exacerbates the situation while reducing the patient to physician ratio in the rural areas.

### *Health Literacy and Economic Barriers:*

Public and professional awareness of kidney diseases and their management is insufficient, and while the number of dialysis facilities has increased, it still falls short of meeting the population's needs, particularly in smaller towns and rural regions. High costs for dialysis and transplantation remain a significant barrier, even with government support, and there is a pressing need for improved quality assurance and monitoring in kidney care services across the country (8). The median annual cost to treat a patient with kidney transplant in the first and second year in India, is approximately \$25,000 and \$8,000, respectively, while that for dialysis therapy is \$ 3,820 (21). Despite improvements in public healthcare support over the past decade, a large portion of kidney care costs are still borne by patients through out-of-pocket expenses. While advanced kidney care for the low-income population is being supported by various state and central government subsidies, the disparity between urban-rural areas and high-low income patients continues to be a social challenge to bridge. The growth of corporate for-profit healthcare facilities in the cities, availability of employer-based healthcare coverage and the rich-poor divide allows for easy access to care to the wealthy affording patients. As a result, the economic divide continues to play a pivotal role in determining the quality and accessibility of kidney care in India.

### *Kidney Transplantation:*

Eighty-seven percent of the kidney donors are living-related with 13% contributed by a deceased donor. The demand for organ donors is huge and the gap was estimated to be around 62 deceased organ donations per million population in a study by Kute et al (22). The deceased donor programs are relatively better organized in the Southern and Western States of India. Sporadic kidney-paired exchange donations are reported mainly from the Western States.

The challenges in kidney transplantation in India are multifaceted, including uneven adoption of the 1994 Act and 2011 amendments across states, which hampers uniformity in legal frameworks (23).

Besides the medico-legal issues around organ trafficking, lack of uniformly equipped transplant centers, variable funding support in each State, social, religious and cultural barriers with limited awareness of the benefits of organ transplants impede the advancement of this therapy at a larger scale (24).

### *Ethics and Safety:*

In India, kidney care faces challenges in standardizing treatment, adhering to ethics and safety guidelines, and balancing healthcare costs. The healthcare options available to patients are not limited by allopathic services. Other unconventional treatment options available include ayurvedic medicine, homeopathy, Unani medicine and several others without standardized treatment regimens. Furthermore, the high prevalence of communicable diseases and the need to develop basic WASH (water, sanitation and hygiene ) needs take a priority over non-communicable disease for allocation of funds by the government. A strategy to build awareness around non-communicable diseases, strong advocacy to promote preventive and therapeutic aspects, and building uniform infrastructure across rural and urban areas, is the need of the hour. Regarding kidney care, these strategic steps are in place. It is expected that they will gradually transition to improving quality of care, addressing ethical and medico-legal issues and supporting standardized care across the nation. These measures should collectively help to bridge gaps, improve accessibility, and ensure better care for kidney patients in India (25, 26).



## Government Efforts and Financial Support for Kidney Care in India:

The Indian Government is supportive of improving kidney care. There are several programs and initiatives in the work to improve access to advanced treatment options for kidney failure. Two such programs are: The National Organ and Tissue Transplant Organization (NOTTO), established under the Ministry of Health and Family Welfare, aims to promote organ donation and transplantation in India. NOTTO needs to embark on developing a regional and national kidney allocation program including paired kidney exchange (PKE) donations. The need for multiple authorization committee's clearances in case of interstate PKE should be abolished, with clearances coming from a central committee authorized by NOTTO. Utilizing O blood group donors in the pairs can increase the donor pool. The National Dialysis Programme aims to expand the dialysis services across the nation and simultaneously reduce the financial burden for the people who are in need by supporting these services in rural and underserved areas. In 2016, the Pradhan Mantri National Dialysis Programme (PMDNP) was introduced to expand dialysis services in the public hospitals to provide free treatments to patients who live below the poverty line (approximately 6.7% of the population is reported to be living below the poverty line in India) (27).

Several dialysis equity programs introduced in recent years include: The One Nation, One Dialysis Programme. Launched in 2019, it aims at narrowing the equity gap and allowing access to standardized care for anyone in need of dialysis. The Ayushman Bharat – Pradhan Mantri Jan Arogya Yojana (AB-PMJAY) offers cashless treatment for chronic kidney disease (CKD), though its implementation remains inconsistent across states, including Delhi. State-specific programs, such as those in Delhi, and the Public Private Partnership (PPP) Dialysis Project by the Government National Capital Territory (GNCT) of Delhi, also contribute significantly to improving dialysis accessibility and affordability through financial assistance schemes like Delhi Arogya Kosh and Delhi Arogya Nidhi, and partnerships with private hospitals to provide high-quality, cost-effective hemodialysis services.

## Advancements in Kidney Care:

Despite the challenges, India has seen significant advancements in kidney care:

- **Increased Transplantation:** Kidney transplants in India have been steadily increasing, with both living and deceased donors contributing (28). To further expand the donor pool, paired kidney donation is being promoted. Swap transplantation was accorded legal sanction in 2011 in THOA Amendment Act 2011(THOA 2011). Apex Kidney Foundation launched the Apex Swap Transplant Registry (ASTRA) in 2011. The initiative is aimed at maintaining a database of recipient donor incompatible pairs and working towards identifying compatible swap pairs through computer algorithm based on reports of age, cross match, blood group etc. India is enhancing this effort by adopting a robust software program that facilitates collaboration between more centers, aiming to increase transplant opportunities.
- **Improved Dialysis Technology:** Many centers now offer advanced dialysis modalities, including hemodiafiltration and online hemodiafiltration.
- **Peritoneal Dialysis:** There has been a growing emphasis on peritoneal dialysis as a viable alternative to hemodialysis, especially in rural areas.
- **Research and Innovation:** Indian nephrologists are contributing significantly to global research in nephrology, with several centers participating in international clinical trials such as EMPA-KIDNEY, DAPA-CKD, ROXADUSTAT Trials, FIND-CKD and SONAR trials.

## Nephrology Training Opportunity in India:

Nephrology training in India has expanded significantly, with institutions offering both a 3-year Doctorate of Medicine (DM) in Nephrology and Diplomate of National Board (DNB) programs, alongside various certificates and fellowships. Indian nephrologists contribute globally through platforms like annual Indian Society of Nephrology Meetings, international conferences and various online educational forums. India also supports neighboring and resource-limited countries, such as Nepal and Bangladesh, by training nephrologists through exchange programs and fellowships. The Indian Society of Nephrology further enhances regional collaboration through workshops and educational forums.

In India, specialty kidney care often relies on non-nephrologists, especially in rural areas where access to nephrologists is limited. Primary care physicians (PCPs) and internal medicine specialists frequently manage early-



stage kidney diseases, including hypertension and diabetes, which contributes to kidney damage. To address the shortage of nephrologists, alternate training pathways like short-term nephrology or dialysis courses have been introduced for non-nephrologists. These programs equip PCPs to handle basic kidney care, including CKD management and dialysis supervision. No doubt the PCP's help access to care, but the need for continuous education and effective referral systems for complex cases need to be emphasized.

### **Pediatric Nephrology Services:**

Between 2016 and 2018, the Ministry of Health and Family Welfare (MoHFW), Government of India, collected data on serum creatinine levels and the eGFR values and estimated the prevalence of impaired kidney function (IKF) among children and adolescents (age 5–19 years) in the Indian Comprehensive National Nutrition Survey (CNNS). The study found the estimated IKF prevalence of 4.9% amounting to around 49,000 children per million population, thus raising the actual need of redressal for pediatric CKD burden in India (29).

Pediatric nephrology in India is a growing subspecialty focused on diagnosing and treating kidney-related disorders in children. Pediatric nephrology encompasses a wide range of conditions, such as congenital kidney diseases, glomerulonephritis, nephrotic syndrome, chronic kidney disease, and acute kidney injuries. There are several specialized centers across the country, which offer training programs in various aspects of pediatric nephrology, including advanced care for young patients. In addition, fellowship programs, and the National Board of Examinations (NBE), are designed to empower doctors with wide range of skills in managing pediatric kidney disorders. Collaborative efforts with international organizations and participation in global forums also encouraged to enhance pediatric nephrology practices in India.

### **Future Outlook and Recommendations:**

India is transitioning through rapid industrial, technological and economic growth phase. India is also faced with a unique challenge to build resources to support healthcare needs for the world's most populous country. As the healthcare industry in India is rapidly trying to catch up with that in the developed countries, India must be mindful of delicately balancing the needs of rich and poor, urban and rural settings, communicable vs non-

communicable diseases, conventional vs non-conventional treatment pathways, multi-ethnic, multi-cultural and multi-religious population for a wide spectrum of health-related problems.

In the past 60 years, kidney care in India has made big strides. The focus for the future needs to be multi-faceted to target the social determinants of health, preventive care with education and control of risk factors and finally with advanced therapies including dialysis, transplantation and palliative care. A long-term strategy from all stakeholders involved with providing kidney focused care is vital to catch up with the developed countries. Simultaneously, India should refrain from blindly following the practices from the developed countries. The lessons and experiences learned from the Western world can be tailored with regional and ancient practices that combine healthy living principles with modern medicine.

More on a practical front, the strategic planning framework could broadly include advocacy, education and resource building. Advocacy through professional organizations, social support groups and public media will help build awareness around kidney disease and its impact on society. General health literacy will empower the population, while educating the medical fraternity to detect risk factors, implement early screening practices and provide standardized and efficient care for early kidney disease while reducing the economic burden on society. Finally, targeting infrastructure and capacity building strategies to support advanced therapies for those who need dialysis, kidney transplantation and supportive comfort care options.

### **Conclusion:**

Over the past 60 years, India has made remarkable advancement in supporting kidney care despite facing immense challenges. As the most populous, low-middle income country, balancing the health care needs between social development, communicable and non-communicable diseases for a wide range of social fabric can be daunting while implementing any reforms. Tackling an unknown burden of chronic kidney disease requires a national strategy that needs to focus on education, preventive care, infrastructure development, governmental policy reforms, partnership with private organizations while simultaneously being mindful of social disparities. The story so far is remarkable; however, the future will depend on the coordinated efforts of all stakeholders. As the country approaches its centenary of independence,

revolutionizing kidney care should be a priority to address the growing burden of kidney diseases and improve the overall health of the nation.

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## Legislative Affairs Review

# Genesis of the HIV and AIDS (Prevention & Control) Act 2017: The First Disease-Centric Legislation in India

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**Abstract:** The Joint United Nations Programme on HIV/AIDS (UNAIDS) aims to end Acquired Immune Deficiency Syndrome (AIDS) epidemic by 2030 under its 95-95-95 strategy programs. In recent times, progress has been made in reducing the spread of AIDS and in treating HIV infection worldwide. The legal avenues for the containment of HIV/AIDS consolidate the efforts taken to eliminate HIV/AIDS as envisaged in the Sustainable Development Goals (SDG). It has been almost five years since the notification of the HIV/AIDS (Prevention & Control) Act, 2017 in India. While this legislation has made some progress towards its intended objectives, additional measures are still necessary. This article analyses the legislation from international, national, state, and grassroots perspectives, aiming to stimulate further roll-out and maximize leverage by all concerned stakeholders.

**Key Words:** HIV, AIDS, Legislation, Prevention & Control

**Introduction:** Human Immunodeficiency Virus (HIV) which leads to a state of Acquired Immune Deficiency Syndrome (AIDS) is still not prevented and controlled worldwide. According to the World Health Organization (WHO) approximately 85.6 million people have been infected with HIV resulting in 40.4 million deaths (1). Globally, about 39.0 million people were living with HIV at the end of 2022 and as per Sankalaks status of the India's national AIDS response, there are about 2.410 million people living with HIV (PLHIV) in 2022 in India (2).

In the past decade, rights-based approach to HIV has been brought to focus and is seen as instrumental for an effective HIV/AIDS response. The 95-95-95 strategy requires people living with HIV (PLHIV) to know their HIV status and eventually suppress their virus through

antiretroviral treatment. For this to happen national legislation which promotes non-discrimination and decriminalizes HIV transmission can be pivotal in accelerating the efforts to halt the pandemic. PLHIV aware about national laws on non-discrimination have significantly higher knowledge about HIV/AIDS and report higher viral suppression (3).

In India, the first report on indigenously infected HIV positive persons was among commercial sex workers in the state of Tamil Nadu in 1986 (4). Subsequently, the first clinical case of AIDS in India was reported in 1986 from Mumbai (5). During the early 1990s, a period characterized by limited understanding of HIV, a multitude of myths and misconceptions prevailed about the spread of HIV, treatment for HIV and PLHIV (6). PLHIV were branded as people with immoral

character and were discriminated against and considered outcast in Indian society. In the case of Mr. X v. Hospital Z, the Apex Court had suspended the right of PLHIV to marry, which was later restored (7).

Stigma and discrimination against PLHIV were incoherently ubiquitous and the same situation is prevalent to a lesser degree even today. In this context, the need for legislation arose, first to educate the masses on HIV/AIDS and then to streamline various aspects about HIV like testing and treatment protocols, eradication of stigma and discrimination, welfare measures for PLHIV, providing avenues for grievance redressal mechanisms and outlining legal procedures, etc.

**International Law:** The origin of the thought of laws specific to PLHIV and HIV emanated from the United States. In 1998, when a patient was denied treatment due to the HIV positive status in USA, the Supreme Court *Bragdon v. Abbott* judgement safeguarded the rights of the people affected with HIV/AIDS in USA (8). In 1987, the United States placed a travel ban on visitors and immigrants with HIV which was later lifted by President Barack Obama in 2009 (9). In many states of the United States of America, actions by individuals with HIV that may expose others to the virus can be criminalized without requiring actual transmission or intent. Since 2014, 12 states have updated or repealed their HIV criminalization laws to align with current scientific evidence (10).

Though policy, framework and guidelines are available for provision of HIV prevention services for people who inject drugs, sex workers and adolescents, they are not implemented comprehensively. The Universal Declaration of Human Rights (UDHR) highlights the principle of non-discrimination, which applies to PLHIV who often face high levels of stigma and discrimination (11). The UDHR includes provisions related to the right to life, liberty, and security of a person, as well as the prohibition of mandatory testing, treatment, and cruelty or degrading treatment. It also recognizes the right to work, participate in cultural life, enjoy the arts, and share in scientific advancements without discrimination. Furthermore, the International Covenant on Civil and Political Rights and the International Covenant on Economic, Social and Cultural Rights, both UN conventions, address non-discrimination issues about PLHIV.

The 1996 UNAIDS Guidelines emphasize the duty of states to reform HIV/AIDS laws, including identifying legal obstacles and creating effective prevention and care strategies. These guidelines also stress the importance of enacting anti-discrimination laws, ensuring privacy and confidentiality, upholding research ethics, promoting education and conciliation, and providing swift administrative and civil remedies for PLHIV (12).

In 2001, the UN Declaration of Commitment on HIV and AIDS recognized the need to strengthen legal responses to eliminate stigma and discrimination. This declaration highlights factors such as poverty, underdevelopment, and illiteracy as major contributors to the spread of HIV/AIDS and called on the global community to address these issues to prevent further impact on the development of many countries (13). As part of the historic declaration of 2001, member states pledged to have policy and legal protection against limited access or denial of services for people affected with HIV/AIDS (13).

In recent times, progress has been made. According to a recent press statement by UNAIDS while commemorating Zero Discrimination Day, 2023 (14); in 2022 alone, Zimbabwe decriminalized HIV exposure, non-disclosure, and transmission and the Central Africa Republic reduced the scope of its HIV criminal laws, while New Zealand removed travel restrictions relating to HIV. Yet in 2021, 134 countries explicitly criminalized HIV transmission, either/or prosecuted HIV exposure and non-disclosure (15).

**Domestic Law:** India, a signatory to the UN Declaration of Commitment on HIV and AIDS, had been in pursuit of enacting a comprehensive legislation even before 2001. The pivotal case of *Lucy R. D'Souza v. State of Goa* in the 1980s provided the impetus to formally come out with specific legislation on HIV/AIDS (16). In this case, one individual had donated blood and was found to be HIV positive. The State's Public Health Act, 1985 authorized the State of Goa to mandatorily test any person for HIV and isolate them if found to be HIV positive. Accordingly, the patient was quarantined in a TB hospital and the mother contested this action, arguing it violated constitutional rights. The Bombay High Court, while recognizing the harmful effects of isolation of PLHIV, held that in a case of conflict between individual liberty and public health,



considerations of public health would prevail and take precedence.

In 1989, India made its first attempt at drafting an HIV/AIDS Bill but withdrew it due to discriminatory provisions such as mandatory testing and confinement of infected persons (17). Lawyers Collective, a non-governmental organization drafted the bill on HIV/AIDS and after having elaborate consultations with PLHIV, marginalized groups, healthcare workers, women and children’s groups, state governments, NGOs, and lawyers, submitted the same to National AIDS Control

Organisation (NACO) (18). Finally, on February 11, 2014, the then Union Health Minister Ghulam Nabi Azad presented the final draft bill in the Indian Parliament. The bill holds distinction of being the first disease-centric legislation in India. After thorough deliberations, the HIV/AIDS (Prevention & Control) Act, 2017 was passed by both Houses of the Indian Parliament on March 21, 2017, and it came into force from September 10, 2018. Figure 1 elucidates the genesis of the HIV/AIDS (Prevention & Control) Act in India.

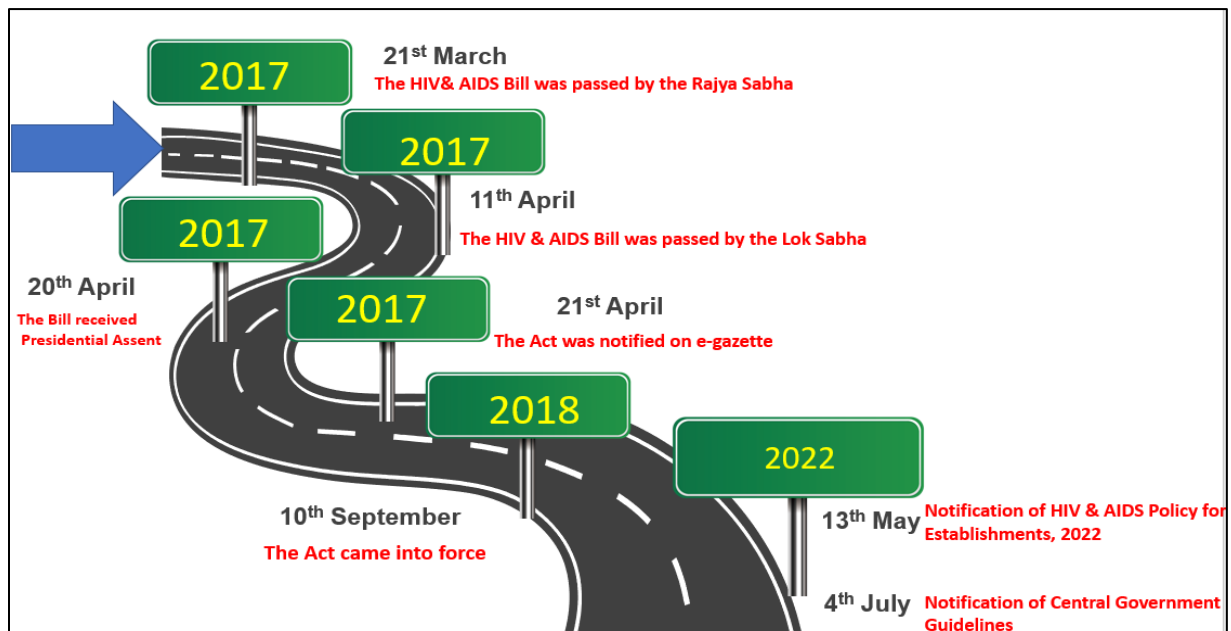


Figure 1: Genesis of the HIV/AIDS (Prevention & Control) Act, 2017

**Indian Constitution, Human Rights and the HIV/AIDS (Prevention & Control) Act, 2017:**

The Indian Constitution protects the rights of every citizen of India including the PLHIV. Article 14 of the Constitution guarantees the right of equality of treatment for all citizens. Article 15 prohibits discrimination in public facilities. Article 16 forbids discrimination in employment and Article 21 protects the right to life, personal liberty and ensures the right to privacy. Chapter IV enshrining the Directive Principles of State Policy (DPSP) directs States to ensure that all citizens, including PLHIV, have an adequate means of livelihood, to provide for securing just and humane conditions of work, to improve public health vide Articles 39, 42 and 47 respectively (19). These general provisions of the Indian Constitution are

appropriately supported by the HIV/AIDS (Prevention & Control) Act, 2017 in dealing with human rights issues of PLHIV (20). Other provisions of law can be applied to obtain legal remedy for ascertaining dignity and human rights of the PLHIV.

Consequent to the advent of Anti-Retroviral Therapy (ART), HIV is not considered a fatal infection anymore. However, the stigma surrounding people living with chronic medical conditions and their difficulty in getting access to health care has made HIV/AIDS a human rights issue and a health challenge. The legislation protects and promotes the rights of people infected with and affected by HIV and AIDS. One of the most pertinent key features of the legislation is that it addresses and prohibits HIV-related stigma and discrimination against people infected and affected by

HIV and strives to create an enabling environment for enhancing access to services. The Act prohibits HIV testing as a prerequisite for obtaining or continuing in employment or accessing healthcare services or education or using any other service or facility (20). It also seeks to protect the rights of healthcare providers if an act such as disclosure of HIV status is done in "good faith" and as such the Act says in Section 9 (3) "The healthcare provider under sub-section (1) shall not be liable for any criminal or civil action for any disclosure or non-disclosure of confidential HIV-related information made to a partner under this section" (20). Section 19 of the Act obligates the establishments to provide a safe working environment and advocates Universal Work Precautions (UWP) to safeguard the interests of the healthcare providers and other workforce in general and thus protect them from possible HIV infection. This section also mandates the establishments to ensure the availability of Post Exposure Prophylaxis (PEP) so that given the accidental exposure or otherwise, PEP may reverse the HIV infection of a person within the golden 72 hours period (20,21).

### Focus Areas under the HIV/AIDS (Prevention & Control) Act, 2017:

The HIV/AIDS (Prevention & Control) Act, 2017 being a central legislation extends to the whole of India, encompassing all the States and Union Territories of India. The Act consists of 50 sections, divided into 14 chapters. The objective of the Act is to prevent and control the spread of HIV/AIDS and to safeguard the human rights of people infected with and affected by HIV (Figure 2). It further seeks to provide free diagnostic facilities and ART to PLHIV; to promote safe workplace in healthcare settings; to prevent occupational exposure; and to strengthen the system of grievance redressal (Figure 2).

The Act gives a legal commitment to provide Antiretroviral therapy (ART) by the government to the patients *as far as possible*. Therefore, for PLHIV, ART has become a legal right where all PLHIV are treated with ART regardless of CD4 count, clinical stage, age or population in conjunction with prevailing international guidelines.

#### What does the HIV and AIDS (P&C) Act, 2017 seek to provide?

- Address Stigma and Discrimination
- Create an enabling environment for enhancing access to services
- Providing free diagnostic facilities and ART to PLHIV
- Promote safe workplace in healthcare settings to prevent occupational exposure
- Strengthens system of grievance redressal

Figure 2: Salient features of the HIV/AIDS (Prevention & Control) Act Act, 2017

Within the Act, four crucial principles are outlined, namely the Principle of Non-Discrimination, the Principle of Informed Consent, and the Principle of Confidentiality and Disclosure & Principle of self-determination which play a crucial role in guiding the legislation's approach to addressing HIV-related stigma and discrimination (20).

The Principle of Non-Discrimination ensures that PLHIV can access services like education, insurance, residence, and healthcare without discrimination based on their

HIV status. Section 3 of the Act elaborates on the various circumstances where discrimination is prohibited. These include instances like denial of employment or occupation, unfair treatment, denial of healthcare services, denial of access to goods, accommodation services, facilities, benefits, privileges, opportunities, right of movement (fundamental right under article 19(1)(d), right to reside, purchase, rent, or occupy property, holding public or private office, and isolation of protected persons (20). Section 4 of the Act prohibits any form of hate speech or communication

targeting protected people, making it an offense punishable by law (20). Those engaged in promoting hatred or discrimination against infected individuals can be legally prosecuted.

The Principle of Informed Consent as discussed under section 5 of the Act ensures that HIV testing occurs only after obtaining individual permission, with comprehensive pre- and post-test counselling to ensure a full understanding of the process (20). Where individuals are minors or unable to provide consent, informed consent can be obtained from their legally recognized representatives. Section 18, sub-clause 3 of the Act affirms that pregnant HIV-positive women have the right to decide on their health and medical procedures, ensuring their consent for permanent methods of contraception and medical termination of pregnancy. This provision upholds individuals' rights to make informed decisions while also reinforcing the right to self-determination regarding their reproductive health (20).

Under the Principle of Confidentiality and Disclosure, a person's HIV status should remain confidential and disclosed only to the person on whom the test has been conducted. This confidentiality encourages PLHIV to seek testing, treatment, and care without fear, promoting early diagnosis and access to necessary medical interventions (20).

Sections 21 and 23 establish an effective grievance redressal mechanism through the appointment of an Ombudsman at the State level and Complaints Officers at the establishment level, to provide prompt resolution (20). These authorities play a crucial role in investigating and addressing violations of the Act's provisions, providing an accessible avenue for dispute settlement. The Ombudsman appointed by the State Government handles complaints relating to discrimination under Section 3 and the provision of healthcare services, aiming to resolve them within 30 days. Likewise, Complaints Officers at the establishment level address violations relating to the provision of the Act, with a goal to resolve them within 7 days, and they expedite resolutions within 24 hours for medical emergencies, reducing the need for lengthy legal proceedings (20).

### **Implementation Framework of the Act:**

Following the notification of the Act and the Central Government Rules in September 2018, NACO directed

States and Union Territories to formulate their State-specific Rules aligning with the Act's provisions for effective implementation at the state level. The States and UTs have largely complied, with a focus on Ombudsman-related aspects. Additionally, Section 12 of the Act mandates the Central Government to notify a "Model HIV and AIDS Policy" for establishments (22). The HIV and AIDS Policy for Establishments 2022 provides a framework for addressing HIV and AIDS issues in workplaces, encouraging non-discrimination, confidentiality, and establishing grievance redressal mechanisms. State AIDS Control Societies (SACS) are implementing these policies and rules through advocacy, training, sensitization, and awareness programs at various levels, involving stakeholders like PLHIV networks, NGOs, healthcare providers, civil society, State Governments, legal experts and the media to ensure effective adoption. Under Section 46 of the Act, the Government of India notified nine central government guidelines on July 4, 2022 to facilitate the effective implementation of the Act and its rules (23). These guidelines cover various aspects such as informed consent procedures, testing protocols for HIV, data protection measures, treatment protocols, care for children with HIV/AIDS, universal precautions, HIV prevention strategies, drug substitution programs, education before marriage, HIV-related services for people in custody, and any other relevant matters necessary for the Act's purposes.

### **Challenges in implementing the Act – The**

**Current Scenario:** Although the Act became effective in September 2018, it has yet to reach all stakeholders, including the judiciary, executives, and the primary beneficiaries, namely PLHIV. This is largely due to poor government infrastructure, funding and resources for capacity building, training and conducting sensitization sessions for stakeholders including health personnel and law enforcement personnel involved in implementation of the Act. The uptake of the Act can be propelled by harmonizing it with existing policies and legal framework related to human rights, social welfare and healthcare. Advocates and judges need awareness of the law, especially when handling cases involving "Protected Persons" outlined in Chapter XII titled "Special Procedure in Court". This involves maintaining privacy, in-camera court proceedings, prioritizing cases related to PLHIV, and considering medical expenses under Section 35. Section 36 states that the court should

consider HIV-positive status when determining the custodial place based on healthcare availability.

In some matters across different courts and tribunals, special protections for PLHIV have been enforced in imparting justice across many states in India. Rights of PLHIV are being respected that encourages their improved engagement with health programs. The government health program and civil society partners have successfully implemented uptake of care, support and anti-discriminatory treatment services like pre-exposure prophylaxis, prevention of transmission from HIV positive mother to her newborn child, anti-retroviral for viral suppression and HIV prevention benefits for sexual partners. Of special mention is the 'Vihaan Care and Support' program implemented across 28 states and 4 union territories in India by a mix of government, community-based organizations and networks of PLHIV (24). Vihaan serves 1.6 million PLHIV to access treatment services and their retention in care through 319 Care and Support Centers (CSCs). Another successful project is Safe Zindagi, an online platform developed by ACCELERATE India Team of the Johns Hopkins University School of Medicine, USA that exemplifies the non-stigmatizing and non-discriminatory support system provided to PLHIV in India to lead a healthy life (25). The platform offers reading material, videos and counsellor services on prevention, control and treatment of HIV and sexually transmitted infections. Yet, a lot more awareness and sensitization at different levels is required for real implementation of the Act, especially regarding provisions related to children under section 16 & 32 and women under section 9, 10 & 18.

Many PLHIV remain unaware of the Act's provisions, hindering their access to legal remedies addressing stigma, discrimination, care, support, and treatment. Employers and employees are unaware of the role of a Complaint Officer and the adoption of the grievance redressal mechanism through Ombudsman is in its early stages. NACO is working on raising awareness of Ombudsman's role by capacity building through hybrid e-training content available at NACO website.

Certain exceptions exist for informed consent and disclosure requirements to accommodate specific circumstances where strict adherence to the law might be impractical. For instance, Section 6 of the Act delineates instances where informed consent is not obligatory, such as when a court order permits otherwise or when conducting research or surveillance without

disclosure. Similarly, exceptions exist for disclosing one's HIV status. However, it is essential to use these exceptions judiciously to prevent them from becoming standard practice.

**Conclusion:** India holds the distinction of being the first South Asian country to pass legislation that protects and supports individuals living with HIV, refraining from criminalization. When this Act was passed by the Parliament in February 2017, the then Health Minister of India Shri J.D. Nadda vivaciously said this law is a "People-centric Law" as it benefits both PLHIV and the general public, instilling confidence in them. And by eradicating stigma and discrimination that surrounds them, the Act encourages the general population to come spontaneously for HIV testing, ensuring immediate treatment if needed. Such initiatives are instrumental in India's goal of achieving an HIV-free nation by 2030, as outlined in the SDGs. Moving forward, the implementation of this Act in real sense also requires collaborative efforts from government agencies, civil society, healthcare professionals, and affected communities to ensure its effectiveness in combating the HIV/AIDS epidemic and upholding the dignity and rights of all individuals.

**Disclosure:** The authors declare no competing interests.

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**This Following Section Contains Non-Peer Reviewed and Unedited Abstracts of Research Posters Presented by the MSRF and PreMed Members at Research Meetings or Summits**

AAPI MSRF AND PREMED PRESENTS THE

FALL VIRTUAL

**Research Symposium**

SATURDAY, OCTOBER 12, 2024

8:30 AM TO 12 PM EST



## Oral Presentations (OR)

### **FVRS-24-OR-001: Prevalence and Predictors of Sarcopenia, Protein-Energy Wasting, And Sarcopenic Obesity in Patients with Chronic Kidney Disease: A Cross-Sectional Study**

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Background: Sarcopenia, sarcopenic obesity, and protein-energy wasting (PEW) are common in chronic kidney disease (CKD) patients and are associated with adverse outcomes. This study aimed to determine their prevalence and predictors.

Methods: This cross-sectional study included 442 adult CKD patients. Sarcopenia was defined using a modified Asian Working Group for Sarcopenia criteria, sarcopenic obesity as the coexistence of sarcopenia and obesity, and PEW according to International Society of Renal Nutrition and Metabolism criteria.

Results: Sarcopenia prevalence was 29.9% (132 patients), with 9.5% severe, 12.7% moderate, and 7.7% mild. Sarcopenic obesity affected 13.3% (59 patients), and PEW 27.3% (121 patients). Among sarcopenic patients, 59% met PEW criteria. Multivariate analysis identified increasing age, male sex, higher BMI, lower eGFR, and cardiovascular disease as independent predictors of sarcopenia. Higher BMI, lower eGFR, and cardiovascular disease predicted sarcopenic obesity. For PEW, significant predictors included age, lower BMI, decreased eGFR, advanced CKD stage, cardiovascular disease, and sarcopenia.

Conclusions: Sarcopenia, sarcopenic obesity, and PEW are highly prevalent in CKD patients, with substantial overlap. Advanced age, lower kidney function, and cardiovascular disease are significant predictors across all three conditions. These findings highlight the need for comprehensive nutritional assessment and targeted interventions in CKD patients.

### **FVRS-24-OR-002: Gestational Diabetes Mellitus is associated with increased myocardial stress in comparison to healthy pregnant control**

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**BACKGROUND:** Pregnancy causes extensive physiological changes across multiple organ systems, including increased cardiac load. Gestational Diabetes Mellitus (GDM) refers to glucose intolerance that arises during the course of pregnancy. GDM is characterised by chronic insulin resistance and is associated with an increased risk of cardiovascular disease and hemodynamic maladaptation. Elevated cardiac biomarkers in GDM patients indicate increased myocardial stress and these patients are at increased risk of cardiovascular events as compared to those with uncomplicated pregnancy. This study was designed to compare the cardiac biomarkers (CK-MB and hs-cTnI) and hs-CRP in patients with GDM and healthy pregnant women.

**METHODS:** A total of 60 pregnant patients were recruited, 30 patients of GDM in their third trimester and 30 healthy pregnant controls (gestational age matched). Peripheral venous blood was collected from participants for high-sensitivity C-reactive protein (hs-CRP), creatine kinase MB (CK-MB), serum high sensitivity troponin I (hs-cTnI), fasting blood sugar and glycated hemoglobin (HbA1c), following which statistical analysis was done.

**RESULTS:** Patients with GDM exhibited elevated levels of cardiac markers (CK-MB, hs-cTnI) and hs-CRP, with statistically significant differences noted for hs-cTnI and hs-CRP. They also had higher levels of fasting blood sugar and HbA1c compared to healthy pregnant controls.

**CONCLUSION:** Patients with GDM have increased myocardial stress and cardiovascular risk as compared to healthy pregnant controls despite correction of hyperglycemia in GDM patients. Diligent monitoring and lifestyle management during pregnancy are essential to prevent complications and increase the probability of positive clinical outcomes. Further studies assessing more such parameters with larger sample size are warranted to prove the findings.

### **FVRS-24-OR-004: A Cross-Sectional Study Analyzing And Comparing Quality Of Sleep Among CKD Patients On Dialysis To CKD Patients Not On Dialysis Visiting Department Of Urology And Nephrology of a Tertiary Care Centre, Hubli, And Assessment Of Their Knowledge On Sleep Hygiene**

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**Background:** Decreased Sleep quality is a very evident yet most commonly neglected symptom. Chronic Kidney Disease (CKD) patients by clinicians. Literature and previous studies demonstrate that the global sleep quality of dialysis patients is substantially impaired [1]. Decreased Sleep quality is very evident yet most commonly neglected symptom among CKD patients by clinicians. CKD and sleep disturbances have a complicated and dynamic interaction that has received comparatively little research.

**Method:** This cross-sectional study was conducted at the Department of Urology and Nephrology, PMSSY Super Specialty Hospital, and the Department of Psychiatry, KIMS, Hubli. A pilot study was first performed and the final sample size was determined. A data collection instrument containing three sections was used in this study and A semi-structured questionnaire was used for sleep hygiene assessment. For data analysis, SPSS version 2.5 was used. Ethical clearance was obtained before starting the study.

**Result:** A significant difference in insomnia severity index scores among CKD patients on dialysis and not on dialysis was observed in our study. The mean score was higher among CKD patients on dialysis when compared to those not on

dialysis indicating that the quality of sleep is significantly more disturbed in CKD patients on dialysis than CKD patients not on dialysis. It was also found in our study that the overall sleep hygiene practice among CKD patients was very poor.

Conclusion: Sleep quality is notably poor among CKD patients, with those undergoing dialysis experiencing even worse sleep quality compared to CKD patients not on dialysis. Additionally, both sleep hygiene practices and knowledge about proper sleep hygiene are alarmingly low in this population. CKD patients on dialysis also tend to have poorer sleep hygiene practices than those not on dialysis. In conclusion, sleep as a symptom requires more thorough evaluation by physicians, and the assessment of sleep quality and hygiene should be integrated into the management of CKD patients. Improved sleep quality and better sleep hygiene practices could contribute to a more favorable prognosis for CKD patients.

### **FVRS-24-OR-005: Genomic profiling of driver gene alterations in patients with non-small cell lung cancer, patterns of treatment and impact on survival outcomes – A single center experience of more than 1200 patients**

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Objectives: The utility of Next-Generation-Sequencing (NGS) in patients with non-small cell lung cancer (NSCLC) has led to an exponential increase in the identification of targetable gene alterations. 60-65% NSCLC patients from Western datasets and 80% of patients from Asian datasets report identification of driver-gene alterations, however, Indian NGS data was lacking.

Methods: This retrospective single-center study conducted between May'19 and Dec'23 included histologically confirmed NSCLC cases with NGS testing done on tissue/liquid biopsy samples at the time of diagnosis. All cases were discussed in the thoracic medical oncology disease- management group, and the study was approved by the Institutional Ethics Committee.

Results: Data of 1230 patients was analyzed. Median age was 59 years (IQR,51-66), 65.3% (n=803) were males, 34.6% (n=426) had a history of smoking, and 78.1% (n=961) had an adenocarcinoma histology. NCCN-approved driver gene alterations were picked up in 64.8% (n=797) cases. EGFR, ALK, ROS1, ERBB2, MET, RET, NTRK, BRAF and KRAS gene alterations were seen in 33.7% (n=414), 7.6% (n=94), 2.4% (n=29), 6.1% (n=75), 1.9% (n=23), 2.2% (n=22), 0.7% (n=8), 3.3% (n=40), and 9.6% (n=118) cases respectively. 62.1% (n=495/797) driver-positive patients could receive targeted therapy, and 21.7% (n=94/433) driver-positive patients could receive targeted therapy, and 21.7% (n=94/433) driver-negative patients could receive immunotherapy

Conclusion: NGS testing is imperative in patients of NSCLC due to high rates of detection of targetable gene alterations. Indian NSCLC NGS data is unique compared to Western and Asian counterparts. Adequate efforts must be undertaken to increase the utility of targeted immunotherapy agents.

### **FVRS-24-OR-006: "The Gut Microbiota-Brain-CAR T Cell Axis: A Systematic Review of Gut Microbiome Modulation and its Impact on Neurological Complications and Treatment Responses in CAR T Cell Therapy"**

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**Background:** CARs are designed against specific antigens on malignant cells. So far, treatment with CAR-T cells works effectively in hematological malignancies; however, low response rates, together with long-term efficacy loss and significant side effects, make this modality challenging to use in solid tumors. A balanced microbiota is helpful for an efficient immune response, which enhances the success rate of immunotherapy and also modifies the anticancer traits of CAR T cell therapy. Personalized CAR-T cell therapies, based on gut microbiome profiles, may increase therapeutic efficacy while reducing associated toxicities.

**Methods:** A thorough literature search was carried out using PubMed, Embase, Cochrane Library, and Web of Science databases by six independent investigators to locate relevant studies published before September 2024. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed. Studies evaluating the impact of Gut Microbiome Modulation on CAR-T Cell Therapy were included. The study characteristics, gut microbiome composition, and clinical results have been extracted and synthesized.

**Results:** Increased abundance of beneficial gut flora species such as Ruminococcus, Bacteroides, Faecalibacterium, and Akkermansia was linked to better treatment outcomes and full response rates in patients who had not received antibiotics. Patients treated with antibiotics before CAR T cell therapy were observed to have reduced microbiome diversity, reduced survival rates, impaired CAR T cell persistence and efficacy. Additionally, it was found that gut microbiota modulates immune checkpoint inhibitors and CAR T-cell therapy outcomes which were influenced by presence of Firmicutes and proteobacteria. Decreased gut microbiota diversity was associated with increased incidence of immune effector cell-associated neurotoxicity syndrome (ICANS) & cytokine release syndrome.

**Conclusion:** The gut microbiome is involved in regulation of immune response and toxicity, thus playing a pivotal role in efficacy and safety of tumor immunotherapies. It acts as a biomarker in response to immunotherapy, enabling precise classification of patients toward personalized treatment

## Poster Presentations (PO)

### **FVRS-24-POS-001: Demographics, Risk Factors, and Pre-Hospital Delay in Acute Coronary Syndrome Patients: An Observational Study in a Tertiary Care Hospital in Central India**

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**Background:** Acute Coronary Syndrome (ACS) is one of the leading causes of mortality worldwide. No accurate estimates are available; however, over three million cases of ACS may occur in India every year. Thus, this study was planned to determine the patient demographics and risk factors associated with ACS and determine the factors causing the prehospital delay.

**Methods:** The study was conducted using a cross-sectional design and a questionnaire-based approach at the Department of Medicine, Government Medical College and Hospital, Nagpur. The study population consisted of patients who were hospitalized due to ACS. All patients were interviewed face-to-face using a self-designed, semi-structured, open-ended questionnaire.

**Results:** The sample consisted of 73 males (81.1%) and 17 females (18.9%), with the participants comprising 86.6% STEMI (n=78), 10% NSTEMI (n=9), and 3.33% Unstable Angina (n=3). Smoking, diabetes, hypertension, and the history of cardiovascular events were identified as common risk factors for ACS. The most cited reason (n=34, 37.7%) for the delay



in seeking medical treatment was not considering presenting symptoms to be serious. Chest pain (73.3%) was the most commonly reported first symptom by patients, with Morning (43.3%) being the most frequent time of symptom onset. Males were more likely to have an anterior wall MI, while females were more likely to have an inferior wall MI and a posterior wall MI. Patients who were referred to more hospitals tended to use ambulances to reach the Tertiary care hospital, while patients who were referred to fewer hospitals tended to use private vehicles or friend's/relative's vehicles. Individuals from rural areas had to go to at least one more hospital before arriving at our Tertiary care center. The majority (76.67%) of participants in our study were managed with thrombolysis. The door-to-needle time for patients receiving thrombolysis in our study was 78+63 minutes.

Conclusion: Patients faced significant economic burdens and delays in seeking medical help, with rural residents having to visit more hospitals before arriving at a Tertiary care center. The study draws attention to the need for reducing the door-to-needle time for thrombolysis in STEMI patients to improve treatment outcomes and the need for improved Emergency Medical Services (EMS) in the country.

### **FVRS-24-POS-002: A Study on QTc prolongation and its' association with serum electrolytes in patients with Chronic Kidney Disease**

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Background: Ventricular arrhythmias and sudden cardiac death are among the leading causes of mortality in patients with chronic kidney disease (CKD). The complex association between CKD and cardiovascular disease attributes to the clustering of several etiologies between them such as advancing age, diabetes, hypertension, anemia, volume overload and electrolyte abnormalities. ECG is a simple tool to measure the QTc interval (corrected QT interval) and monitor any pro-arrhythmogenic conditions of the heart. Although the association between prolonged QTc interval and mortality is established, not much is known about the combined association of CKD, QTc interval, and serum electrolytes.

Methods: This is an observational, cross-sectional, case-control study. Convenience sampling was adopted, and the estimated sample size was 63 in each group (Difference of Means Formula). Consecutive outpatients or in-patients with CKD (stages G3-G5) were recruited following confirmation of their diagnosis based on clinical, biochemical or radiological criteria. The control group included healthy subjects without any major ailments. Those with known arrhythmias, any severe illnesses, taking QT prolonging medications, pregnant women were all excluded from the study. Venous blood samples were obtained from all the subjects to run renal function tests; sodium, potassium, chloride, calcium and magnesium levels. ECG monitoring was conducted and the QTc interval (Bazett formula) was recorded.

Results: Nearly 50% of the CKD patients and 11% of the controls had prolonged QTc interval. Hypermagnesemia was the most common electrolyte aberration. There was no significant correlation between QTc interval and serum electrolytes ( $P > 0.05$ ) and no significant association between the severity of CKD and QTc interval.

Conclusion: We conclude that QTc prolongation is more prevalent in CKD patients. Simple ECG monitoring would enable the detection of patients with high-risk profiles and bring down the incidence of arrhythmias. Large-scale, multi-center studies with follow-up will be necessary before application in clinical practice.

### **FVRS-24-POS-003: Association of Covid-19 with the emergence of comorbidities: A hospital based retrospective cohort study**

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Background: In 2019, SARS-CoV-2 marked the starting of global pandemic which reached its peak in 2020. Novel Corona Virus emerged as respiratory illness, later started causing multi organ complications in recovered patients.

Methods: Study was conducted in a tertiary hospital by using semi-structured questionnaire through telephonic interviews after taking verbal consent from the subjects.

Results: Out of 54 people in cohort group, 64.8% were males & 35.1% were females. The mean days of stay in the hospital were more in males but the mean time lag between the onset of comorbidities and COVID-19 recovery in days was actually shorter in females as compared to males. On further analysis, it came out that females are more prone to develop multiple comorbidities at once; i.e. in 37.5% of females. Diabetes Mellitus alone has the highest incidence rate of 12.9% followed by STEMI [7.4%] and thrombocytopenia [5.5%]. 51.8% of cohort group developed comorbidities after COVID-19 while about 14.8% of control group developed comorbidities from March 2020 onwards i.e. from the commencement of covid-19 global pandemic. Relative Risk assessed comes out to be 3.5. Attributable Risk is 71.42% for this study.

Conclusion: The incidence of comorbidities in cohort group is more than that of control group; showing COVID-19 as a risk factor for its post-exposure comorbidities. There is a direct association between COVID-19 & development of comorbidities which is inferred with a Relative Risk of 3.5

### **FVRS-24-POS-005: Assessment and Evaluation of Psychosocial Factors responsible for alcohol consumption in patients being affected by Alcoholic Liver Disease (ALD) - Retrospective Cross-Sectional Study**

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Background: Alcohol consumption is a leading preventable cause of Alcoholic Liver Disease (ALD) & liver cirrhosis, contributing significantly to global morbidity & mortality. The World Health Organization estimates that alcohol abuse accounts for 3.3 million deaths annually. In rural India, early onset of alcohol consumption is prevalent, driven by factors like peer pressure, emotional trauma, & socio-economic challenges. This study aims to identify the psychosocial factors contributing to alcohol addiction among patients with ALD in a rural Indian population.

Methods: This retrospective cross-sectional study analyzed data from 200 adults admitted to a tertiary care hospital in a tier-II city in India for ALD. Participants, aged 18 to 65, provided informed consent, & data were collected on demographic details, reasons for alcohol initiation, co-addictions, & other influencing factors. The study primarily focused on work-related stress, emotional trauma, peer pressure, & socio-economic status as key determinants of alcohol addiction.

Results: The majority (76.7%) of participants were male, with 41.9% beginning alcohol consumption between 18-28 years. Hectic work schedules emerged as a significant factor, with 51.2% attributing their alcohol use to work-related stress. Emotional trauma, including divorce & loss of a family member, influenced 36.4% of participants, while peer pressure affected 27.9%. Lower monetary compensation drove 66.7% to alcohol as a coping mechanism. Furthermore, 81.4% lacked awareness of alcohol's harmful effects, & 83.7% were influenced by the easy availability of cheap liquor in rural areas.

Conclusion: This study underscores the critical psychosocial factors contributing to alcohol addiction in rural India. Addressing these factors through targeted education, improved work conditions, & enhanced socio-economic support is essential to mitigate the risk of ALD. Additionally, comprehensive public health interventions & policy reforms are crucial to preventing alcohol addiction in these vulnerable populations. Further research should explore these factors in greater depth to develop effective, long-term strategies.

### **FVRS-24-POS-008: Impact of fuel transition to Bharat Stage 6 and Ethanol Blending on Human Health and Ambient Air Quality in India**

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**Background:** Air pollution is one of the five leading risk factors for mortality worldwide<sup>1</sup>. India has been dealing with serious environmental problems as its economy develops<sup>2</sup>. The number of automobiles on the road has increased the risk of air pollution<sup>3</sup>. Therefore, to reduce pollution levels, Government of India decided to skip Bharat Stage 5 (BS5) emission standards and directly implement the stricter and more comprehensive Bharat Stage 6 (BS6) emission regimen. This study compares the ambient air quality to clinical and self-reported health effects of pollutants on exposed individuals in order to describe the projected health and environmental advantages of a complete transition to the BS6 regime.

**Methods:** A cross-sectional survey involving 550 participants was conducted in Delhi (BS6 region) and Narnaul (BS4 region). Blood samples were collected to measure pro-inflammatory markers (NT-Pro-BNP, Fibrinogen, TNF- $\alpha$ , IL-6, and HS-CRP) and chemicals (benzene, nitrates, sulphates, etc.) and heavy metals (Arsenic, Cobalt, Iron, Aluminum, Copper, Cadmium, and lead) were analyzed in urine samples. Also, air quality parameters like PM<sub>10</sub>, PM<sub>2.5</sub>, CO, NH<sub>3</sub>, Ozone, Benzene, oxides of sulphates and nitrates, as well as volatile organic compounds (toluene, xylene, and ethylbenzene) of the regions was monitored during the study period.

**Results:** Our data recorded a 70%, 40% and 10% overall drop in Benzene, Ozone and PM<sub>2.5</sub> emissions respectively in the BS6 region when compared to the BS4 region. Urine heavy metal analysis recorded higher levels of aluminum, iron, and lead in the BS4 region. Serum benzene levels registered a drop of 57% in Delhi. Overall, serum biomarkers were recorded higher in Narnaul as compared to Delhi.

**Conclusion:** We conclude from this study that the full switch from BS4 to BS6 emission standards will significantly enhance both human health and air quality. This will help in overall economic development and improvement in the quality of life.

### **FVRS-24-POS-009: The Prevalence and Impact of Autoimmune Comorbidities in Patients with Inflammatory Bowel Disease**

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**Background:** Inflammatory bowel disease (IBD), including Crohn's disease (CD) and Ulcerative colitis (UC), has previously been associated with various autoimmune conditions. However, their prevalence and the impact remain unclear. We sought to explore this relationship.

**Methods:** We used the National Inpatient Sample (NIS) 2016-2020 and International Classification of Diseases 10th Version, Clinical Modification (ICD-10 CM) diagnosis codes to identify patients with IBD and autoimmune conditions.

**Results:** The study population included 141,478,025 patients. An association was found between 24 autoimmune conditions and IBD. Odds of in-hospital mortality were elevated in age 45-65 (aOR 2.47,  $p < 0.001$ ) and  $> 65$  (aOR 5.05,  $p < 0.001$ ). Female patients had 15% lower odds of mortality (aOR 0.85,  $p < 0.001$ ). Odds of in-hospital mortality were lower amongst IBD patients with psoriasis vulgaris (aOR 0.53,  $p < 0.001$ ) and hypothyroidism (aOR 0.70,  $p < 0.001$ ), and higher in patients with comorbid Polymyositis (aOR 2.56,  $p = 0.017$ ), AIHA (aOR 2.60,  $p = 0.006$ ), ITP (aOR 2.19,  $p < 0.001$ ), and thrombotic microangiopathy (aOR 4.94,  $p < 0.001$ ).

Conclusion: Our study identified autoimmune comorbidities that are more prevalent in IBD patients. We found that polymyositis, AIHA, ITP, and thrombotic microangiopathy are associated with a higher risk of in-hospital mortality. Psoriasis and hypothyroidism are associated with lower risk of in-hospital mortality. Further studies are needed to explore the mechanisms responsible.

### **FVRS-24-POS-010: To Assess the Incidence of Subcutaneous Recombinant Erythropoietin Induced Hypertension In African-American Patients with Anaemia Of Chronic Kidney Disease- A Retrospective Study**

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Background: Anemia of chronic disease can be managed with recombinant human erythropoietin (rhEPO). However, rhEPO treatment is associated with adverse effects including hypertension (HTN), headaches, and stroke(1,2). Hypertension may develop between two weeks and four months after starting treatment (1).

Methods: We conducted a retrospective analysis of African American adults with chronic kidney disease (CKD) and anemia at a Brooklyn cancer clinic. With IRB consent waiver, we reviewed 547 patient charts to assess rhEPO's impact on blood pressure (BP) over 90 days. We recorded baseline and highest post-initiation BP readings according to the American Heart Association's 2022 guidelines (3).

Results: Of the 547 patients, 160 received subcutaneous rhEPO. After excluding 19 patients due to unrecorded vital signs or loss to follow-up, 141 patients were included in the study group. Among these, 21 patients (14.89%) developed hypertension: 1 patient (0.70%) had new-onset hypertension, and 20 patients (14.18%) had exacerbated hypertension. A significant finding was that 12 patients (57.14%) experienced a hypertensive crisis (SBP >180 mm Hg and/or DBP >120 mm Hg). Additionally, 8 patients (38%) had Stage II hypertension (SBP ≥140 mm Hg or DBP ≥90 mm Hg), while only 1 patient (0.04%) had Stage I hypertension with SBP 130-139 mm Hg and DBP 80-89 mm Hg. Headaches were reported by 13 patients (8.125%), and 1 patient (0.625%) experienced a stroke.

Conclusions: Regular blood pressure monitoring is crucial for patients receiving subcutaneous recombinant human erythropoietin (rhEPO) to identify and address any new or worsening hypertension, along with other potential adverse effects, such as headaches and the risk of stroke. While prior studies have primarily concentrated on intravenous rhEPO, subcutaneous administration also carries comparable risks. Additional research is necessary to investigate these effects more comprehensively.

### **FVRS-24-POS-011: Will photon counting detectors replace Computed tomography scanners : An updated comprehensive review**

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Background: Photon Counting Detectors and computed tomography (PCD-CT) have revolutionized the field of medical imaging over the past decade, offering significant advancements in diagnostic accuracy and patient care. First approved by the FDA for clinical use in 2021. PCD-CT counts individual photons and measures their energy; the main advantages of PCD-CT are better spatial resolution, spectral imaging, and reduced radiation doses. PCDs are integral to various clinical imaging applications, including cardiovascular, thoracic, oncology, neuroimaging, abdominopelvic soft tissue and musculoskeletal imaging, providing enhanced diagnostic capabilities. In this review article, we will describe the most

updated clinical applications of PCD-CT with a focus on how it has been used in imaging various systems of the body and further discuss the challenges and its resolution.

Methods: A comprehensive search of multiple databases including Pub med, Cochrane and google scholar was done to collect data on clinical application of the photon counting detectors on human subjects and phantom studies.

Results: In cardiovascular imaging, PCD helps reduce blooming artifacts and improve the visualization of calcified plaques, contributing to more accurate assessments of coronary artery disease and better patient outcomes. In oncology, PCDs have improved the detection and characterisation of small tumors, particularly pancreatic and liver cancers, thus enhancing treatment planning and personalized medicine. Neuroimaging applications of PCDs include superior arterial and venous circulation differentiation and improved visualization in complex neurosurgical procedures. Additionally, PCD-CT has demonstrated potential in musculoskeletal imaging for assessing trabecular bone microstructure, offering new possibilities for osteoporosis prognosis and other diseases of the bone.

Conclusion: Technological advancements in PCDs have enhanced spatial and spectral resolution, tissue contrast, and dose efficiency, expanding their imaging applications. Challenges like photon pile-up, charge sharing, and artifacts persist. Ongoing research focuses on innovations such as geometric calibration and post-processing techniques to address these issues and improve PCD performance.

### **FVRS-24-POS-012: Pattern of Ambulatory Blood Pressure in Normotensive Patients of Type 2 Diabetes Mellitus Attending a Tertiary care Hospital in South India**

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Background: Hypertension is a prevalent comorbidity in patients with Type 2 Diabetes Mellitus (T2DM), significantly increasing cardiovascular risk. Diabetic patients with Hypertension have a fourfold increased risk of cardiovascular disease (CVD) as compared to normotensive nondiabetic controls (1) Traditional office blood pressure (BP) measurements may fail to detect various hypertensive phenotypes, such as masked or white coat hypertension. Variability of BP values when the subject's measurement was done in a medical environment using a sphygmomanometer led to the advent of out of office BP measurement techniques (2). Ambulatory blood pressure monitoring (ABPM) offers a more accurate assessment by providing continuous BP measurements over 24 hours, including daytime and nighttime periods. This study aims to compare office BP with ABPM patterns in normotensive T2DM patients at a tertiary care hospital in South India.

Methods: A cross-sectional study was conducted over two months, including 57 normotensive T2DM patients as per office BP readings. Patients with hypertension, autoimmune disorders, malignancies, or advanced cardiovascular or neurological diseases were excluded. ABPM was performed using a validated device to record BP at 30-minute intervals during the day and hourly at night. Data were analyzed using SPSS, with chi-square tests and t-tests applied to assess differences in hypertensive phenotypes and dipping patterns.

Results: Among the 57 patients, 38.6% were identified with masked hypertension. The study found that 50.9% exhibited a non-dipping pattern in systolic BP, which is associated with a higher cardiovascular risk. In diastolic BP, 42.1% were dippers, while 40.4% were non-dippers. There was no statistically significant difference between diurnal index and hypertension classification.

Conclusion: ABPM identified a substantial proportion of normotensive T2DM patients with masked hypertension, which would have been missed using only office BP measurements. The high prevalence of non-dipping BP patterns further underscores the importance of ABPM in this population, suggesting that ABPM should be routinely used in T2DM management to better identify and address cardiovascular risks.



### **FVRS-24-POS-013: A systematic review on assessment of Cognitive Behavioural Therapy as promising intervention in management of Irritable Bowel Syndrome**

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**Background:** Irritable bowel syndrome is a chronic gastrointestinal condition impacting 15% of the global population and is characterized by recurrent bouts of abdominal pain associated with constipation or diarrhea. Irritable bowel syndrome is currently diagnosed by Rome IV diagnostic criteria. The absence of effective treatment protocols has contributed to a significant decrease in the quality of life (1,2). This systematic review focuses on assessing the impact of cognitive behavioral therapy in the management of irritable bowel syndrome.

**Methods:** The systematic review was conducted according to the PRISMA guidelines. A literature search was conducted on major medical literature databases of PUBMED, PUBMED CENTRAL, COCHRANE AND GOOGLE SCHOLAR. The search was conducted to identify available observational studies and randomized control trials which assessed the impact of cognitive behavioral therapy on irritable bowel syndrome with primary outcomes of post-intervention IBS-SSS and IBS-QOL or any other indicator that measured quality of life or the severity of pain.

**Results:** The study reviewed 891 papers and included 9 studies with a total of 1,070 subjects. Post-therapy outcomes for cognitive behavioral therapy's impact on irritable bowel syndrome were measured using standardized scales, including the McGill Pain Scale, IBS-QOL, Global Well-Being, and IBS-SSS. Most studies reported a significant reduction in IBS-SSS scores by over 50 points, along with notable improvements in IBS-QOL scores.

**Conclusion:** The study assessed the impact of cognitive behavioral therapy and highlighted CBT as a promising modality of intervention in the treatment of IBS. The study showed promising results in the improvement of the quality of life of the patients and decrease in the severity of the symptoms of IBS post-CBT. Considering the evidence included in the systematic review, CBT is a promising intervention in the management of IBS and would be a valuable addition to the current treatment protocol.

### **FVRS-24-POS-014: To study the clinical profile of dengue patients in a Tertiary Care Institution in North India**

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**Background:** Dengue fever is a mosquito borne viral illness carried worldwide by *Aedes aegypti* mosquito. Dengue infection manifests itself in a variety of ways, from mild febrile illness to severe hemorrhagic diseases like Dengue Hemorrhagic Fever (DHF) and Dengue Shock Syndrome (DSS). Thrombocytopenia is a common clinical finding in dengue fever and therapeutic platelet transfusions are given to patients with clinical bleeding. Since no data about the dengue mortality and morbidity has been reported from Jammu region, this study aims to generate data and identify weak points or blind spots that could be covered in a future epidemic and aid in timely intervention.

**Methods:** A cross-sectional observational study was conducted on 128 dengue patients aged 18 and above, diagnosed with thrombocytopenia and positive for NS1 antigen or dengue IgM/IgG. Exclusion criteria included pregnancy, co-infections, pre-existing chronic diseases, and long-term hepatotoxic drug intake. Patients were categorized into two groups: 41 patients received platelet transfusions, while 87 did not. Clinical parameters including age, gender, vital signs, symptoms, lab values (e.g., platelet count, hematocrit, liver enzymes, creatinine, ascites), and final outcomes were recorded. Chi-square tests were used to analyze differences between the two groups.

**Results:** The transfused group had longer hospital stays ( $7.0 \pm 5.7$  days) compared to the non-transfused group ( $4.0 \pm 3.4$  days,  $p = 0.0003$ ). The transfused group showed higher instances of bleeding (36.5% vs. 5.7%,  $p = 0.000$ ) and lower platelet counts ( $29,146.34 \pm 24,652.14$  vs.  $61,643.68 \pm 40,892.36$ ,  $p = 0.0000$ ). Body aches and weakness were more common in the non-transfused group. Other parameters, like vital signs, liver enzymes did not show statistically significant differences.

Conclusion: Patients receiving platelet transfusions were more likely to have severe manifestations of dengue, including bleeding, leading to longer hospital stays. While transfusion is a key intervention in managing severe cases, timely identification of high-risk patients may help improve outcomes.

### **FVRS-24-POS-015: Mortality Predictors in Inpatients with Atrial Fibrillation and the Impact of Pulmonary Hypertension, a National Inpatient Sample Retrospective Study**

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Background: Pulmonary hypertension (PH) encompasses a diverse group of conditions and remains a significant cause of high morbidity and mortality in healthcare.(1) Similarly, atrial fibrillation (AF) confers higher risk of overall mortality in hospitalized patients.(2) This study aims to investigate the morbidity and mortality profile of patients with combined AF-PH diagnosis and compare it to the trajectories observed in those with PH without AF.

Methods: Utilizing HCUP, two cohorts were identified in patients hospitalized from 2017 to 2021: those with AF only (n = 22,944,870) and those with combined AF and PH (n = 2,384,054). Patient characteristics were compared using Pearson Chi-Square analysis for categorical variables and two sample T-tests for continuous variables.

Results: Patients with combined AF and PH had increased risk of inpatient mortality (OR 1.124, 95% CI 1.107-1.14, p < 0.001) and increased length of stay  $\geq 7$  days (OR 1.607, 95% CI 1.593-1.622, p < 0.001). Other statistically significant comorbidities with increased risk of mortality included myocardial infarction, congestive heart failure, stroke, dementia, moderate/severe liver disease, hemiplegia or paraplegia, renal disease, acquired immunodeficiency syndrome (AIDS), cancer and obstructive sleep apnea (OSA) treated with positive airway pressure (PAP) therapy, and obesity hypoventilation syndrome (OHS). Peripheral vascular disease, rheumatoid disease, peptic ulcer disease, and diabetes mellitus were found to be protective of mortality.

Conclusion: AF and PH interplay to accelerate morbidity and mortality among inpatients. Other comorbidities significantly affect mortality in hospitalized patients with AF. Future research is key in optimizing these conditions amongst patients with AF and PH.

### **FVRS-24-POS-016: Autoimmune Hepatitis masquerading as skin lesions**

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Introduction: Autoimmune hepatitis (AIH) is a chronic liver disease characterized by autoantibodies, hypergammaglobulinemia, and interface hepatitis. It often presents symptoms like jaundice and hepatomegaly, but diagnosis can be challenging, particularly in atypical cases. This report highlights an unusual presentation of AIH in a 40-year-old female who presented with dermatological lesions.

Case Description: A 40-year-old female presented with a maculopapular rash on forearms and shins for one month, initially diagnosed as psoriasis, along with dry, rough, and scaly palms and soles, suspected to be ectodermal dystrophy. She was being treated for the same but showed no significant improvement. During follow-up, she developed icterus and jaundice. Clinical examination revealed hepatomegaly, confirmed by ultrasound. The patient didn't complain of abdominal pain or pruritus. Laboratory tests showed elevated liver enzymes (ALT > AST) with an albumin-to-globulin ratio reversal, normal alkaline phosphatase levels, and a deranged coagulation profile. Hypothyroidism was also noted. Viral markers were negative, and serum total IgG levels were elevated. A high antinuclear antibody titre suggested type 1 autoimmune hepatitis. A pre-treatment diagnostic score of 17 confirmed AIH.

Discussion: This case underscores the importance of considering autoimmune conditions in patients with unusual dermatological manifestations without systemic symptoms. The patient in question was undergoing dermatological treatment for long before her systemic symptoms emerged. Following that, diagnosis was challenging, as viral hepatitis was also suspected. The patient ultimately received systemic and local immunosuppressive therapy, resulting in significant clinical improvement, which further cemented the diagnosis. In this era of super specialization, it is easy to miss the forest for the trees. Taking a step back when the response to treatment doesn't match the initial diagnosis can be crucial, particularly in cases where classic symptoms appear late in the disease progression. Recognizing atypical presentations can facilitate early diagnosis and prompt treatment, ultimately improving patient outcomes.

### **FVRS-24-POS-017: Social Determinants in High-Risk Pregnancy: A Clinico-Social Case Review**

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Introduction: High-risk pregnancies are prevalent in India, particularly among socioeconomically disadvantaged women [1]. Cultural norms, such as a strong preference for male children, often exacerbate these risks by encouraging multiple pregnancies [2], even against medical advice.

Case Description: A 34-year-old multiparous woman (G6P5L4) from a low-income background presented to the Gynecology ER at 33+3 weeks of gestation with a primary complaint of shortness of breath. She was diagnosed with rheumatic heart disease eight years ago, following a similar episode during her third pregnancy, which ended with intrauterine fetal death at seven months of gestation. Three months postpartum, she underwent open mitral commissurotomy but has since remained non-compliant with her medication regimen. One month prior, at 29 weeks of gestation, she was admitted in the ward due to worsening shortness of breath and was managed with intravenous digoxin. Despite being referred to cardiology for follow-up, she did not comply. On her current presentation, the patient was tachycardic and unable to lie supine. Auscultation revealed wheezing and coarse crepitus across all lung fields. Detailed examination revealed polyhydramnios, NYHA Class IV heart failure, mitral stenosis with mitral regurgitation, and atrial fibrillation. No signs of labor, leaking, or vaginal bleeding were noted. An emergency LSCS was performed, resulting in the birth of a healthy male infant. The mother required mechanical ventilation postoperatively.

Discussion: This case underscores the importance of addressing social and cultural factors and ensuring adherence to medical advice. The patient in question had previously delivered four healthy female infants, and her want for a son is presumed to be the motivation behind her multiple conceptions with minimal spacing in between. The addition of a lack of follow up and non-compliance from the patient's end made this a highly precarious situation that could otherwise have been prevented with timely interventions and counseling.

### **FVRS-24-POS-019: Sleepless Nights & Carrying life: An overview of Obstructive Sleep Apnea in Pregnancy**

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Obstructive sleep apnea (OSA) is characterized by five or more episodes of apnea or hypopnea per night, causing intermittent hypoxia and sleep fragmentation, which have significant implications on health. OSA is frequently underdiagnosed in the pregnant population due to the presence of non-specific symptoms that are often overlooked. The physiological changes occurring during pregnancy, such as increased fluid retention, raised hormone levels, immunological adaptations, and anatomical shifts, can worsen airway collapse, making pregnant females particularly vulnerable to adverse health outcomes such as gestational hypertension, preeclampsia, gestational diabetes mellitus, cardiomyopathy, and psychiatric disorders. The placental hypoxia caused by this condition can lead to intrauterine growth retardation (IUGR), low APGAR scores, small for gestational age and low birth weight infants, and increased risk

of perinatal mortality. The review emphasizes the implications of OSA in pregnancy along with the importance of screening OSA in prenatal care to detect at-risk patients early and initiate appropriate treatment. It discusses several screening methods, such as various questionnaires and diagnostic techniques like polysomnography, which, despite its limited availability and accessibility, remains the gold standard. CPAP is the primary treatment for OSA in pregnancy, while lifestyle modifications, including weight loss and positional therapy, can also act as alternatives.

### **FVRS-24-POS-020: Breaking the Chains: Addressing Nicotine Dependence and Tobacco Cessation Motivation in Psychiatric Patients- A Cross-sectional study**

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**Background:** Nicotine dependence is highly prevalent among psychiatric patients, contributing significantly to both physical and mental health burdens. Despite the availability of tobacco cessation interventions, there is a scarcity of studies, particularly in Northern India, assessing nicotine dependence severity and motivation for cessation. Given the higher nicotine content in Indian tobacco products, this study investigates the severity of nicotine dependence and motivation for tobacco cessation among psychiatric patients in a tertiary care hospital in Punjab.

**Methods:** This prospective study involved 122 psychiatric patients from GGS Medical College, Faridkot, diagnosed according to ICD-10 criteria. Severity of nicotine dependence was assessed using the Fagerstrom Test for Nicotine Dependence (FTND) and FTND-Smokeless Tobacco (FTND-ST). Motivation for tobacco cessation was evaluated using the Readiness to Quit Ladder (RTQL). Scores were recorded at baseline following initial intervention and reassessed after one month. Data were analyzed using appropriate statistical methods.

**Results:** The cohort comprised 37.7% with Substance Use Disorders, 35.2% with mood disorders, 11.5% with psychotic disorders, and 15.6% with other psychiatric diagnoses. Tobacco consumption included chewed forms (45.9%), cigarettes (26.2%), bidis (11.5%), and a combination of these (16.4%). At baseline, 21.3% exhibited low, 41.8% moderate, and 36.9% high nicotine dependence, with corresponding mean FTND/ST scores of 4.80. After one month, these proportions shifted to 33.6%, 37.7%, and 28.7%, respectively, with a mean score of 4.04, indicating a significant reduction in dependence ( $p < 0.000$ ). Motivation levels showed 50% of patients in pre-contemplation, 30.3% in contemplation, 12.3% in preparation, and 7.4% in action at baseline, improving to 45.1%, 29.5%, 13.1%, and 12.3% after one month. Labourers demonstrated the lowest motivation for cessation. Higher nicotine content was positively associated with FTND/ST scores both at baseline ( $p < 0.000$ ) and at one month ( $p = 0.014$ ). Combined tobacco use correlated with more severe dependence and lower readiness for cessation.

**Conclusion:** Nicotine dependence remains a significant concern in psychiatric patients. However, brief interventions significantly improve motivation for tobacco cessation, underscoring the importance of integrating cessation advice and regular follow-up into psychiatric care.

### **FVRS-24-POS-021: Suicidal auras during Migraine: a psychiatrist's conundrum**

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**Introduction:** A third of migraineurs have coexisting auras. Here we present a case of suicidal ideations occurring exclusively during migraine episodes. We posit that aura can manifest as acute suicidality due to the involvement of the emotion regulation cortex. We also explore amitriptyline's potential role in the treatment.

**Case Description:** A 43-year-old Indian female presented with a decade long history of migraine with auras. She reported a recent onset of suicidal ideations during migraine episodes. A total resolution of symptoms in between episodes was seen. The patient was started on propranolol 120 mg but reported worsening of symptoms. We put her on amitriptyline 25 mg and after two weeks she reported a reduction in the frequency/ intensity of headaches as well as suicidal ideations. Three months later there was a complete remission of her suicidal ideations.

**Discussion:** Multiple studies have reported increased rates of depression in migraineurs. Here, the focal point of interest was the acute suicidality experienced exclusively during episodes of migraine. We posit a couple of theories: Cortical spreading depression and its spread to the limbic system. Biological and genetic factors: Modulation in serotonin during attacks. Migraines involve reduced functioning in the serotonergic descending pain inhibitory system. There is a significant difference in the distribution of genetic polymorphisms within the serotonin transporter-linked promoter region between patients who experience aura during migraines and those who do not. Amitriptyline increases levels of serotonin. Its analgesic and anti-inflammatory effects are beneficial for migraine prophylaxis as well. Amitriptyline's dual role in migraine prophylaxis and mitigating associated suicidal ideations serves to highlight their shared pathophysiology.

### **FVRS-24-POS-022: Neuroprotective Role of Gut Microbiota after Regulation by various methods in Alzheimer's Disease: A Review**

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**Background:** The interplay between the Brain and GM is through various systems, including the ANS, Endocrine System, Immune System, hypothalamic-pituitary-adrenal axis, and various others. Microbiota influences glial cells and neurons by secreting neurotransmitters, fatty acids, and bacterial metabolites. Scientific evidence highlights the role of the GM in Alzheimer's pathogenesis. GM transmits signals primarily through bacterial metabolites which penetrate the gut wall and induce intestinal inflammation, leading to reduced expression of tight junction proteins and an inflammatory response. In neurodegenerative disorders or diseases, GM dysbiosis is typically observed, including an increase in inflammatory bacteria such as Firmicutes and Bacteroidetes. Thus, maintaining the balance of the microbiome is critical for the functioning of the ENS and the CNS.

**Methods:** A search was conducted on PubMed to find Randomized Controlled Trials (RCTs) or observational studies exploring the role of GM in the pathogenesis of AD and which regulatory interventions of GM can help in Alzheimer's management. Studies which met the inclusion criteria were then analyzed for this review.

**Results:** Various methods showed efficacy in modulating the GM, a crucial factor in reducing the risk and progression of AD. Notably, these effects have been primarily observed in patients aged 50 years and above who are predisposed to AD.

**Conclusions:** Various methods can regulate GM composition, including ketogenic diet, probiotics, fecal microbiota transplantation (FMT), and exercise. Probiotics restore GM balance which reduces inflammatory flora and improves cognition. FMT can regulate GM by promoting anti-inflammatory bacterial species. Exercise helps in neuronal protection and the ketogenic diet alters brain fuel, reduces ROS, and increases cytokine levels which reduces neuronal damage. The restoration of GM balance and its metabolites exhibits a neuroprotective role, which helps in treating AD or reducing the disease risk. These methods impact neurotransmitters, which can be examined further to improve potential interventions.

### **FVRS-24-POS-023: Background and Epidemiology of Rural Trauma in Nepal**

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**Background:** Trauma is a leading cause of morbidity and mortality across the globe. However, the burden of injury falls disproportionately on low and middle-income countries such as Nepal. Our research aims to improve trauma care in rural Nepal.

**Methods:** We conducted a literature review assessing the state of trauma care in Nepal with a particular focus on rural areas. Building upon findings from the literature review, we partnered with Nyaya Health Nepal, a healthcare-based nonprofit, and Bayalpata Hospital, a rural primary hospital, to better understand the epidemiology of trauma in far western Nepal.

**Results:** Of 38403 total patients at the hospital, demographic and injury data was extracted for 8928 patients from electronic health records (EHR) at the emergency department. The major catchment district of the hospital is Achham district (n = 5570), where it is located, as well as neighboring districts Bajura (n = 1874) and Doti (n = 1202). All three districts are located in rural Nepal. The demographic most at risk of injury is males ages 0-9, which is consistent with findings from research and government data with an urban or nation-wide focus. The most prevalent type of injury (85.7% of all trauma cases) identified in this study was fractures, which are commonly a result of falls. This reflects previous studies identifying falls as the most common cause of injury. The most prevalent location of injury (37.7% of all trauma cases) identified in this study was lower limbs, followed by head (29.6%) and upper limbs (20.6%).

**Conclusion:** Each project contributes to a more comprehensive understanding of the prevalence and characteristics of trauma in a rural primary hospital context, which will help inform other rural primary hospitals, public health initiatives, resource allocation, and infrastructure development.

### **FVRS-24-POS-024: Prevalence of Colon Polyps in Asymptomatic Indians Undergoing Screening Colonoscopy in the U.S.A, An Update**

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**Background:** From 2004 to 2014, colorectal cancer (CRC) incidence rates in India increased by 20%. There is limited information available on CRC among Indians and Indian immigrants, especially regarding the frequency and properties of colonic polyps. With over 3 million people from the Indian subcontinent residing in the United States, studying the epidemiology and characteristics of colon polyps in this subgroup is essential.

**Methods:** This was a retrospective study analyzing the prevalence of colon polyps Indians in an office-based setting in Middlesex County in New Jersey. Endoscopic data was curated from an endo-surgery center affiliated with private practice. Middlesex County has a high immigrant population from India. Control patients were from the same private practice and included Caucasians and African Americans. The total study included roughly 400 patients. The indication for colonoscopy was age-specific screening for CRC.

**Results:** A total of 69 Indian subjects out of 200 had colon polyps (34.5%). In the non-Indian group, 68 out of 200 subjects had polyps(34%). Of the Indian group, 63.7% had hyperplastic polyps, 48.8% had adenomatous polyps, and 0% had villous polyps. In non-Indians, 70.5% of subjects had hyperplastic polyps, 41.1% had adenomatous polyps, and 5.8% had villous polyps. Chi Squared test set at .05 significant level showed no difference regarding polyps between Indian and non-Indian groups.

**Conclusion:** This pilot study shows no difference in the risk for colon polyps between Indians and non-Indians. Thus, need for screening colonoscopy in Indians cannot be minimized and increased public awareness campaigns are warranted. A weakness of the study is a small sample size, and the study only looked at the incidence of polyps. Therefore, the

carcinogenicity of colon polyps in Indians cannot be commented on. We recommend larger population studies to be conducted at larger academic centers in the future.

### **FVRS-24-POS-025: Squamous Cell Lung Cancer Still Remains the Most Common Histological Subtype of Lung Cancer in Rural India**

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**Background:** India, now the most populous country, has lung cancer data primarily derived from urban populations via the National Cancer Registry Program (NCRP). Despite rural areas comprising 65% of the population, rural lung cancer data remains underrepresented. This report analyzes demographic and clinical data of lung cancer patients treated at a northern Indian university hospital predominantly serving rural populations.

**Methods:** Data of patients managed at the thoracic oncology clinic between September 2022 and March 2023 were collected. Urban patients were excluded. Demographic data, smoking profiles, and clinical information were analyzed and compared with the NCRP 2022 report.

**Results:** Of 540 lung cancer patients, 36 urban cases were excluded. The mean age was  $59.8 \pm 10$  years, with 82.9% males and 95.2% smokers. Among smokers, 81.7% were current smokers, with 44.9% still smoking at diagnosis. Bidis, indigenous hand-rolled cigarettes, were used by 96.7% of smokers. The mean BMI was  $18.4 \pm 3$  kg/m<sup>2</sup>. Most patients presented with ECOG PS 1 (41.9%) or PS 2 (32.9%). Primary lesions were central in 56.2% of cases. Endobronchial biopsy was the most common tissue retrieval method (49.8%), and 71.4% had emphysema on CT thorax. Histological subtypes included squamous cell carcinoma (46.4%), adenocarcinoma (28.8%), and small cell carcinoma (11.3%). Stages IIIB (39.7%) and IVA (33.9%) were most common at presentation. Compared to NCRP data, rural patients had a similar mean age, a higher proportion of males, and a significantly higher rate of squamous cell carcinoma.

**Conclusion:** Lung cancer in rural India predominantly involves central squamous cell tumors, with bidi smoking as a major contributing factor. Smoking habits and histological subtypes in rural populations differ from those reported in urban areas.

### **FVRS-24-POS-026: Virtual Reality for Patients With Various Psychiatric Disorders**

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**Background:** Virtual reality is a growing technology that provides visual and audio transmissions, replicating the real world. It simulates the real world using multiple screens, audio, and tactile inputs. VR technology is increasingly employed to diagnose, assess, and treat various psychiatric conditions, such as anxiety disorders, substance abuse, post-traumatic stress disorder, psychosis, and mood.

**Aim:** We have attempted to review the available literature used to treat various psychiatric disorders.

**Methods:** A systematic search was conducted using the following electronic databases: PubMed, PsycINFO, Web of Science, and Google Scholar (up to June 2024). We screened 661 articles, including clinical trials, meta-analyses, case studies, and literature reviews. The keywords included "virtual reality," "VR therapy," "virtual relaxation," "quality of life," "PTSD," "mental health," "depression," "anxiety disorders," "phobia," "schizophrenia," and "psychosis." Out of the articles screened, we included 32 pieces as long as they quantitatively examined the efficacy of VR-based interventions for alleviating symptoms of psychiatric disorders.

Results: The review found that VR intervention is helpful for mood disorders like depression and anxiety disorder; VR-based intervention improved social skills in patients with psychotic disorders. VR therapy has also shown promise in reducing cravings and improving cognitive functions in patients with substance abuse disorder. For PTSD, VR therapy is comparable to traditional CBT or exposure therapy; it offers an engaging alternative that sustains long-term benefits.

Conclusion: Virtual Reality (VR) has emerged as a promising tool for mental health treatment, providing novel therapeutic approaches for various psychological disorders. The review of current literature indicates that VR enhances engagement, adherence, and effectiveness in treating conditions such as psychotic disorders, anxiety disorders, substance abuse, PTSD, and mood disorders. In conclusion, VR therapy significantly advances mental health treatment by offering immersive and effective options. Further trials are needed; however, current evidence supports its role as a valuable adjunct to traditional therapies.



The poster features a night cityscape background. At the top, the AAPI logo is on the left and right. The text reads: 'AAPI MSRF & AAPI PreMed present Medical Scholars Summit January 25-26th, 2025 Rutgers-Robert Wood Johnson New Brunswick, NJ'. Social media handles '@aaplmsrf' and '@aaplpremed' are also present.

### Oral Presentations (OR)



#### **MSS-25-OR-001: Ancient Problems Require Modern Solutions: Tackling Age-Old Neurophobia with a Novel Teaching Approach**

**Avi Singh Gandh MBBS, Japjee Parmar MBBS, Department of Neurology, Emory University**

**Background:** To ascertain the prevalence of Neurophobia, the colloquial term used for apprehension and anxiety surrounding Neurology among Internal Medicine (IM) residents and evaluate the effectiveness of Neuro-Medicina, an original trivia-based interactive educational intervention, based on novel learning techniques such as interleaving, active recall and spaced-repetition, which are deemed superior to traditional rote memorization per the current literature. Neurophobia, is a significant barrier in medical education and subsequently in interdisciplinary patient care, particularly amongst IM residents. Traditional didactic methods seem to be insufficient in alleviating this well-recognized discomfort, underscoring the need for innovative time-efficient approaches that foster long-term clinically applicable utility.

**Methods:** This pilot project involved delivering an originally designed Neuro-Trivia based interactive educational intervention to 152 residents/interns across 4 hospital sites, followed by targeted bite-sized teaching based on active-recall and interleaving. Post-intervention, participants completed a 5-point Likert scale questionnaire (1 = strongly disagree, 5 = strongly agree) assessing their perception of prior comfort (adequate exposure), confidence (clinical knowledge) & curiosity (continued interest) towards neurology, and the session's impact on these variables. Descriptive statistics were used to analyze the results.

**Results:** 64.5% of participants reported to have previously experienced significant Neurophobia. The intervention was reported to have a positive impact on all 3 measured variables based on their likert scale scores (mean, median) all being well above the neutral point of 3: comfort (4.16, 4.5), confidence (4.30, 4.5) and curiosity (4.37, 5) towards neurology. 90.8% of participants reported it to be an overall enriching experience (scoring 4.49, 5).

**Conclusion:** Our pilot study elucidates the potential of interactive trivia-based learning tools in reducing Neurophobia, through adopting the principles of interleaving and active recall. Future iterations will incorporate spaced-repetition

through recorded lectures and supplementary material, validate preliminary findings through larger cohorts, and access long term efficacy through long-term follow-up.



### **MSS-25-OR-002: Impact of Marine Microplastics on Neurologic and Functional Disabilities: A Population-Level Study**

**Brinda Desai MD (1)**, Bhargav Makwana MD, Jayashri Srinivasan MD PhD FRCP (1), Diana Apetauerova MD (1), Sourbha S. Dani MD MSc, Siddharth Sehgal MD (1), Oleg Yerstein MD (1), Sumanth Khadke MD, Ashish Kumar MD, Khurram Nasir MD, Rishi Wadhera MD MPH, Yixin Kong PhD, Ana Navas-Acien MD PhD MPH, Gary Adamkiewicz PhD MPH, Sanjay Rajagopalan MD, Sadeer Al-Kindi MD, Susan Moffatt-Bruce MD PhD, Sarju Ganatra MD. Department of Neurology, Lahey Hospital & Medical Center, Burlington, MA

**Background:** To investigate the correlation between marine microplastic levels in ocean water and the prevalence of cognitive, mobility, self-care, and independent living-associated disabilities in adjacent coastal counties.

**Methods:** In this cross-sectional study comprising 218 coastal counties in the United States, we compared the prevalence of cognitive disability, mobility disability, self-care disability, and independent living disability in counties with very high and low MMLs. Unadjusted and adjusted prevalence ratios (PRs) were computed using population-weighted quasi-Poisson regression across three different models to examine the relationship between disability prevalence and MMLs.

**Results:** The mean prevalence of cognitive, mobility, self-care, and independent living disability was significantly higher in counties with very high MMLs (15.2%, 14.1%, 4.2% and 8.5%, respectively) compared to low MMLs (13.9%, 12.3%, 3.6% and 7.7%, respectively,  $p < 0.001$ ). After adjusting for potential confounders, counties with very high MMLs showed significantly higher adjusted prevalence rate (PR) of cognitive (PR: 1.09 [1.06, 1.12],  $p < 0.001$ ), mobility (PR: 1.06 [1.03, 1.10],  $p < 0.001$ ), self-care (PR: 1.16 [1.11, 1.20],  $p < 0.001$ ), and independent living disability (PR: 1.08 [1.05, 1.12],  $p < 0.001$ ) compared to those with low MMLs.

**Conclusion:** Our findings indicate a significant association between marine microplastic levels and the county-level prevalence of cognitive, mobility, self-care, and independent living disabilities. Further research is warranted to explore the health implications of microplastic pollution at an individual level.



### **MSS-25-OR-003: Subdural and Epidural Hematoma Following Lumbar Puncture in Patients on Anticoagulants or Antiplatelets: A Retrospective Propensity Score-Matched Registry Study**

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**Background:** Lumbar punctures are widely used diagnostic and therapeutic procedures for a range of CNS pathologies including infection, increased intracranial pressure, and more. Lumbar punctures violate the dura of the thecal sac, posing some risk for formation of epidural or subdural hematomas, which is increased in patients on anticoagulant or antiplatelet therapy. This study compares the odds of developing epidural or subdural hematomas within 30 days of lumbar puncture in patients with and without anticoagulant or antiplatelet use.

**Methods:** The TriNetX multi-institutional electronic health record database was used to perform a retrospective, propensity score-matched analysis of outcomes of cohorts of patients who underwent lumbar punctures on anticoagulants, antiplatelets, and no anticoagulants or antiplatelets within one month of the procedure. The outcomes of interest were examined within 30 days of lumbar puncture and included occurrence of epidural or subdural hematoma.

**Results:** A total of 25,788 patients were identified for both lumbar puncture patients with anticoagulants and without blood thinners after propensity score matching. For this study, epidural hematoma (OR [95%CI], 1.000 [0.561-1.784])



showed no difference in odds ratio between two cohorts, while subdural hematoma (OR [95%CI], 0.780 [0.640-0.950]) showed a statistically significantly lower odds ratio for the anticoagulant use group. We identified 13,310 patients for both lumbar puncture patients with antiplatelets and without blood thinners after propensity score matching. For this analysis, epidural hematoma (OR [95%CI], 1.904 [0.885-4.095]) showed a higher odds ratio compared to subdural hematoma (OR [95%CI], 1.008 [0.784-1.296]), both of which were not statistically significant.

Conclusion: The data analyses suggest that there are no increased risks of epidural and subdural hematoma in patients with history of use of antiplatelet or anticoagulant compared to those who do not. These results could be further validated by single or multi-institutional retrospective cohort study with additional parameters that characterize patient population.

### **MSS-25-OR-004: Improving SBIRT Training at Albany Medical Center: A Qualitative Analysis**

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Background: Substance abuse disorders (SUDs) are a prevalent health issue, with over three million deaths attributed to alcohol or drug use annually. Individuals with SUDs often face negative bias and stigma, including in the healthcare setting. In 2016, Albany Medical Center's Department of Psychiatry was awarded a three-year grant to train healthcare professionals in SUD screening and intervention. This training utilized the SBIRT (Screening, Brief Intervention, and Referral to Treatment) program to increase SBIRT intervention efficacy, enhance provider knowledge, and improve communication skills. This 7–8-hour training included online modules, in-person instruction, live demonstrations, and role-playing exercises. Trainees were evaluated by SBIRT experts during their standardized role plays. Trainees completed post-training surveys to identify areas of improvement regarding the SBIRT training. This study aims to qualitatively assess this trainee survey response data set.

Methods: Survey responses were thematically classified by recurring themes. Themes were refined by our team through three iterations to identify core themes.

Results: Participants included 770 trainees from various healthcare disciplines: medical, pharmacy, nurse practitioner, physician assistant, and psychiatry students. In total, 244 responses were left blank and 185 listed "none" for areas of improvement. The remaining responses were qualitatively themed and labeled as "specialize training" (n=135) and "training logistics" (n=252). Sub-themes of "specialize training" included "more and varied role play" (n=104) and "more tailored training and long-term application" (n=31). Sub-themes of "training logistics" included "improve didactics" (n=94), "shorten and less redundant training" (n=90), and "improve training organization and structure" (n=68).

Conclusion: Creating tailored training focused on career-specific long-term applications of SBIRT may improve training experience. More concise and organized training may also contribute to enhanced training. These findings highlight the importance of improving SBIRT training for healthcare professionals to maximize SUD intervention efficacy. SBIRT training can greatly improve SUD screening and management techniques, optimizing patient outcomes.

### **MSS-25-OR-005: Assessing Public Awareness of Heart Attack Symptoms, Risk Factors, and Emergency Response: A Cross-sectional Study**

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Objective: Early recognition of symptoms and prompt hospital presentation for ischemic heart disease (IHD) can significantly impact patient outcomes. Many patients delay treatment due to limited awareness of the symptoms of heart

attack. The study aimed to evaluate public awareness of heart attack symptoms, risk factors and awareness of basic life support steps.

Methods: A two-month cross-sectional study was conducted in the Outpatient department (OPD) from April to May 2024. The study used a designed questionnaire covering demographic data, including education level, risk factors, typical symptoms, and information on how to initially respond to a heart attack. All the data was collected through one-on-one surveys with subjects aged 18 to 91.

Results: A total of 801 subjects participated. Of these, 471 (58.8%) were male and 330 (41.2%) were female. Of the participants, more than half (54.8%) knew that chest pain is a common symptom of heart attack. A considerable proportion of the participants (74.9%) do not know how to perform cardiopulmonary resuscitation. More than two-fifths of subjects (44%) know that smoking increases the chance of heart attack. Some respondents (74.1%) were unaware that diabetes mellitus patients do not experience heart attack symptoms.

Conclusion: The study emphasizes increasing public knowledge of heart attack symptoms, risk factors and knowledge of cardiopulmonary resuscitation for lay rescuers. We advise implementing educational programs that promote the identification of heart attack signs and prompt treatment in response to them, which may save lives.

Keywords: Awareness, basic life support, risk factors.

### **MSS-25-OR-006: Comparison of High-Sensitivity and Standard Cardiac Troponin in Diagnostic Management and Outcomes in Hospitalized Patients**

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Background: High-sensitivity cardiac troponin (hs-cTnT) has become a valuable biomarker for detecting myocardial injury, offering superior sensitivity compared to standard cardiac troponin (cTnT). Its role outside ACS including sepsis, heart failure, and acute kidney injury (AKI) is still being explored. This study compares the clinical outcomes and diagnostic utility of hs-cTnT and standard cTnT in 156 consecutive patients with a range of diagnoses.

Methods: The hs-cTnT group had 156 with an average value of 505.3 (74±13 years; 67 female, 89 male). Diagnoses included STEMI (1), NSTEMI (22), sepsis (29), AKI (4), and heart failure (33). Transthoracic echocardiograms (TTE) were performed in 98 patients, Cardiac catheterization in 47 and CABG in 5 patients. The average LOS was 199.2 hours (8.2 days).

For standard cTnT, 156 patients (73±13 years; 65 female, 91 male) had an average value of 361.3. TTE was done in 129 patients, cardiac catheterization in 35 and CABG in 8 patients. Average LOS was 21.62 hours (8.79 days).

Results: Echocardiography: 16% higher with standard cTnT. Cardiac Catheterization: 7.6% higher with hs-cTnT. Length of Stay: hs-cTnT had an average LOS of 8.2 days, while standard cTnT had 8.7 days. In-Hospital Mortality: No significant difference.

Discussion: The Study demonstrates that hs-cTnT, with its high sensitivity, led to more frequent cardiac catheterizations (7.6%) reflecting early or diseases without overt ACS symptoms. However, this didn't result in any statistically significant improvement in in-hospital mortality or period of stay, indicating increased diagnostic sensitivity does not necessarily correlate with better outcomes. The reduced echocardiograms also highlight decreased reliance on non-invasive diagnostic options with the usage of hs-cTnT. The results highlight that even though hs-cTnT offers better diagnosis, clinical decisions should be made cautiously to avoid overuse of invasive procedures. Further studies are needed to evaluate the long-term effects of hs-cTnT on patient outcomes and cost-effectiveness.

### **MSS-25-OR-007: Comparing Shoulder Surgery Outcomes in Workers' Compensation vs. Non-Workers' Compensation Patients: A Meta Analysis**

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**Introduction:** Orthopedic surgeries for workers' compensation (WC) patients often yield worse outcomes compared to non-WC (NWC) patients. This includes longer recoveries, more complications, and delayed returns to work, especially in shoulder surgeries, where WC patients show poorer functional outcomes and lower satisfaction. Since the last review in 2007, new studies on WC as an outcome predictor for shoulder surgeries have emerged, yet findings are scattered. This paper provides a comprehensive review and meta-analysis of recent studies on shoulder surgery outcomes in WC versus NWC patients.

**Methods:** A systematic review and meta-analysis were conducted per PRISMA guidelines. PubMed, Scopus, and Google Scholar were searched using terms related to workers' compensation and shoulder surgeries, including "arthroscopy," "cuff tear," "biceps tenodesis," "subacromial decompression," "labral tear," "arthroplasty," and others. Eligible studies reported comparative outcomes for WC and NWC patients undergoing shoulder procedures. Data on patient characteristics, surgical techniques, outcomes, and complication rates were extracted. Two independent researchers assessed study quality and risk of bias, with disagreements resolved by consensus.

**Results:** Among 827 studies searched, 28 met inclusion criteria, involving 2,676 patients (942 WC, 1734 NWC). ASES scores showed no significant difference at  $\leq 1$  year (MD, -12.40;  $P=0.08$ ), but NWC patients demonstrated greater improvement at  $> 1$  year (MD, -18.91;  $P=0.0005$ ). VAS scores improved more in NWC patients within the first year (MD, 0.69;  $P<0.00001$ ), with no significant difference afterward (MD, 1.26;  $P=2.28$ ). SST scores favored NWC patients (MD, -1.03;  $P<0.00001$ ). NWC patients had significantly fewer complications (MD, 5.02;  $P<0.00001$ ), while revision rates and return to work status showed no significant differences (MD, 1.31;  $P=0.33$ ; MD, 0.49;  $P=0.22$ ).

**Conclusion:** This meta-analysis examines shoulder surgery outcomes for Workers' Compensation (WC) versus non-Workers' Compensation (NWC) patients, finding that WC patients experience worse long-term ASES and SST scores and more complications, though revision rates and satisfaction are similar. These results underscore the need for tailored rehabilitation and support to improve WC patient recovery and guide healthcare providers in setting realistic expectations.

### **MSS-25-OR-008: Asian Patients Are Underrepresented in Diabetic Retinopathy Research**

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**Background:** Diabetic retinopathy (DR) is a microvascular complication of diabetes caused by prolonged hyperglycemia and poor metabolic control that disproportionately affects minority patient populations due to higher rates of diabetes and barriers to healthcare. Using data from the Vision and Eye Health Surveillance System (VEHSS), this study examines DR prevalence and associated trends across age, gender, racial identity, ethnicity, and risk factors to inform targeted interventions for marginalized communities.

**Methods:** US noninstitutionalized population data was sourced from VEHSS—of 10,320 potential ophthalmic studies only available from 2005–2008, 476 (4.6%) met inclusion criteria (i.e., exam-based DR [EBDR] or self-reported prior physician diagnosis of DR [SRDR] excluding studies with sample sizes  $<30$ , relative standard errors  $>30\%$ , or both). Data were examined for trends in age, gender, racial/ethnic identity, and risk factors, including diabetes, hypertension, and smoking.

**Results:** Race/ethnicity agnostic DR studies comprised 30.7% of all eligible data points, while studies stratified by race/ethnicity consisted of 19.1% Hispanic, 21.2% Black, 28.6% white, and 0.4% other (including Asian-only studies). SRDR (41.8%) and EBDR (58.2%) demonstrated relatively similar risk factor composition study foci (21.6% vs. 28.5% diabetes, 26.1% vs. 25.6% hypertension, 30.7% vs. 30.0% smoking, 21.6% vs. 15.9% all participants—no risk factor stratification).

Across SRDR, EBDR, and in aggregate, pediatric populations were exceptionally underrepresented with no 0-17 or 12-17 age strata studies (as observed in other non-DR VEHS data), 18-39 (1.5%), 40-64 (29.4%), 65-79 (26.3%), 80+ (10.9%), and all ages (31.9%).

Conclusion: Asian populations are underrepresented in DR research according to publicly available data from VEHS. The temporal limitation to 2005-2008 data restricts the scope of findings, emphasizing the need for updated, diverse datasets to capture evolving trends and disparities.

### **MSS-25-OR-009: Qualitative Analysis of the SBIRT (Screening, Brief Intervention, and Referral to Treatment) Training at Albany Medical Center**

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Background: Substance abuse is a significant health crisis, causing more preventable deaths than any other disease. Many healthcare providers lack the skills to assess and treat substance use disorders (SUD), a problem further exacerbated by stigmatizing attitudes. To address this, Albany Medical Center's Department of Psychiatry received a three-year grant in 2016 to train healthcare professionals using the Screening, Brief Intervention, and Referral to Treatment (SBIRT) program. SBIRT aims to improve knowledge and competency in SUD, foster interdisciplinary collaboration, and enhance intervention effectiveness. The training, lasting 7-8 hours, included online modules, live instruction, demonstrations, and role-playing exercises. Participants were evaluated on SBIRT skills through standardized role plays assessed by experts. Methods: Post-training surveys identified the most useful aspects (Useful) and areas needing improvement (Improve). Thematic analysis of the survey responses identified recurring themes that highlighted the most useful aspects of SBIRT training, with responses categorized and refined through several iterations to reveal core themes. This study aims to qualitatively analyze the "Useful" survey responses through thematic analysis to describe the dataset.

Results: Out of 770 responses, two primary themes describing the most useful aspects of SBIRT emerged: applicable skills (353) and the learning environment (526). Sub-themes of applicable skills included SBIRT's structured approach (74), counseling techniques (34), patient risk screening (39), and methods for addressing substance use and sensitive topics (206). Sub-themes of the learning environment included role play (370), a safe and organized training environment (63), and didactics (93).

Conclusion: In conclusion, role play and the structured approach to addressing substance use were the most valued components. These results underscore the importance of hands-on practice and clear, structured guidelines in improving SUD intervention skills. By focusing on these key aspects, SBIRT training can enhance healthcare providers' ability to manage and treat SUD effectively, contributing to improved patient outcomes.

## **Poster Presentations (PO)**



### **MSS-25-PO-001: Chyle leak status post robotic assisted cholecystectomy: A case report**

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Introduction: A robotic-assisted cholecystectomy (RAC) is a minimally invasive procedure for removal of the gallbladder. Common complications include bile duct injury, sepsis and intestinal obstruction [1]. One rare postoperative complication of cholecystectomy is a chyle leak, having only eight reported cases. It carries significant morbidity and thus requires

prompt diagnosis and treatment [2]. With there being no current cases in literature, this report presents possibly the first RAC-associated chyle leak and discusses its associated history, findings, and treatment.

**Case Description:** 65-year-old male presents to the emergency department roughly six days after an elective robotic assisted cholecystectomy (RAC) with severe abdominal pain, nausea, vomiting, and unable to keep anything down post-op. The patient was admitted to the hospital and was found to be in diabetic ketoacidosis associated with his history of Type 2 Diabetes Mellitus, requiring intensive care unit management. The patient underwent computerized tomography of abdomen and pelvis, which illustrated bilateral pleural effusions as well as a large complex fluid collection in the gallbladder fossa despite the presence of a drain, raising concern for bile leak or abscess. Upon further workup, drain fluid was tested positive for high triglycerides count, raising suspicion of chyle leak, an exceptionally rare complication of laparoscopic cholecystectomy and even more so for RAC.

**Discussion:** The therapeutic goals outlined in current literature aligned with our treatment plan, with a focus on limiting lymphatic flow and replenishing lost nutrients, primarily through dietary adjustments (total parenteral nutrition (TPN) and a low-fat, high-protein diet) and pharmacological treatments [3]. Moreover, as opposed to TPN alone, combining octreotide with TPN has been shown to shorten the time required for drain removal [4]. In summary, studying chyle leak in patients after robotic-assisted cholecystectomy is essential for preventing complications, ensuring proper recovery, and refining surgical techniques to minimize risk in future procedures.



### **MSS-25-PO-002: Nanoparticle-Based Delivery Methods for Enhancing Curcumin Bioavailability in Humans**

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Curcumin, a bioactive compound derived from turmeric (*Curcuma longa*), is widely recognized for its potential therapeutic properties, including anti-inflammatory, antioxidant, and anticancer effects. However, its clinical application is hindered by poor bioavailability, primarily due to low solubility, rapid metabolism, and poor systemic distribution. Nanoparticle-based delivery systems have emerged as a promising approach to overcome these challenges, offering enhanced stability, targeted delivery, and controlled release of curcumin. This meta-analysis evaluates the efficacy of nanoparticle-based curcumin delivery systems in improving bioavailability and therapeutic outcomes in human subjects. A systematic review of peer-reviewed studies from major literature databases was conducted. Inclusion criteria included the use of nanoparticles such as liposomes, polymeric nanoparticles, and solid lipid nanoparticles, among others. Outcomes assessed included curcumin plasma concentration, therapeutic efficacy, and safety profiles. The results indicate an increase in curcumin bioavailability with nanoparticle-based formulations compared to conventional formulations. Several studies reported enhanced therapeutic outcomes, including improved anti-inflammatory markers, reduced oxidative stress, and better patient-reported outcomes in chronic diseases. The analysis also highlights variability in nanoparticle formulations, emphasizing the need for standardized methodologies to optimize delivery systems. This meta-analysis demonstrates the potential of nanoparticle-based delivery methods as a transformative approach to curcumin therapy, paving the way for its broader clinical application. Future research can be conducted on methods to standardize formulations, evaluate long-term safety, and explore cost-effective solutions for large-scale implementation.





**MSS-25-PO-003: Rested Resident Physicians: The effects of duty-hour reforms on all-cause-in-hospital mortality**

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**Introduction:** Resident physicians are often overworked. Prior to 2003, over 87% of surgical residents worked more than 80-hour work weeks (Niederee et al., 2003). With only 168 hours present in a given week, residents were treating patients with limited sleep and rest. The increasing public awareness of long resident work hours led to the Accreditation Council for Graduate Medical Education (ACGME) formulating comprehensive duty hour regulations (Weinger & Ancoli-Israel, 2002). In order to tackle the public concerns and to prevent national legislation, the ACGME implemented new resident duty-hour regulations starting from July 1, 2003. A major aspect of the regulation was an 80-hour work week limit averaged over four weeks for residents (Weinger & Ancoli-Israel, 2002).

**Case Description:** This paper intends to measure the impact of the 2003 regulation on all-cause mortality and over a slightly extended time period. Using National Inpatient Survey data from 2000-2006, this paper uses a differences-in-differences linear regression model to analyze the impact of the 2003 ACGME duty-hour reforms on all cause inpatient mortality rates.

**Discussion:** This study finds that the 2003 ACGME duty-hour reforms did not have a significant effect on all cause inpatient mortality rates. These results have implications for policies regarding resident duty-hours.



**MSS-25-PO-004: The Efficacy of Osteopathic Manipulative Treatment in Managing Cardiovascular Health in the Geriatric Population**

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**Background:** Cardiovascular disease (CVD) continues to be one of the leading causes of adult deaths globally. Due to its complexity and variety of diseases, non-invasive and complementary therapies such as OMM have become popular due to their potential to improve cardiovascular health, using a low-risk and conservative approach. This review aims to synthesize the available research on OMM's role in supporting cardiovascular function and to highlight gaps in the literature that warrant further investigation.

**Methods:** A comprehensive literature search was conducted using two major databases, PubMed and Google Scholar. Starting from the earliest date of 24 September 2024, search terms were identified and expanded using MeSH, and all articles were hand-searched following established inclusion criteria. This was done following the reporting guidelines provided in the Scale of Assessment of Narrative Review Articles.

**Results:** Following inclusion and exclusion, two qualitative articles remained, that took place in Brazil and Turkey. Although these articles varied in study design, they focused on the same broad topics. Overall, OMM was effective in improving CVD symptoms including pulmonary capacity, exercise tolerance, and vascular health.

**Conclusions:** At this time, OMM presents a promising complementary therapy for managing CVD, however, the research on this topic is limited and mixed in quality. Therefore, further research is needed to fully understand the therapeutic potential of OMM in maintaining cardiovascular health.



### **MSS-25-PO-005: PRP May Improve Healing & Re-tear Rates After Rotator Cuff Repair: A Review of the Literature**

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**Background:** Rotator cuff tears (RCT) are very common and if left untreated result in tear progression and a protracted history (Fouse et al., 2018). Platelet-rich plasma (PRP) is a potential adjuvant to rotator cuff repair due to its ability to promote muscle healing through increasing growth factor and tenocyte production (Degen et al., 2014). However, its efficacy remains debated. This study aims to evaluate PRP's role in reducing re-tear rates and improving pain and function in rotator cuff tears.

**Methods:** A literature search of PubMed was conducted in July 2024 using search terms including: ("Platelet-Rich Plasma"[Mesh]) AND "Muscles"[Mesh], Platelet Rich Plasma OR PRP AND Muscle Injuries, Platelet Rich Plasma OR PRP AND Rotator Cuff Tears. Only human randomized controlled trials and papers written in English were included. Data on re-tear rates, pain, and subjective and objective functional outcomes were extracted and converted to percent change from baseline at 1, 3, 6, 12, and 24-months for comparison.

**Results:** 25 of 80 studies were identified and met the inclusion criteria. 68% of studies (17/25) evaluated PRP alone and 24% (6/25) evaluated PRP+arthroscopic RCT repair(aRCR). 83% (5/6) demonstrated decreased incidence of retears with PRP+aRCR(re-tear rates PRP+aRCR 3-15% at 12-months, aRCR alone 20-30%; aRCR+PRP 4-18% at 24-months, 20-38% aRCR alone. Of the 4 studies that reported pain 1 month postoperatively, 75% (3/4) showed significant improvements in pain with PRP+aRCR(19-77%) compared to aRCR alone(14-63%). There were no significant differences in function between the two groups.

**Conclusion:** This study suggests that PRP in conjunction with aRCR may improve healing and decrease re-tear postoperatively.

### **MSS-25-PO-006: The Effect of Inflammatory Bowel Disease on Maternal-Fetal Health Outcomes**

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**Background:** Inflammatory Bowel Disease (IBD), which includes Crohn's disease and ulcerative colitis, is a chronic autoimmune condition affecting the gastrointestinal tract. Women with IBD face unique challenges during pregnancy, including an increased risk of complications such as preterm labor, gestational diabetes, and hypertensive disorders. The inflammatory environment associated with active IBD and the potential teratogenic effects of certain medications can negatively impact maternal and fetal outcomes. Understanding these dynamics is essential for effective management of IBD during pregnancy to optimize health for both mother and child.

**Methods:** A comprehensive review of the literature was conducted using PubMed and Google Scholar to examine maternal and neonatal outcomes associated with IBD. Articles focusing on pregnancy complications, neonatal health, and the effects of IBD treatments during pregnancy were selected. Outcomes analyzed included gestational age at delivery, type of delivery, disease activity, and neonatal health.

**Results:** Pregnant women with IBD had a higher incidence of preterm labor (8.40% vs. 5.03%) and cesarean delivery (25.6% vs. 42.8%) compared to women without IBD. Active disease during pregnancy was linked to increased risks of low birth weight and small-for-gestational-age infants due to impaired placental function and nutrient transfer. Medication management posed additional challenges, with some therapies like methotrexate contraindicated, while others like aminosalicylates were generally safe. Multidisciplinary care involving obstetricians, gastroenterologists, and neonatologists significantly improved maternal and neonatal outcomes.

Conclusion: IBD presents significant risks to maternal and fetal health, particularly when disease activity is not well controlled. Tailored treatment plans and close monitoring are essential to mitigate risks while maintaining disease remission. Further research is needed to evaluate the safety of newer biologic therapies and to develop personalized care strategies for pregnant individuals with IBD.

### **MSS-25-PO-007: Environmental and Socioeconomic Determinants of Lung Cancer: The Role of Particulate Matter in Carcinogenesis**

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Background: Lung cancer remains the leading cause of cancer-related mortality globally, with higher prevalence in developed nations. Epidemiological factors such as urban residence, proximity to highways and manufacturing facilities, lower socioeconomic status (SES), and air pollution significantly contribute to its incidence. Emerging evidence highlights the role of particulate matter (PM) in triggering biological mechanisms that promote lung carcinogenesis, including inflammation, oxidative stress, and DNA damage.

Methods: A comprehensive review of literature from 2000 to 2022 was conducted using databases including PubMed, Google Scholar, and the Rowan-Virtua SOM library. Inclusion criteria focused on primary and secondary research exploring the relationships between geographic location, SES, air pollution, and lung cancer prevalence. The outcomes of interest included cancer incidence, mortality, and the influence of biological mechanisms such as particulate matter deposition on lung tissue.

Results: Analysis revealed higher lung cancer incidence in urban areas and among populations of lower SES, particularly near highways and industrial facilities. Particulate matter less than 2.5  $\mu\text{m}$  (PM<sub>2.5</sub>) was identified as a critical factor, associated with increased collagen deposition, macrophage infiltration, and IL-1 $\beta$  release, which promote malignant transformations in cells with EGFR mutations. Studies also confirmed the carcinogenic potential of diesel exhaust particles and polycyclic aromatic hydrocarbons, highlighting their role in inducing oxidative stress and DNA damage.

Conclusion: Lung cancer prevalence is strongly influenced by environmental and socioeconomic factors. Long-term exposure to particulate matter exacerbates risks through oxidative and inflammatory pathways, contributing to lung carcinogenesis. Future research should focus on elucidating precise mechanisms of PM-induced malignancies and on assessing the impact of urban planning and public health interventions to mitigate these risks.

### **MSS-25-PO-008: The Efficacy of Osteopathic Manipulative Treatment in Managing Migraine Headaches**

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Background: Migraines are the third most common disease in the world, often impacting on an individual's quality of life. Aside from NSAIDs, and other conventional therapies such as triptans, definitive evidence to suggest the most efficacious treatment remains lacking. Therefore, techniques such as muscle energy, myofascial release, and cranial sacral OMM can serve as a non-invasive, low-risk option for improving symptoms of migraine headaches. This narrative review aims to evaluate the efficacy of osteopathic manipulative medicine (OMM) for treating migraine headaches.

Methods: On 24 September 2024, a literature review was conducted using PubMed and Google Scholar, following the reporting guidelines provided in the Scale of Assessment of Narrative Review Articles. Using key search terms that were initially identified using MeSH terms and an optimized Boolean search string, bibliographies were individually evaluated according to the predetermined inclusion criteria.

Results: Following screening for inclusion and exclusion criteria, three qualitative studies from the United States, Italy, and Germany remained for analysis. The articles explored various OMM techniques for headache and migraine management. Overall findings suggest that OMM techniques, particularly myofascial release, can significantly reduce

headache and migraine frequency, intensity, and duration. In addition, there was evidence of decreased medication consumption and improved outcomes.

Conclusions: The evidence indicates that OMM improves migraine severity and functional outcomes. This suggests that OMM can be a useful adjunctive treatment for migraines and related symptoms. However, the number and quality of studies investigating this topic are few. Therefore, more research is needed to further elucidate the efficacy of using OMM for treating migraine headaches.

### **MSS-25-PO-009: Wound Healing Technologies**

Sonali Amin, Aravind Aryasomayajula, **Daarsh Goradia**, Praksha Patel, Kyle Werther, Samuel Zhang, François Berthiaume PhD, Rick Cohen PhD.

Background: Understanding wound healing is crucial due to its impact on recovery, infection prevention, and quality of life. Chronic skin conditions and mechanical trauma are often exacerbated by inflammatory pathways, complicating wound healing. Current treatments, such as grafts and engineered scaffolds, can trigger swelling and inflammation. Modulating inflammatory protein cascades, specifically targeting the cytokine HMGB1, offers a transformative approach to improving outcomes.

Methods: The study focuses on optimizing the production of a recombinant fusion protein, vRAGE-ELP, which competitively inhibits HMGB1 to modulate inflammation and promote healing. Protein production involved bacterial transformation, followed by centrifugation and sonication for extraction. Verification of the fusion protein was conducted via Western Blot Analysis. Functional assessment was designed to include fluorescence testing and microscopy. The process unfolded in three phases: protein production, verification, and bioactivity testing.

Results: Protein production yielded 12 mg/mL of purified vRAGE-ELP with minimal degradation in a 4 mL volume. Western Blot Analysis confirmed the structural integrity of the recombinant fusion protein, validating the efficacy of the production protocol. Although the bioactivity testing phase remains to be completed, the initial findings represent a significant milestone in exploring vRAGE-ELP's potential as a therapeutic agent.

Conclusion: This study highlights the potential of recombinant fusion proteins, such as vRAGE-ELP, to revolutionize wound healing therapies by targeting inflammatory pathways. While initial phases were successful, further exploration is required to assess the protein's bioactivity and therapeutic applications. These findings pave the way for novel interventions in wound management, offering hope for improved outcomes in patients with chronic wounds or trauma.

### **MSS-25-PO-010: A case report: Rare idiosyncratic reaction of acute drug induced hepatotoxicity in the setting of long-term Metronidazole, Aztreonam, and Vancomycin use**

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Introduction: Drug-induced liver injury (DILI) is a significant cause of acute liver dysfunction, responsible for 14% of acute liver failure cases and a leading indication for liver transplantation in the U.S. It results from direct toxicity or idiosyncratic reactions influenced by genetic, immunological, and metabolic factors. Antibiotics, particularly metronidazole, vancomycin, and aztreonam, account for 45% of DILI cases [1,2]. Vancomycin, used for MRSA infections, rarely causes hepatotoxicity but may lead to elevated liver enzymes, jaundice, and Drug Reaction with Eosinophilia and Systemic Symptoms (DRESS), which can progress to liver failure [3]. Metronidazole-induced hepatotoxicity usually presents as cholestatic injury, and aztreonam is associated with rare hepatic damage [4]. Risk factors for DILI include prolonged drug exposure, advanced age, and genetic or immune factors.

Case Description: A 64-year-old female with a history of HTN, HLD, T2DM, and PAD presented with fatigue, myalgias, generalized weakness, and diarrhea following a prolonged course of metronidazole, vancomycin, and aztreonam for osteomyelitis. Two months prior, she had received a three-week IV course via a PICC line. She developed a diffuse rash,

eosinophilia, and suspected DRESS thereby treated with prednisone and benadryl. Three weeks later, symptoms recurred with worsening liver function and diarrhea. Lab tests showed elevated creatinine, bilirubin, ALT, AST, and INR, along with positive c-ANCA, anti-smooth muscle antibodies (ASMA), and low C3/C4 levels.

Discussion: The patient's condition involved acute kidney injury (AKI), suspected drug-induced interstitial nephritis, and hepatocellular injury, suggestive of immune-mediated liver damage mimicking autoimmune hepatitis. Despite steroid treatment, the patient's liver dysfunction progressed, and she was transferred for higher-level care, including hepatology evaluation and biopsies. DILI may require corticosteroids and drug discontinuation, with outcomes ranging from recovery to liver failure [5]. This case highlights the diagnostic and therapeutic challenges of DILI, especially in complex cases with comorbidities.

### **MSS-25-PO-011: The Unknown Betrayal: Isolated Interatrial Septum Aneurysm as a Risk Factor for Cryptogenic Stroke**

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Introduction: Interatrial septal aneurysm (ISA) is a cardiac pathology characterized by abnormal bulging of the interatrial septum. When associated with patent foramen ovale, ISA can cause embolic stroke. Isolated ISA complications and management guidelines are unexplored and here we try to narrate one such case presenting as a cerebrovascular accident.

Case: A 72-year-old female with a past medical history of hypertension presented with confusion, aphasia and left upper limb weakness. Her blood pressure was 187/92 mmhg on presentation with no acute changes in CT head and CT angiogram head and neck. She was given a tissue plasminogen activator as she was in the window. MRI brain imaging showed multiple acute and subacute infarcts. Transesophageal echocardiogram with bubble study showed interatrial septal aneurysm without a patent foramen ovale. The patient does not have any embolus valvulopathies or thrombogenic arrhythmia with telemetry monitoring during the stay. The stroke was concluded to be secondary to cardioembolic origin in the background of the interatrial septal aneurysm. Her symptoms improved significantly during the period of stay and she was started on apixaban for anticoagulation.

Discussion: An ISA associated with a patent foramen ovale is linked with cryptogenic stroke but there are no recommendations for isolated ISA stroke. Cardiogenic embolism can occur by developing a thrombus on the left atrial side of the aneurysm. Transthoracic Echocardiogram (TTE) and TEE are preferred imaging techniques but small thrombi in the ISA region may go undetected, highlighting the need for improved diagnostic modalities. Anticoagulation remains the standard treatment for interatrial septal thrombus and associated cardioembolic stroke, as used in this case. Clinicians should remain proactive in considering ISA as a potential risk factor for cardioembolic stroke, especially in patients with no other identifiable cause. Further studies and research can help in understanding isolated ISA-associated strokes and also in developing management guidelines.

### **MSS-25-PO-012: Diverse Manifestations of Moyamoya: Exploring Moyamoya's Spectrum Through Two Unconventional Case Presentations**

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Introduction: Moyamoya disease is a progressive condition affecting the brain's blood vessels, specifically marked by the narrowing or blockage of arteries in the circle of Willis. While it typically presents in the bimodal age distribution (5-9 and 45-49 years), we report two cases outside these ranges, highlighting the importance of recognizing unconventional presentations.

Case Description: Case 1: A 68-year-old man with a history of hypertension and alcohol abuse who presented with slurred speech and right-sided limb weakness. CT head revealed frontal hematoma and intracerebral hemorrhage in the basal



ganglia. CTA and MRA revealed a chronic occlusion of the left MCA after the point of origin. The cerebral angiogram confirmed Moyamoya vasculopathy, diagnosing it as stage 3 Moyamoya disease according to the Suzuki classification. The patient's neurological function improved rapidly during his hospitalization following successful micro anastomosis of the superficial temporal artery to the middle cerebral artery. Case 2: A 27-year-old man with type 1 diabetes who presented with worsening weakness after initial improvement following a recent stroke. CTA revealed terminal occlusion of the internal carotid artery without occlusion of the ACA and MCA. MRI showed new infarct in corona radiata and centrum semiovale. Cerebral angiogram recognized an evolving Moyamoya pattern, consistent with Suzuki Stage 2. No surgical intervention was recommended by neurosurgery. He was diagnosed with Moyamoya syndrome and was discharged on Aspirin and ticagrelor.

Discussion: These cases underscore the variability in the presentation and natural history of moyamoya disease. In elderly it commonly presents as a hemorrhagic stroke secondary to fragile vessels and comorbidities including hypertension. While the younger cases present as ischemic stroke due to lack of development of collaterals. The cases illustrate the differences in management approaches based on presentations and the Suzuki grading system. Regardless of age, early recognition of the condition is crucial for optimal patient outcomes.

### **MSS-25-PO-013: HTLV-1 associated myelopathy - Tropical Spastic Paraparesis**

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Introduction: HTLV-1 associated myelopathy – Tropical Spastic Paraparesis (HAM- TSP) is a neurodegenerative disease caused by the HTLV-1 virus. It causes chronic inflammation within the central nervous system to present as UMN disease like – spastic paresis, sensory dissociations and bowel and bladder symptoms (1). Although the global prevalence of HTLV-1 is only 1-2% (Approx. 10-20 million), the prevalence among endemic countries ranges between 20-40% among adults (2,3,4).

Case description: A 59-year-old male presented with progressive neurological symptoms starting in November 2020 with tingling and numbness in the lower limbs, severe neck and arm pain, and lower back pain. By December 2020, he experienced frequent falls, and by January 2021, developed chronic constipation and urinary retention requiring catheterization. Skin scaling, itching, and eye irritation were also noted. In February 2021, he developed heaviness and weakness in the bilateral lower limbs, leading to wheelchair dependence by April 2021. Neurological examination revealed spasticity, 0/5 power, decreased sensation, hyperreflexia in the lower limbs, bilateral Babinski's sign, and ankle clonus. His medical history included residence in Caribbean regions, with no fever or recent infections. This case highlights a progressive spastic paraparesis with sensory deficits, bowel and bladder dysfunction, and systemic involvement, suggesting a complex neurological disorder requiring further investigation.

Discussion: The discussion section covers key aspects, including the hallmark symptoms of HAM-TSP and its strong association with HTLV-1, particularly in endemic regions. It also addresses the typical age of onset and links with co-existing conditions like infective dermatitis. Diagnostic challenges involved in early detection of HAM-TSP are also highlighted. Treatment approaches and ongoing clinical trials along with future research priorities, such as identifying biomarkers, understanding genetic susceptibility, and developing vaccines, are essential to advancing care and prevention (5-11).

### **MSS-25-PO-014: The Narrative Review: Advancements in Heart Failure Diagnosis and Management using Artificial Intelligence: A New Era Of Patient Care**

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**Background:** Heart Failure (HF) is a prevailing medical illness worldwide that affects millions and is a huge economic burden. Its epidemiological impact is on the rise due to factors such as the aging of the population, increasing rates of diabetes and hypertension, and better survival post-myocardial infarction. Some limitations in HF management include diagnostic challenges, sudden progression of the disease, and increasing rates of readmission. Artificial intelligence (AI), through machine learning and deep learning, offers transformative opportunities in heart failure care by enhancing diagnosis, risk stratification, and therapeutic personalization [1,2].

**Methodology:** In this narrative review, we identified and examined existing studies on the use of AI in HF care by searching multiple medical databases (PubMed, Google Scholar, Medline, and Scopus). The review synthesizes current evidence on the role of AI in HF, covering applications in diagnostic imaging-like echocardiograms and MRIs [3,4], wearable sensors[5], and biomarker analysis[6]. Predictive models, such as neural networks and ensemble learning, are evaluated for their efficacy in prognosis and treatment optimization [7,8]. Further, challenges are discussed, including ethical considerations and data privacy [9].

**Results:** The AI-enabled diagnostic tools had superior performances in the identification of HF and its subtypes, with precision rates higher than 90% in some studies [4,5]. Wearable devices and telemedicine platforms improve patient monitoring and early intervention, thus reducing hospitalizations [5,10]. Predictive models, such as Gradient Boosting Machines and Random Forests, greatly enhanced risk stratification and mortality predictions [6,7]. AI integration in therapeutic management optimized drug dosing and minimized adverse effects, improving patient outcomes [8,9].

**Conclusion:** AI has become a key driver in the transformation of HF care, providing accurate diagnoses, early monitoring, and personalized treatment. While there have been promising developments, challenges persist in terms of clinical integration, model validation, and equity of access. Future research is needed to address these gaps and ensure maximum potential for AI-driven transformation in HF management [9,10].

### **MSS-25-PO-015: Vaping During Pregnancy and Its Impact on Neonatal Outcomes: A Systematic Review and Meta-Analysis**

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**Background:** Vaping during pregnancy is becoming more prevalent, with nearly 7% of individuals using e-cigarettes [1-4]. This increase may result from tobacco companies targeting younger users with e-cigarette marketing, similar to their strategies with traditional tobacco [5]. While e-cigarette use continues to rise, evidence regarding its effects on neonatal outcomes remains inconsistent. This meta-analysis examines research on the connection between vaping during pregnancy and negative neonatal outcomes, exploring the potential adverse effects.

**Methods:** According to PRISMA [6] guidelines, we conducted a thorough review of studies from PubMed/MEDLINE, Google Scholar, Scopus, EMBASE, and Web of Science for eligible studies that reported vaping during pregnancy and its effects on neonatal outcomes, including low birth weight (LBW), preterm birth (PTB), and small for gestational age (SGA). We utilized binary random-effects models to estimate pooled odds ratios (OR) and 95% confidence intervals (CI). A p-value of  $\leq 0.05$  was deemed statistically significant.

**Results:** A total of 14 studies [with a total of 523273 pregnant women were included in the analysis. Of them, 3,840 (0.7%) vaped during pregnancy. In comparison to pregnant women who did not vape, neonates born to those who vaped had significantly higher odds of LBW (OR 1.60; 95% CI 1.23 - 2.09;  $p=0.0005$ ) and SGA (OR 1.73; 95% CI 1.34 - 2.22;  $p<0.0001$ ), as well as higher odds of PTB (OR 1.95; 95% CI 0.74 - 5.14;  $p=0.17$ ) (Figure 1).

**Conclusion:** Vaping during pregnancy is significantly associated with adverse neonatal outcomes. These findings emphasize the potential risks of vaping during pregnancy and highlight the necessity for public health initiatives to increase awareness and develop preventive strategies. Further research is needed to gain a better understanding of the long-term neonatal outcomes connected to prenatal e-cigarette exposure.

### **MSS-25-PO-016: A Case of Takotsubo Cardiomyopathy induced by Epinephrine in local anesthetic**

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**Introduction:** Takotsubo cardiomyopathy (TTC), also known as broken-heart syndrome, is a form of non-ischemic cardiomyopathy that predominantly affects post-menopausal women [1]. It is characterized by transient regional systolic dysfunction of the left ventricle in the absence of angiographically significant coronary artery disease or acute plaque rupture. In most TTC cases, the regional wall motion abnormality extends beyond the territory perfused by a single epicardial coronary artery. This report describes a case on TTC induced by epinephrine contained in a local anesthetic.

**Case Description:** A female patient in her late 70s, with a history of non-insulin-dependent diabetes mellitus and hyperlipidemia, presented to the ER with chest pain that began immediately after she returned home from a dental tooth extraction. An initial ECG revealed a right bundle branch block with no acute ST-T wave changes. A repeat EKG performed an hour later showed ST depressions and T-wave inversions in the anterior and anterolateral leads. The initial troponin level was slightly elevated but subsequently increased to 3555. An ECHO conducted in the hospital indicated severe hypokinesis, particularly in the anterior wall, with an ejection fraction (EF) of approximately 15-20%. Cardiac catheterization revealed nonischemic cardiomyopathy, leading to the diagnosis of TTC as a result of excessive septocaine with epinephrine used during her dental procedure. Upon discharge, the patient was started on an ACE inhibitor, a beta-blocker, and an SGLT2 inhibitor. A follow-up ECHO three months later showed significant improvement, with the EF returning to normal levels of 55-60%.

**Discussion:** The term "takotsubo" describes a Japanese octopus trap that resembles the ballooning appearance of the left ventricle in TTC [2]. Physical and emotional triggers can cause TTC through catecholamine release. This case, along with many others, suggests that the administration of exogenous epinephrine (like Septocaine with 1:100,000 epinephrine) may also result in TTC. Therefore, if hemodynamic or ECG changes occur after epinephrine use, TTC should be considered [3].

### **MSS-25-PO-017: A Novel NAA10 De Novo Mutation in a Symptomatic Female: A Case Report**

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**Introduction:** Ogden's Syndrome (OS) is a rare X-linked neurodevelopmental disorder caused by pathogenic variants in the NAA10 gene, which encodes a subunit of the N-terminal acetyl transferase complex involved in acetylation of human proteins. OS typically affects males, with females often being asymptomatic carriers due to the presence of a second, unaffected X chromosome. The syndrome is characterized by cognitive impairments, autism spectrum disorder (ASD), intellectual disability, and global developmental delays.

**Case Description:** We report a 5-year-old female with delayed speech, poor eye contact, sensory integration issues, and repetitive behaviors, which were suggestive of ASD. Genetic testing revealed a de novo heterozygous duplication in the NAA10 gene (c.517dup), resulting in a frameshift mutation (p.Leu173Profs\*33), producing a truncated protein. This variant, not found in population databases, was consistent with clinical features observed in other NAA10-related disorders, supporting its pathogenicity. The patient's symptoms also included hyperactivity, impulsivity, and attention difficulties.

**Discussion:** OS is typically more severe in males due to the lack of a second X chromosome, but females may exhibit symptoms based on lyonization, the random inactivation of one X chromosome. This case demonstrates the potential for symptomatic expression in females, emphasizing the variable penetrance and expressivity of the disorder. The patient's presentation was consistent with OS, including developmental and behavioral features overlapping with ASD. Genetic testing remains crucial in diagnosing OS, particularly in females with neurodevelopmental symptoms, as it enables the identification of pathogenic mutations. This case expands the known phenotypic spectrum of OS and

highlights the importance of early diagnosis for providing tailored management strategies, including behavioral therapy and educational support.

### **MSS-25-PO-018: Algorithm Over Autonomy? The Ethical Considerations in the Use of Brain-Computer Interfaces for Psychiatric Disorders: Balancing Innovation and Free Will**

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**Background and Objectives:** The significant public health burden of psychiatric morbidities necessitates the integration of novel techniques, with the Brain-Computer Interface (BCI) being increasingly recognized as a potential strategy to address this treatment gap, particularly in depression and schizophrenia. However, it is crucial to exercise cautious optimism and consider the potential ethical implications surrounding mental well-being, informed consent, confidentiality among other concerns, to prevent active patient harm. This review aims to examine the ethical quandaries surrounding the use of BCIs in the treatment of psychiatric disorders, specifically focusing on the balance between technological innovation and patient autonomy.

**Methodology:** A comprehensive review of recent literature was carried out per the PRISMA guidelines primarily through PubMed by utilizing the appropriate MeSH terminology to examine the utility of BCIs in psychiatric conditions such as depression and schizophrenia. Following our initial screen of 125 records published between 2010-2024, 25 papers that met the inclusion criteria were included in our review and subsequently analyzed for key insights on patient outcomes, the present scope and future potential of BCI technology, as well as the currently underdressed research gaps about ethical considerations that impede effective implementation. Additionally, quantitative measures of BCI effectiveness were evaluated in terms of symptom reduction and quality of life improvements.

**Results and Conclusion:** The current literature posits that in smaller cohorts of psychiatric patients, BCIs demonstrated an average 35% reduction in depressive symptoms and a 40% subjective improvement in cognitive functioning for schizophrenia patients. However, only 20% of the studies were found to address long-term ethical risks. Substantial gaps were recognized in the current regulatory frameworks surrounding the use of BCIs to ensure equitable access that safeguards patient autonomy, particularly in populations with diminished capacity to provide consent. These findings indicate that while BCIs show promise in providing symptomatic improvements, ethical concerns, especially regarding autonomy and informed consent, remain under explored.

### **MSS-25-PO-019: Anti-LGI1 Autoimmune Encephalitis: A Rare Correlation with COVID-19 Vaccination and Infection – A Narrative Review of Case Reports**

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**Background:** Anti-leucine-rich glioma inactivated 1 (LGI1) autoimmune encephalitis is a rare neurological disorder caused by the immune system attacking the LGI1 protein, primarily affecting the hippocampus [1]. It is characterized by cognitive and memory impairments, faciobrachial dystonic seizures (FBDS), and electrolyte disturbances such as hyponatremia[2]. Our paper suggests a potential correlation between the development of anti-LGI1 encephalitis and COVID-19 vaccination or infection.

**Methods:** A comprehensive literature review was conducted, yielding 400 papers on anti-LGI1 encephalitis. We refined our search based on predefined criteria. Studies not in English, lacking full-text access, or focusing on pediatric populations were excluded. Seven relevant cases were identified and analyzed.

**Results:** The reviewed cases involved patients aged 18–73 years, i.e. 5/7 (71%) males and 2/7 (29%) females. While FBDS is an important symptom of LGI1 encephalitis, only 3/7 (43%) of the reviewed cases presented with FBDS. Cognitive impairment was the most common symptom, and hyponatremia was noted in 5/7 (71%) cases. MRI findings varied: 3/7

(42%) patients had normal imaging, 3/7 (42%) exhibited characteristic T2 FLAIR hyperintensities in the hippocampus, and 1/7 (16%) showed basal ganglia abnormalities. EEG findings indicated the right frontotemporal abnormalities in patients with seizures. LGI1 antibodies were detected in both serum and CSF in 5/7 (71%) cases. Management primarily included intravenous methylprednisolone. The mRNA COVID-19 vaccine was implicated in most cases, with symptom onset occurring 4–23 days after the second dose. One patient with COVID-19 antibodies developed LGI1 encephalitis without prior vaccination.

Conclusion: While anti-LGI1 encephalitis remains a rare entity, this review underscores the importance of increased awareness among clinicians. Early recognition and treatment are crucial for favorable patient outcomes.

### **MSS-25-PO-020: Racial Disparities in Cancer Screening Utilization before and after the COVID-19 Pandemic**

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Cancer screening services such as mammograms, pap smears, and colonoscopies have allowed doctors to mitigate the mortality of breast cancer, cervical cancer, and colorectal cancer, respectively, by enabling early detection. However, as with many preventative care services, cancer screening has various racial and ethnic disparities. During the COVID-19 pandemic, the utilization of critical preventative care services such as cancer screening dramatically decreased. This paper studies the changes in cancer screening utilization based on race during the COVID-19 pandemic using survey data from the 2018, 2020, and 2022 Behavioral Risk Factor Surveillance System (BRFSS). This paper finds that total utilization of mammograms and colonoscopies decreased in 2020, but returned to pre-pandemic levels in 2022; however, pap smears decreased significantly in 2020 and continued to decrease through 2022. Using a probit model, this paper finds that racial disparities for breast and colorectal cancer screening were largely unchanged, while disparities in cervical cancer screening for Blacks and Hispanics were exacerbated during the pandemic. In addition, young Hispanic women had a greater decrease in cervical cancer screening compared to older Hispanic women during the pandemic. Policymakers should emphasize the importance of and prioritize improving access to pap smears for Black and Hispanic populations.

### **MSS-25-PO-021: Implementation of Artificial Intelligence in Pancreaticobiliary Endoscopy: a Systematic Review**

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Pancreaticobiliary diseases can lead to significant morbidity and their diagnosis relies on imaging and endoscopy which are dependent on operator expertise. Artificial intelligence (AI) has seen a rapid uptake in the field of luminal endoscopy, such as polyp detection during colonoscopy. However, its use for pancreaticobiliary endoscopic modalities such as endoscopic ultrasound (EUS) and cholangioscopy remains scarce, with only few studies available. In this review, we delve into the current evidence, benefits, limitations and future scope of AI technologies in pancreaticobiliary endoscopy.

### **MSS-25-PO-022: The Current State of Reproductive Health for Women Living with Intellectual and Developmental Disabilities, A Scoping Review of Global Literature**

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Introduction: Despite comprising a large subset of individuals, women living with intellectual and developmental disabilities continue to face healthcare disparities and structural challenges. Although current literature provides insight into the medical management of women living with disabilities, there is seldom research focusing on the sexual and reproductive health of this population. This scoping review aims to fill a gap in the literature by summarizing the current state of reproductive health, as it pertains to women living with intellectual and developmental disabilities.



**Methods:** A scoping review of global literature was conducted by searching 3 databases (PubMed, Embase, MedLine) alongside an academic search engine, GoogleScholar in June of 2023. Eligibility criteria included the following: data collected among women living with intellectual or developmental disabilities, addressed barriers and limitations regarding reproductive health, and included studies published no earlier than 1990. All studies were independently screened, reviewed, and synthesized following PRISMA guidelines by three reviewers. Of 72 original items, 28 studies met the criteria.

**Results:** The results of this review comprise data from 11 countries (USA, England, Germany, France, Spain, The Netherlands, Taiwan, Iran, Canada, Sweden, and Belgium) with a distribution of 23 papers assessing intellectual and developmental disability as a monolith group and 5 focusing solely on the role of Down Syndrome in reproductive health. Women living with intellectual and developmental disabilities as a whole experienced disparities in three key areas: menstrual health and screening, expression of romantic and sexual desire, and family planning/prenatal care. Careful thematic analysis of the literature suggested three possible causes attributed to these findings, them being: a lack of tailored medical guidelines, a general failure to appreciate and understand the romantic and sexual desire of women living with disabilities, and sociocultural factors surrounding disability.

**Conclusion:** Women living with intellectual and developmental disabilities experience substantial healthcare disparities as they pertain to reproductive health. The results from this scoping review substantiate the need for the development of guidelines and best clinical practices as they pertain to women living with disabilities, continued healthcare destigmatization of sexuality and romantic expression in this space and expanded training for all women's health providers on this topic. Furthermore, additional research is needed to understand the unique circumstances and lived experiences of women living with intellectual and developmental disabilities, specifically focusing on their individual etiologies and disability status.

### **MSS-25-PO-023: Beer Potomania-Induced Hyponatremia in Chronic Alcohol Use Disorder: A Case Study**

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1. Internal Medicine, Robertwood Johnson University Hospital, NJ, USA

**Introduction:** Beer potomania, derived from "poto" (to drink) and "mania" (excessive), is a condition characterized by severe hyponatremia resulting from excessive beer consumption and poor dietary solute intake [1]. This syndrome can lead to life-threatening complications such as altered mental status, nausea, seizures, and death [2]. Diagnosis involves assessing serum sodium, urine osmolality, and fractional excretion of sodium (FeNa). Our case highlights the critical considerations in managing severe hyponatremia in beer potomania and underscores the need for a cautious and well-monitored approach in such cases.

**Case Description:** A middle-aged female with hypertension, type 2 diabetes, alcohol use disorder, and COPD presented with headache and nausea for 4 days. She reported consuming an average of two daily beers, poor dietary intake, and recent difficulties in performing routine daily activities. Significant smoking history of 40 pack-years. Physical exam revealed mild tremors. Labs showed severe hyponatremia (sodium 119 mmol/L) and hypomagnesemia, low serum osmolality. Low urine osmolality and low urine sodium concentration. A diagnosis of beer potomania was established based on clinical presentation and laboratory findings. She was treated with gradual sodium correction, electrolyte monitoring, and symptom management.

**Discussion:** With millions of people diagnosed with Alcohol Use Disorder each year, understanding and awareness of beer potomania is crucial. Beer potomania involves excessive beer intake and inadequate solute intake, leading to ethanol-induced ADH inhibition and increased free water clearance [3, 4]. This results in severe hyponatremia (<125 mEq/L). Management requires careful sodium correction to prevent osmotic demyelination syndrome, with guidelines recommending a gradual increase of 4-8 mmol/L per day [5]. Follow up includes alcohol cessation counseling, nutritional support, and outpatient monitoring. This case underscores the importance of recognizing beer potomania as a cause of severe hyponatremia in alcohol abuse and highlights cautious management to prevent neurological sequelae.

## **MSS-25-PO-024: Ultrasound-guided Platelet-Rich Plasma Therapy: Efficacy in Temporomandibular Joint Osteoarthritis Management and Outcomes**

**Ankit Patel BS (1)**, Amr Mohammed MD

1. Northeast Ohio Medical University, Rootstown, OH, USA

**Background:** Osteoarthritis (OA) is a chronic, degenerative joint disease characterized by progressive and irreversible destruction of synovial joint structures, causing impaired mobility and quality of life. One potentially affected joint is the temporomandibular joint (TMJ). Traditional management primarily focuses on symptom relief through over-the-counter medications, physical therapy, and lifestyle modifications. Recently, Platelet-Rich-Plasma (PRP) therapy has emerged as a promising treatment option for advanced OA. PRP is derived from the patient's own blood and contains high concentrations of growth factors and bioactive molecules. Administered via ultrasound-guided injections, PRP therapy is believed to promote tissue repair and anti-inflammation. This review explored the clinical applications and outcomes of PRP injections in the treatment of TMJ-OA.

**Methods:** A review of the current literature on PRP injections for the treatment of TMJ-OA was performed. The search focused on studies published within the past decade, using keywords such as "ultrasound-guided injections", "temporomandibular joint", and "osteoarthritis". A total of 5 randomized-controlled-trials were identified and analyzed to evaluate the outcomes of PRP therapy in TMJ-OA management.

**Results:** Fernandez-Ferro et al. reported statistically significant improvements in pain intensity amongst 50 PRP injection-treatment TMJ-OA patients, as measured according to the visual analogue scale (VAS); they found a 6.44 decrease in mean VAS score at 18 months post-treatment. Dasukil et al. reported significant increases in extent of maximum mouth opening in 30 PRP injection-treatment TMJ-OA patients; they saw a 12.73 point increase at 6 months post-treatment. ( $p < 0.001$ ), as well as significant decreases in joint clicking sounds ( $p < 0.001$ ).

**Conclusion:** Currently, PRP injections are an exciting treatment option for TMJ-OA in patients not satisfied with their outcomes following conservative management. Despite notable side effects, some studies have shown a positive benefit in their use. At this time, more standardized experimentation is needed to establish PRP injections as a treatment modality for TMJ-OA patients.

## **MSS-25-PO-025: The Effects of Circadian Misalignment on Astrocytes in the Blood Pressure Regulatory Center: The Nucleus Tractus Solitarius**

**Kush Patel (1)**, Diana Martinez PhD (1) Rowan-Virtua School of Osteopathic Medicine, Stratford, NJ, USA

**Background:** Approximately 40% of US adults work non-standard hours, which is associated with increased risks of hypertension. Shift work causes circadian misalignment (CM), when the body's internal clock is not in sync with the actual time of day. The role shift work plays in hypertension is not understood; however, certain brain regions are implicated. The nucleus tractus solitarius (nTS) plays a pivotal role in blood pressure control. Astrocytes in the nTS are critical for regulation of glutamate and of the neural circuitry that controls blood pressure. Glutamatergic regulation occurs through astrocytic transporters; glutamate increases, blood pressure decreases. We hypothesized that CM increases nTS astrocytes to reduce glutamate and increase blood pressure. We investigate CM's effect on astrocyte morphology and density in the nTS, and subsequent hypertension.

**Methods:** Male Sprague Dawley rats (7-11 weeks old) underwent a six-hour light phase delay every two days for 22 days to simulate shift work, while control (CTL) was maintained in a standard 12-hour light-dark schedule. Brain tissue was collected at 9 AM and 9 PM. Immunohistochemistry (IHC) labeling of astrocytes for GFAP (structural) and S100 $\beta$  (somatic, number). Confocal microscopy and ImageJ were used, and images were taken at 10x, 40x, and 60x to identify nTS location, and perform cell count/morphological measurements. Statistical analysis was conducted using unpaired Student t-tests. Significance:  $p < 0.05$ .

Results: nTS astrocyte number (S100 $\beta$ ) significantly increased in CM compared to control at both 9 AM and 9 PM ( $p < 0.05$ ). This suggests that CM induces astrocyte proliferation, potentially contributing to increased glutamate uptake and reduced extracellular glutamate.

Conclusion: Circadian misalignment leads to increased nTS astrocyte density, which may play a role in the development of hypertension observed in shift workers. Further studies will focus on detailed morphological changes in astrocyte branching and their relationship to hypertensive states.

### **MSS-25-PO-026: VO<sub>2</sub> Max: An Aerobic Capacity Indicator**

**Kush Patel BS (1), Simran Gandhi BS 1.** Department of Medical Scholarship, Rowan-Virtua School of Osteopathic Medicine, NJ, USA

Background: VO<sub>2</sub> max, the maximum oxygen uptake during intense exercise, serves as a critical indicator of aerobic capacity and cardiovascular health. Variations in VO<sub>2</sub> max are influenced by genetic polymorphisms, physiological parameters, and lifestyle factors such as physical activity and nutrition. This metric is widely used in health assessments and athletic training to optimize performance and prevent cardiovascular diseases.

Methods: A systematic review was conducted using PubMed, Clinical Key, and Web of Science databases to analyze studies from 2000 onward. Search terms included combinations such as "VO<sub>2</sub> max," "cardiovascular," and "genetics." Articles were screened based on relevance to VO<sub>2</sub> max physiology, and key findings were synthesized to identify the roles of physical activity, nutrition, and genetic markers.

Results: The review identified 251 DNA polymorphisms associated with athletic performance, of which 128 were linked to athlete status in at least two studies. Key alleles correlated with endurance, power, and strength phenotypes. Lifestyle interventions, including aerobic and resistance training, were associated with increased VO<sub>2</sub> max and prolonged healthy life years. Nutritional interventions, such as nitrate supplementation, showed mixed results, indicating individual variability.

Conclusion: VO<sub>2</sub> max serves as a pivotal metric for evaluating and improving cardiovascular health and athletic performance. While physical activity and diet are established contributors, genetic testing and epigenetic analyses are emerging as tools to personalize interventions. Further research into the interplay of these variables could enhance disease prevention strategies and optimize athletic training protocols.

### **MSS-25-PO-027: Engagement of Orthopedic Surgery Content on Instagram and TikTok**

**Sohil Dharia BS, Neil Poddar, Dev Dwivedi, Ishan Patel BS**

Background: Social media has become an invaluable tool for medical professionals to connect with patients, disseminate educational content, and market their services [1]. Platforms like TikTok and Instagram have become popular tools among physicians for patient engagement [2]. While previous research has explored orthopedic surgery content on Instagram, there has been little focus on orthopedic engagement on TikTok or comparisons of engagement across both platforms.

Methods: This cross-sectional study analyzed posts from TikTok and Instagram in August 2024. The top ten most popular orthopedic surgeons on each platform were identified, and their 25 most recent posts were assessed for views, likes, comments, and shares. An engagement score was calculated based on these metrics. Posts were further categorized into content types: "Before and After," "Celebrity," "Private Life," "Comedy," "Advertisement," "Education," "Testimonial," and "Entertainment."

Results: A total of 500 posts were analyzed across both platforms. On TikTok, the most common content type was Entertainment (48.8%), followed by Education (47.6%), Comedy (16%), Advertisement (2%), Testimonial (1.6%), and Private Life (0.4%). Comedy and Entertainment garnered the highest engagement, while Advertisements received the least. Instagram posts predominantly featured Entertainment (56.4%), Education (42.8%), Testimonials (13.2%), Comedy (12.4%), Private Life (12%), Advertisement (4.4%), and Before and After (1.6%). The highest engagement on Instagram

was seen in Before and After posts, followed by Comedy, with Education receiving the least engagement. Overall, TikTok posts exhibited a higher engagement rate (5.85 per post) compared to Instagram (3.47 per post).

Conclusion: These findings highlight that TikTok and Instagram are key platforms for orthopedic surgeons to share content, with comedy focused posts driving the most engagement. These findings can inform orthopedic surgeons of social media strategies to optimize engagement, selecting the platform and content type most suited to their audience.

### **MSS-25-PO-028: ChatGPT in Orthopedic Patient Education: A Review of Performance and Potential for Addressing Common Patient Questions**

Sohil Dharia BS, Neil Poddar (1), Angadh Singh (1), Shreya Patel BS. 1. Department of Biology, Rensselaer Polytechnic Institute, NY, USA

Background: Social media has become an invaluable tool for medical professionals to connect with patients, disseminate educational content, and market their services [1]. Platforms like TikTok and Instagram have become popular tools among physicians for patient engagement [2]. While previous research has explored orthopedic surgery content on Instagram, there has been little focus on orthopedic engagement on TikTok or comparisons of engagement across both platforms.

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Conclusion: These findings highlight that TikTok and Instagram are key platforms for orthopedic surgeons to share content, with comedy focused posts driving the most engagement. These findings can inform orthopedic surgeons of social media strategies to optimize engagement, selecting the platform and content type most suited to their audience.

### **MSS-25-PO-029: Applying the Principles of High Reliable Organizations to Manage Multiple COVID-19 Hospitalization Surges**

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Background: Health care organizations have started implementing principles of Highly Reliable Organizations (HROs) to create a system for managing the unexpected. Those working in HROs apply five principles. Hospital Medicine Divisions require these skills to anticipate and manage unexpected surges in patient volume and additional challenges as seen during the COVID-19 pandemic.

Methods: We created a questionnaire to explore the five components of HROs and determine how the UF Hospital Medicine Division providers can better manage the unexpected. The survey was taken by twenty-four of seventy faculty members. We applied standard qualitative analysis identifying recurrent themes using N-Vivo software, and accumulating representative quotes related to the five elements of HROs. As more narratives were analyzed, new codes were grouped into thematic categories by applying comparative analysis.

Results: We found that faculty are preoccupied with what could go wrong and they identified impediments to care. While the faculty did not ignore these impediments, most did not use a “root-cause analysis” approach. Instead, staff members used telemedicine, interdisciplinary teams, standardization in charting, and their administrative leaders’ guidance and support to address the impediments to patient care. High reliability organizations maintain a positive attitude and social connectedness, exercise and teamwork were sources of stability. The hospital has established an excellent collaborative relationship with our consultants, which allowed for collaborative decision making and reduced miscommunication in patient management. The leadership hierarchy was flattened, and feedback was encouraged through weekly Town Hall meetings.

Conclusion: Our study shows that there are HRO elements that the UF Hospital Medicine Division displays, particularly around identification of impediments to care. The comments about the Division's response to the COVID-19 surges were positive and focused on leadership support. Our results give us guidance on implementing and achieving the principles of HROs, which can help in future response to the unexpected.

### **MSS-25-PO-030: The Effect of Curcumin Supplements on Inflammatory Markers in Athletes: A Systematic Review**

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Background: Curcumin is a supplement with anti-oxidative and anti-inflammatory properties that can aid in managing arthritis and viral infectious diseases, as well as the potential to manage metabolic disorders and cardiovascular disease. Its significance in athletes, a population that undergoes high physical stress, has yet to be fully understood. This systematic review aims to investigate the effectiveness of curcumin supplementation on various inflammatory markers in athletes undergoing an exercise intervention.

Methods: A systematic review of six databases (PubMed, Embase, Web of Science, Scopus, Cochrane Library, and Google Scholar) was completed following PRISMA 2020 guidelines, yielding 112 articles. Any randomized controlled trial that analyzed the impact of curcumin on an athlete's inflammatory markers Creatine Kinase (CK), Lactate Dehydrogenase (LDH), Erythrocyte Sedimentation Rate (ESR), and C-Reactive Protein (CRP) were included in the screening performed by two reviewers.

Results: After initial title and abstract analysis, 15 articles were selected for full paper review. 7 articles were included in the final review. Curcumin supplementation in doses from 50 mg/day to 4 g/day given before and after an exercise intervention was associated with a lesser increase in CK post-exercise when compared to placebo groups. Similar trends were seen with LDH, ESR, and CRP.

Conclusion: Curcumin limits the increase of various inflammatory markers post-exercise in athletes at different dosages. A minimum dosage of 500mg per day of curcumin results in the most effective reduction of CRP and CK. For further investigation into the effectiveness of curcumin for inflammation reduction or control more quantitative data is needed. More consistent time points for administration as well as follow-up testing in randomized controlled trials will help quantify the beneficial effects of curcumin.

### **MSS-25-PO-031: The National Acceptance of Pelvic Congestion Syndrome, a Stigmatized Vascular Disease.**

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Background: Pelvic congestion syndrome (PCS) is characterized by chronic pelvic pain persisting over 6 months that is exacerbated by coitus, menstruation, and prolonged standing. PCS is associated with ovarian and iliac varicose veins and majorly affects women of childbearing age. Vascular studies suggest that retrograde pooling of blood, subsequent venous ballooning, and ensuing pressure on surrounding nerves in PCS result from venous insufficiency (VI). Therefore, the purpose of this study is to detect the concomitance of VI, PCS, and varicose veins (VV).



**Methods:** Patient data was collected from the Healthcare Cost & Utilization Project's National Inpatient Sample (2004-2021), bridging ICD-9-CM and ICD-10-CM codes for pelvic congestion syndrome (ICD-9: 625.5; ICD-10: N94.89), varicose veins (ICD-9: 454.x; ICD-10: I83.x), pelvic varices (ICD-9: 456.5-6; ICD-10: I86.2-3), and chronic venous insufficiency (ICD9: 459.8; ICD-10: I87.2) for analysis. Data extraction and statistical programming were conducted via Stata Ver.17.0.

**Results:** During the years using the ICD-9 coding system, the prevalence of PCS decreased. However, with the transition to ICD-10, PCS prevalence began to rise and continued, from 8605 cases in 2016 to 9250 cases in 2021. Similarly, the prevalence of VV and chronic VI increased across the ICD-9 to ICD-10 transition period. Varicose veins cases rose from 44,185 in 2004 to 71,180 in 2021. Chronic venous insufficiency cases increased from 173,430 to 232,850 over the same period. In contrast, the prevalence of pelvic varices cases decreased, from 2185 in 2004 to 990 in 2021.

**Conclusion:** The study highlights the rising prevalence of PCS, VV, and chronic VI, underscoring the need for heightened clinical awareness and targeted interventions to manage these conditions effectively. The decrease in pelvic varices prevalence suggests changes in diagnostic practices or reporting. These findings emphasize the importance of continuous monitoring and research to better understand and address the evolving landscape of venous disorders.

### **MSS-25-PO-032: General Models, Specialized Failures: Lessons from Mental Health Text Analysis**

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**Background:** Increasing use of large language models (LLMs) in medicine necessitates responsible implementation, particularly when leveraging specialized clinical text embedders [1]. This study evaluates embeddings generated by a domain-specific model (MentalBERT) and a general-purpose model (all-MiniLM-L6-v2) on mental health-related text from Reddit. Using dimensionality reduction and clustering, we assess which model better captures nuances indicated by subreddit labels, while exploring the implications for clinical application integration.

**Methods:** A Hugging Face dataset containing 54,412 Reddit posts labeled with mental health-related subreddits (e.g., r/SuicideWatch, r/Depression, r/Anxiety) was utilized in this study. Fixed-length embeddings were generated using MentalBERT (a domain-specific model) [3] and all-MiniLM-L6-v2 (a general-purpose model) and visualized via t-SNE for clustering. KMeans clustering (k=5) was applied to the t-SNE embeddings, and performance was evaluated using metrics such as Silhouette Score, Normalized Mutual Information (NMI), Adjusted Rand Index (ARI), and Purity Score.

**Results:** The dataset exhibits significant variability in post lengths, with an average of 178 words (SD = 237) and a median of 108. Clustering performance metrics (Table 1) and visualizations (Figure 1) show that all-MiniLM-L6-v2 outperformed MentalBERT across all measures, though both models struggled to align clusters with true subreddit labels as evidenced by low evaluation metrics such as Silhouette Score, NMI, ARI, and Purity Score. While all-MiniLM-L6-v2 demonstrated better generalization, both models faced challenges in representing the nuances of informal, mental health-related text for unsupervised clustering tasks.

**Conclusion:** Although all-MiniLM-L6-v2 marginally outperformed MentalBERT, both models struggled to capture the nuanced and overlapping expressions of mental health conditions in the informal and diverse language of online forums. Label imbalance, variability in post lengths, and the models' focus on short-sentence tasks likely contributed to the underperformance, raising concerns about the use of specialized embedders in fine-tuning LLMs for clinical applications [4].

### **MSS-25-PO-033: Protein Diet Intervention Protects in Mouse Model of Mahvash Disease**

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**Background:** Mahvash Disease is an autosomal recessive hereditary pancreatic neuroendocrine tumor (PNET) syndrome with pancreatic alpha cell hyperplasia, hyperglucagonemia caused by defective glucagon receptors (GCGR). In addition to glucagon metabolism, GCGR signaling regulates amino acid transport and catabolism in the liver. Studies in mice suggest that the alpha cell hyperplasia results from severe hyperaminoacidemia when GCGR signaling is interrupted, illuminating a liver-alpha cell axis where amino acids regulate both alpha cell function and mass. The primary objective of this study was to observe if a low protein diet reduces the circulating amino acids, thus leading to reduced alpha cell hyperplasia and PNET formation when GCGR is interrupted.

**Methods:** We placed liver-specific GCGR knockout (CreGCGRfl/fl) and GCGRfl/fl alone control mice on a low protein diet (6%PD) or normal protein diet (20%PD) at weaning and followed the mice for 14 weeks. We analyzed serum amino acids and changes in physiological response to several nutrient stimuli. The pancreas was analyzed for markers of alpha cell proliferation Ki67, PhosphoS6(S235/236), and SLC38A5, a glutamine transporter.

**Results:** Liver-specific GCGR knockout mice maintained on 20%PD have hyperaminoacidemia, hypoglycemia, hyperglucagonemia, and increased alpha cell expression of Ki67, PhosphoS6, and SLC38A5. Liver-specific GCGR knockout mice maintained on a 6%PD have milder hyperaminoacidemia, similar glycemia, and lower alpha cell markers of proliferation compared to 20%PD fed knockout mice. Surprisingly, control mice on 6%PD had higher serum amino acid levels and a greater alpha to beta cell area compared to 20%PD fed mice.

**Conclusion:** Currently, there is no consensus on how to treat pediatric patients with Mahvash disease. Our study suggests that the liver-alpha cell axis is tunable by dietary protein and early intervention of a low protein diet may modestly protect against alpha cell hyperplasia and hyperglucagonemia for individuals with Mahvash disease.

### **MSS-25-PO-034: Impact of Delays in Radiological Investigations Due to Prior Authorization and the Role of AI and Electronic Health Records in Simplifying the Process: A Systematic Review**

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**Background:** Delays in radiological investigations due to prior authorization affect over 69% of patients, with 73% experiencing delays exceeding two weeks and 22% facing denied or altered care. AI systems enable the efficient processing of 74% of authorizations, reducing review time by 50% and denial rates to 0.9%. EHR integration decreases processing time from 118 to 79 hours. These advancements save \$27.3 million annually, emphasizing the need for technology-driven solutions.

**Materials and Methods:** This systematic review analyzed data from 30 peer-reviewed articles (2000–2024) obtained through PubMed and Google Scholar databases using keywords like "Prior Authorization Delays", "Radiological Investigations", "Patient Outcomes", "Artificial Intelligence", "Electronic Health Records". Inclusion criteria focused on studies with quantitative metrics such as delay durations, persistence rates, and odds ratios, prioritizing observational studies, cohort analyses, and trials on AI-driven or EHR-based systems. Studies with unclear methods or incomplete data were excluded. Data synthesis highlighted the impacts of delays and the effectiveness of technological interventions.

**Results:** Prior authorization delays extended up to 31 days in critical cases, significantly increasing patient-reported anxiety ( $74.7 \pm 20.2$  vs.  $37.5 \pm 22.6$ ,  $P < .001$ ) and reducing trust in healthcare systems (OR = 6.0; 95% CI: 1.9–19.2). AI

systems handled 60% of workflows, achieving sensitivity (98.8%) and specificity (97.6%). EHR systems reduced approval times by 33%.

Conclusion: This systematic review highlights the effects of prior authorization delays and the potential of AI and electronic health records to address these delays. Radiological imaging delays contribute to critical negative outcomes, such as increased patient anxiety and reduced access to timely care. These delays disproportionately affect patients with higher healthcare-related expenses, worsening healthcare disparities. The adoption of AI-based solutions and EHR-integrated ePA systems offers an effective approach to reducing delays and improving healthcare efficiency.

### **MSS-25-PO-035: Cardiac Tamponade in Newly Diagnosed Primary Hypothyroidism: An Overlooked Entity**

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Introduction: Cardiac tamponade as the sole initial manifestation of primary hypothyroidism is extremely rare. We report an elderly male presenting with cardiac tamponade with classical features. Workup revealed TCMP secondary to newly diagnosed severe hypothyroidism. Urgent pericardiocentesis and levothyroxine supplementation resulted in rapid resolution of symptoms.

Case Description: A 63-year-old male presented with complaints of chest discomfort and worsening dyspnea for 2 weeks. On initial assessment, vitals: pulse= 124 bpm, blood pressure= 140/100 mmHg, respiratory rate= 26/minute and SpO<sub>2</sub>= 96% on room air. Physical examination: thin built (body-mass-index =25.1 kg/m<sup>2</sup>, Cardiovascular examination: bilateral pedal edema, elevated jugular venous pressure and muffled heart sounds. Electrocardiography revealed sinus rhythm consisting of low voltage complexes. Chest X-ray showed cardiomegaly with an 'Erlenmeyer-shaped' heart, suggesting massive pericardial effusion. Transthoracic echocardiogram (TTE) showed cardiac tamponade with preserved left ventricular (LV) systolic function (LV ejection fraction= 60%). Diagnosis of cardiac tamponade was made, and the patient was taken up for urgent pericardiocentesis, which revealed 450 cc of clear straw-colored serous fluid. On further investigations, the fluid was transudative and negative for tuberculosis and malignant cells. The endocrine panel showed severe hypothyroidism- thyroid-stimulating-hormone (TSH) > 100 uIU/ml (normal=0.4-4 uIU/ml) and low levels of T<sub>3</sub> (0.2 ng/ml) and T<sub>4</sub> (0.9 ng/ml). All other investigations were within normal limits. The patient was subsequently initiated on levothyroxine supplementation which resulted in a dramatic resolution of symptoms over the next two weeks. Repeat thyroid function assessment was within normal limits and a repeat TTE at two weeks showed no residual pericardial effusion or regional-wall-motion-abnormalities. The patient was discharged in stable condition, is currently on maintenance therapy of levothyroxine and being regularly followed-up on an outpatient basis

Discussion: Cardiac tamponade as the initial presentation of hypothyroidism is a rare occurrence and requires a high suspicion index. Urgent pericardiocentesis is imperative for the management of this cardiac tamponade. However, Cardiac tamponade associated with hypothyroidism can often be managed medically by addressing the underlying thyroid dysfunction. The complete resolution following targeted treatment underscores the importance of a comprehensive approach which should include ruling out potential endocrine disorders, such as hypothyroidism.

### **MSS-25-PO-036: Novel Interventional Approach to Valve Dislodgement During Valve-in-Valve-in-Valve (ViViV) Transcatheter Aortic Valve Replacement (TAVR) in an Elderly Patient with Severe Aortic Stenosis**

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Background: Transcatheter aortic valve replacement (TAVR) is the preferred treatment for severe aortic stenosis in symptomatic elderly patients with comorbidities. Valve-in-Valve (ViV) TAVR has emerged as an option for failing bioprosthetic valves, often preferred over redo-surgical aortic valve replacement (SAVR). Valve-in-Valve-in-Valve (ViViV) TAVR is a rare occurrence with only a few documented cases. We report a case of valve dislodgement during ViViV TAVR managed with a novel interventional technique.

**Case Description:** A 75-year-old man with a history of hypertension, diabetes, coronary artery disease, chronic kidney disease, and obstructive pulmonary disease presented with chest pain and shortness of breath. History revealed percutaneous transluminal coronary angioplasty (PTCA) to the right coronary artery and circumflex artery, coronary artery bypass graft surgery, and SAVR. The patient had severe aortic stenosis due to bioprosthetic valve degeneration, 99% in-stent restenosis of circumflex artery, and 80% long, calcified ostio-proximal left anterior descending (LAD) artery disease with occluded grafts. The fractional flow reserve was 0.78 in the LAD and creatinine was 2mg/dL. After PTCA to circumflex artery and rotablation to LAD, TAVR was planned. A 22mm self-expanding valve was deployed at 5mm below the surgical valve ring but got dislodged in the ascending aorta due to the incomplete release of the last tentacle from the release system. Subsequently, a second self-expanding bioprosthetic valve was taken over the wire through the previous prosthesis, positioned across the aortic valve, and deployed with post-dilatation to 20mm. There was no valvular leak with a post-deployment trans-aortic gradient of 32 mmHg. Fracture of the surgical valve ring using an Atlas balloon was completed, reducing the gradient to 11 mmHg. Post-procedure, the patient was asymptomatic.

**Discussion:** ViV TAVR is recommended for aortic stenosis in moderate-to-high surgical risk patients but presents challenges. This rare case illustrates the successful management of valve dislodgement during ViViV TAVR with a novel interventional technique. The approach involved crossing the dislodged valve with a second prosthesis and fracturing the surgical valve ring to achieve optimal hemodynamics.

### **MSS-25-PO-037: Fighting the Brain Injury Crisis: Improving Helmet Safety and Affordability**

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**Background:** Traumatic brain injuries (TBIs) afflict 55 million people worldwide and are a leading cause of death and disability (1,2). >90% of TBI-related deaths occur in low- and middle-income countries (LMICs), with one major cause being lack of high-quality, affordable helmets (3). This project aims to develop a safer, low-cost solution to improve helmets used in LMICs.

**Methods:** The design uses a shear-thickening fluid (STF) to make a prototype helmet layer. STFs are non-Newtonian fluids with properties of both liquids and solids since their viscosity increases with shear stress (4). Cheap and readily available materials (i.e., cornstarch and water) were used to create an STF called Oobleck, to lower manufacturing/maintenance costs. Oobleck was encapsulated and heat-sealed in a rectangular pocket of heat-transfer vinyl to create the layer. Experiments were conducted using a bike helmet on standardized NOCSAE head form at the Rawlings helmet facility in St. Louis, using standard vinyl nitrile (VN) foam as control (5). Severity index (SI) and gravitational force (g-force) were measured after dropping helmet/headform on an anvil from 3 feet (average height of fall from a bike). Higher SI and g-force represent lower protection (6).

**Results:** Preliminary results (mean  $\pm$  SD from three experiments) demonstrated for STF, SI=  $180.2\pm 56.3$ ; g-force =  $64.5\pm 10.7$ . For VN foam, SI =  $203.6\pm 52.6$ ; g-force =  $70.5\pm 10.7$ . Although not statistically significant ( $p=0.2$ ), the STF outperformed the VN form despite a partial tear of heat-transfer vinyl. Ongoing experiments utilize a more robust encapsulating material (vacuum-sealed Mylar bags) for STF to eliminate perforation risk.

**Conclusion:** Next steps involve testing STF's effectiveness in rotational force absorption and defining the layer's optimal thickness. Successful completion of this project will facilitate the development of a protective headgear technology that will be an effective and accessible option for LMICs.

### **MSS-25-PO-038: Epidemiological Trends at a Burn Hospital in Pakistan: Age and Gender Disparities**

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**Background:** Burn injuries are a significant public health issue, particularly in low- and middle-income countries. Pakistan's high burn incidence highlights the need for a better understanding of demographic factors affecting burn outcomes.

**Objective:** This study investigates gender, age, and outcome disparities among burn patients in Pakistan to inform targeted prevention and treatment strategies.

**Methods:** A retrospective study was conducted at Holy Family Hospital, Rawalpindi, from January to December 2002, involving 389 patients admitted for major burns. Data on demographics, burn characteristics, and outcomes were analyzed using SPSS.

**Results:** The study included 224 adults and 165 pediatric patients, with a slightly higher prevalence in males (50.6%). Flame burns were the most common injury mechanism, particularly among females, who had higher rates of full-thickness burns, inhalation injuries, and mortality (39.58% vs. 18.27% in males). Older age and higher TBSA were significant predictors of mortality, with patients over 60% TBSA facing the highest risk. Younger patients, especially infants and toddlers, showed better outcomes.

**Conclusion:** The study reveals significant gender and age disparities in burn outcomes in Pakistan, with females facing more severe injuries and higher mortality, with socio-economic factors and access to care likely being key contributors as women globally face a higher poverty rate. Younger patients, especially infants, had better outcomes. Targeted, gender-sensitive, and age-specific interventions, including improved access to specialized care and integrated mental health support, are crucial for addressing these disparities and improving outcomes for vulnerable groups.

### **MSS-25-PO-039: Evaluating Tobacco Use Among United States Air Force Military Trainees**

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**Introduction:** This study examines smoking behaviors and associated factors within the context of the United States Air Force (USAF) Basic Military Training (BMT) at Lackland Air Force Base, Texas. It focuses on pre-BMT smoking histories, the effects of smoking bans, and factors influencing smoking initiation and reinitiation, providing a foundation for interventions and policy enhancements to support USAF trainees' health.

**Methods:** A PubMed literature search from January 1998 to December 2020 identified publications meeting strict inclusion criteria, focusing on Air Force basic trainees.

**Results:** The strongest predictor of smoking initiation was ownership of cigarette-branded merchandise. For former smokers, the intention to use tobacco was the key predictor of re-initiation. Of never-smokers, 65% remained abstinent, while 9.3% started smoking. Among ex-smokers, 9.6% stayed abstinent, and 16.1% relapsed. Before BMT, 32% of trainees smoked regularly, and 7.6% were ex-smokers. Smoking was more common among men, Euro-Americans, and those with lower education levels. Smokers had a four-year average smoking history and low nicotine dependence. Pre-BMT smokers were likelier to use other substances (alcohol, binge drinking, smokeless tobacco) and be less physically active.



The Modified Perceived Susceptibility to Cigarette Smoking (PSQ) effectively predicted smoking initiation, with higher likelihoods among susceptible trainees.

Conclusions: Smoking is a significant health risk for USAF trainees. Customized tobacco control strategies during BMT are critical to addressing this issue. Preemptive interventions can improve the long-term health and readiness of military personnel.

### **MSS-25-PO-040: A Rare Case of Cholecystitis Secondary to Prolonged Ketamine Use in a Patient with Major Depressive Disorder**

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We present a rare case of cholecystitis secondary to prolonged ketamine use in a 48-year-old male with a history of major depressive disorder. The patient presented to the emergency room with complaints of right upper quadrant abdominal pain, fever, and jaundice. Imaging studies revealed an inflamed gallbladder consistent with acute cholecystitis. Further history revealed that the patient had been undergoing ketamine therapies for depression and anxiety through an online company not approved by regulatory authorities. This case underscores the importance of considering ketamine abuse in the differential diagnosis of cholecystitis, particularly in patients with atypical presentations and a history of substance use. Clinicians should remain vigilant for potential complications of ketamine use beyond its primary effects on the central nervous system and be aware of the risks associated with unregulated ketamine therapies.

### **MSS-25-PO-041: Immediate effect of aerobic exercise at varying intensities on cognition in healthy young adults**

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Background- Regular exercise positively impacts cognition, but its effects can vary based on factors like demographics, task complexity, and exercise intensity. However, the impact of exercise intensity on immediate cognitive effects in young healthy adults is not well understood. To address this gap, the present study explores the immediate effects of aerobic exercise at different intensities on cognitive performance in individuals.

Methods- Young female adults (N=21, 21.2±1.32 yrs) participated in the study after providing informed consent and passing the PAR-Q+ for physical activity eligibility. On Day 1, they performed 20 minutes of mild-intensity aerobic exercise with a 5-minute warm-up and cool-down. On Day 2, they performed 20 minutes of moderate-intensity exercise, also with a 5-minute warm-up and cool-down. Resting heart rate was recorded, and target heart rate was calculated using the Karvonen formula taking %HRR as 30-<40 for mild intensity exercise and 40-<60 for moderate intensity exercise. Cognitive tasks (Stroop, Corsi Block-Tapping, Trail Making, and Verbal Fluency tests) were administered before (T0) and after (T1) exercise on both days.

Results: Significant immediate improvements were observed in most cognitive tasks following both mild and moderate intensity exercise. However, comparison of the immediate effects between mild and moderate intensity exercise revealed no significant differences, except in the Trail Making Test (TMT-B), where the mild intensity group showed a significantly greater improvement (p = 0.0159).

Conclusion: Both mild and moderate intensity aerobic exercise result in immediate cognitive benefits. Notably mild intensity exercise led to significantly greater improvements in visual attention and task-switching functions with no significant differences observed in other cognitive domains. These findings suggest that variations in exercise intensity may not substantially influence the cognitive benefits immediately following an acute bout of aerobic exercise. Further studies with larger sample size and different demographics need to be performed for better understanding.

### **MSS-25-PO-042: Assessing the Impact of COVID-19 on Burnout Among Medical Residents Across Specialties and Its Consequences for Patient Care**

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**Background:** Feelings of burnout because of increased workload and emotional exhaustion pose a great challenge to healthcare professionals and the care their patients receive. Our review aims to gain a better understanding of the burnout experienced by resident physicians prior to and during COVID-19, using the Maslach Burnout Inventory (MBI).

**Methods:** PubMed and SCOPUS were searched using the terms (“Burnout”) AND (“COVID” OR “COVID-19” OR “Pandemic”) AND (“Maslach Burnout Inventory–Human Services Survey) AND (“Patient Care” OR “Psychiatric Residents” OR “Trainees”) from 2010 to 2023. Included articles evaluated the impact of COVID-19 on burnout amongst residents in orthopedic surgery, pediatrics, psychiatry, and emergency medicine. We excluded articles that were not written or translated into English, were not accessible in full text, or were irrelevant to the research question.

**Results:** There was no statistically significant difference in burnout rates between residents and physicians because of the COVID-19 pandemic for orthopedic surgery. However, emergency medicine residents experienced greater burnout following the pandemic despite already having elevated rates of burnout when compared to other specialties. Psychiatric residents saw a smaller increase in burnout compared to the other three specialties, which can be attributed to the heightened social tension during the pandemic. Lastly, pediatric residents saw a large increase in depression during the pandemic.

**Conclusion:** The changes in burnout rates among various specialties were shown to be fundamental in-patient care given that positive burnout screens exhibited statistically significant increases in the mean number of harmful medical errors.

### **MSS-25-PO-043: Effects of Prior Authorization on Patient Mortality in Oncology: A Literature Review**

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**Background:** Prior authorization (PA) in oncology delays care, alters treatment plans, and restricts access to therapies, potentially impacting patient outcomes and mortality. This review synthesizes recent findings, highlighting disparities in diagnosis, socioeconomic barriers, and administrative burdens, emphasizing the need for equitable policies balancing cost control with timely, effective cancer care delivery.

**Materials and Methods:** This review systematically examined prior authorization (PA) in oncology, focusing on its impact on treatment delays, mortality, and patient outcomes. A PubMed, Embase, and Cochrane Library search (2014–2024) identified 287 articles, with 31 studies meeting inclusion criteria. Data were extracted using standardized tools and analyzed using RevMan and NVivo, with study quality assessed via Newcastle–Ottawa, Cochrane, and AMSTAR 2 scales. Transparent reporting followed PRISMA guidelines, ensuring a rigorous evaluation of PA's effects on oncology care.

**Results:** Prior authorization (PA) delays cancer care, with average delays of three weeks, up to four months for appeals, and 16 days in gynecologic oncology. PA denial led to 19% abandoning radiation therapy and 18% facing care changes. Removing barriers, like for checkpoint inhibitors, improved survival from 13.9 to 16.9 months. Racial disparities persist, with minorities facing later diagnoses and uninsured leukemia patients having 70% survival versus 86.2% for insured.

Medicaid expansion improved early-stage detection, but inequities remain.

Conclusion: Significant racial and socioeconomic disparities affect cancer outcomes, with minorities and Medicaid patients at greater risk for delays and suboptimal care. Prior authorization (PA) contributes to delays, treatment abandonment, and care changes, indirectly impacting survival. Streamlined PA processes and equitable policies are essential for improving timely access and outcomes.

### **MSS-25-PO-044: Efficacy of Platelet-Rich Plasma (PRP) Injections in the Management of Tendinopathy**

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Background: Platelet-rich plasma (PRP) has emerged as a potential treatment for various tendinopathies (Van Schaik KD et al., 2021). This review evaluates the impact of PRP on pain and function in tendinopathy.

Methods: A systematic search of PubMed was conducted in June 2024, utilizing MeSH terms "PRP" and "Tendinopathy." Inclusion criteria were human randomized controlled trials, English, PRP-only treatment groups, and outcome measures. The Modified Coleman Methodology Score was used to evaluate methodological quality (Coleman et al., 2000; Giordano, Murrell, & Maffulli, 2021). Percent change in both objective and subjective pain and function measures were analyzed from baseline at 3- and 12-months follow-up.

Results: Twenty-five of 58 studies identified met the inclusion criteria. 48% (N=12) evaluated elbow tendinopathy, 20% (N=5) shoulder, 16% (N=4) knee, 12% (N=3) Achilles tendon, and 4% (N=1) glutes. PRP resulted in higher maximum percent change in pain compared to all other treatment and control groups at 3-months in elbow, shoulder, and knee (100%, 62.5%, and 58.54% respectively) and 12-months in elbow, shoulder, and knee (100%, 90.63%, and 77.27% respectively). PRP group demonstrated the higher maximum percent change in function outcomes compared to all other groups at 3-months in elbow, shoulder, and knee (132.23%, 128.61%, and 60.98% respectively) and 12-months in elbow and knee (98.48% and 65.1% respectively). Leukocyte-poor PRP (LP-PRP) consistently outperformed leukocyte-rich PRP (LR-PRP) in both pain (e.g., 63.54–72.4% vs. 25–35.71% at 6 months) and function (47–76.6% vs. 18.37–45.4% at 12 months) across all tendinopathy types. Single injections demonstrated higher maximum improvements than two-injections in pain (100% vs. 53.75% at 3 months) and function (138.44% vs. 54.85% at 6 months) across all tendinopathy types.

Conclusion: PRP successfully improves pain and function across various tendinopathy types. LP-PRP formulations consistently outperform LR-PRP, and single injection protocols yield greater improvements compared to two-injections. Further research is needed to optimize PRP formulation and administration techniques to maximize therapeutic benefits for tendinopathy.

### **MSS-25-PO-045: A case of pineal gland tumour with triventricular (obstructive) hydrocephalus in a 70-year-old female**

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Introduction: Due to the unique location of the pineal gland, its tumors can cause a variety of misleading symptoms including ophthalmologic and endocrinological disturbances, motor and sensory abnormalities, and cognitive and psychiatric symptoms. Pineal Gland tumors, although common in children & between 10-65 years, can present at all ages. Most pineal gland tumors fall into one of 3 categories all of which are benign: germ cell tumors, pineal parenchymal tumours and others. However, histology can have a bearing on presenting symptoms. The unique location of pineal gland tumours often results in obstruction of the cerebral aqueduct resulting in triventricular hydrocephalus.

**Case Description:** The patient, a 70-year-old female, presented with the chief complaint of difficulty in walking for the past 6 months along with episodic headaches and diplopia. The patient has a history of bilateral Total Knee replacement 2 years ago. The patient was conscious but slightly confused. Pupils were bilaterally normal in size and reactive to light (NSRL). Ataxia present. On physical examination, the patient has a slow gait with short steps. She has an expressionless face. The Reflexes are brisk. Plantar response is down. The extraocular movements are complete. Initial imaging missed any structural lesions and a provisional diagnosis of idiopathic parkinson's was considered. However, repeat imaging after rapid clinical worsening was revealed. Contrast Mediated MRI of the brain revealed a pineal gland tumor (mass obstructing the aqueduct of sylvius adjacent to the pineal gland) with triventricular hydrocephalus. LP was unrevealing without any malignant cells.

**Discussion:** After confirming the diagnosis, the patient underwent Right VP (Ventriculo-peritoneal Shunt) under General Anesthesia. The procedure was well tolerated and her stay in the hospital was uneventful. The patient was discharged in stable condition. The symptoms reversed promptly after the procedure indicating normalization of intracranial pressure by draining the excess CSF in the ventricles into the peritoneum. No resection of the pineal gland tumour was carried out considering the age of the patient and the benign nature of most pinealomas. A thorough attempt should be made to exclude any structural lesions potentially mimicking symptoms of parkinsonism before diagnosing a patient with parkinson's disease even especially with atypical presentations.

### **MSS-25-PO-046: The Effect of Fragmented Sleep on Astrocytes Within a Cardiorespiratory Regulatory Brain Center in Juveniles**

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**Background:** Sleep fragmentation (SF), are repetitive short interruptions of sleep associated with various negative health effects, including elevated blood pressure. Increased blood pressure during childhood is linked to an increased risk of hypertension in adulthood; however, the underlying mechanisms remain unclear. The nucleus tractus solitarius (nTS), located in the medulla oblongata, processes information related to blood pressure. Astrocytes, glial cells in the central nervous system, perform diverse roles such as modulating synaptic transmission, and clearing excess neurotransmitters including glutamate. Despite the established role of astrocytes their contribution to blood pressure regulation in SF remains unknown. We hypothesize that SF causes an increase in astrocytes within the nTS to increase blood pressure. .

**Methods:** Rats (Sprague Dawley, 3-7 weeks of age) acclimated to specialized SF chambers, which disrupted their ability to achieve deep sleep. Immunohistochemistry was performed on brainstem sections containing the nTS to analyze astrocytes using antibodies against glial fibrillary acidic protein (GFAP, astrocyte cytoskeleton protein) and S100B (astrocytic soma calcium binding marker), followed by secondary antibodies for visualization. Confocal microscopy was used for astrocyte cell counts and tracing, at 10x, 40x, and 60x. ImageJ software was employed to quantify astrocytes number and structure.

**Results:** The findings revealed a statistically significant difference in the number of astrocytes between the 9 AM and 9 PM timepoints in control rats, suggesting a normal diurnal variation in astrocyte activity. However, this variation was absent in sleep-fragmented (SF) rats. Additionally, no difference in astrocyte number was found between control and SF rats at either timepoint.

**Conclusion:** These results suggest that sleep fragmentation may disrupt the normal diurnal patterns of astrocyte activity, potentially affecting their regulatory roles in the nTs. This disruption could impair astrocytic modulation of blood pressure, offering a potential mechanism for SF-associated increases in blood pressure.

### **MSS-25-PO-047: Profile of pediatric patients with Congenital Heart Diseases in rural teaching hospital**

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**Background:** Congenital heart disease (CHD) is the most prevalent congenital malformation worldwide, with India reporting CHD as accounting for 28% of birth defects [1]. The prevalence of CHD in India at birth ranges from 8–12 per 1000 live births [2]. Timely intervention is essential, as untreated CHD significantly reduces life expectancy, with many affected children not surviving beyond the age of five.

**Methods:** This cross-sectional study was conducted at Shree Krishna Hospital and B and M Patel Cardiac Centre from December 2022 to January 2024. It included patients under the age of 17, either newly diagnosed or with a known case of CHD, excluding previously operated patients. Data were collected through interviews with parents or guardians using a structured questionnaire.

**Results:** A total of 115 paediatric patients were enrolled. Of these, 36% were < 1 year, 39% were between 1-5 years, 13% between 6-10 years, and 15.7% over 10 years. The mean age at suspicion of heart disease was 19.7 months, while the mean age of confirmed diagnosis was 24.8 months.

98/115 children were suspected to have heart disease by their PCP due to recurrent visits for illnesses - Common symptoms such as recurrent cough (83.5%), cold (43.5%), poor weight gain (15.7%), and dyspnea (13%) were seen. The parents did not suspect their children having heart disease in almost all cases barring 4 patients. The most prevalent CHD diagnoses were ventricular septal defect (35%), tetralogy of Fallot (20%), patent ductus arteriosus (17%), and atrial septal defect (14%).

**Conclusion:** The study highlights that early diagnosis is often delayed due to a lack of healthcare resources for screening infants and awareness of the disease. Malnutrition was prevalent among younger patients, which increased susceptibility to respiratory infections and impacted post-treatment recovery [3,4]. Despite improvements in healthcare access through government insurance schemes, there remains a significant gap in the availability of dedicated pediatric cardiac centers, which hinders timely care. CHD remains a major health concern in rural pediatric populations, with delayed diagnosis and malnutrition complicating treatment outcomes. There is a need for increased awareness, better healthcare infrastructure, and more evenly distributed pediatric cardiac care to improve outcomes for affected children in rural India.

### **MSS-25-PO-048: Squamous Cell Carcinoma in a Mid-Esophageal Diverticulum: A Rare Occurrence**

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**Introduction:** Esophageal diverticula are relatively rare, with a prevalence of 0.06% to 3.6% based on radiologic and endoscopic studies. Cancer arising in diverticula is uncommon, but the incidence is higher in mid-esophageal diverticula compared to pharyngeal and epiphrenic types. The anatomical characteristics of diverticula increase the likelihood of cancer invading surrounding tissues and becoming metastatic.

**Case Description:** A 51-year-old male presented with progressive dysphagia to solids for 6 months and a dry cough for 25 days. Esophagogastroduodenoscopy revealed a mid-esophageal diverticulum, located 25 cm from the incisors, 6-8 cm in length (Fig. 1). The mucosa appeared irregular, and multiple biopsies showed normal mucosa with granulation tissue. Contrast CT of the thorax showed advanced growth in the infracarinal esophagus with pulmonary metastatic deposits (Fig. 2). A subsequent bronchoscopy and biopsy revealed moderately differentiated squamous cell carcinoma. The patient underwent 6 cycles of chemotherapy and radiotherapy, with good treatment response.



Discussion: Cancers arising from diverticula are often diagnosed at an advanced stage due to the lack of early symptoms. Hence, esophageal cancer in the diverticula are considered to be at a more advanced stage compared to similar cancers in other esophageal regions. Early detection of cancer in esophageal diverticula requires a high index of knowledge and attention to detail. Delayed diagnosis complicates surgical management, and the disease may progress asymptotically.

### **MSS-25-PO-049: An intriguing case of necrotizing pneumonia caused by *Nocardia farcinica***

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Introduction: Nocardiosis is a rare, serious infection caused by *Nocardia* species, often affecting immunocompromised individuals. It typically presents as pulmonary disease but can involve skin, brain, and other organs, mimicking tuberculosis or bacterial pneumonia. (1) *Nocardia asteroides* is the primary pathogen, commonly seen in patients with COPD, bronchiectasis, or those on immunosuppressive therapy.(2,3) *N. farcinica* is the least common clinically significant species but is highly aggressive, often multidrug-resistant, leading to disseminated infections as well as significant morbidity and mortality.(4,5,6) This case describes a 74-year-old woman with necrotizing pneumonia due to *Nocardia farcinica*, complicated by septic shock and type II respiratory failure.

Case Description: A 74-year-old woman with Type 2 Diabetes and Hypertension presented with a 20-day history of high-grade fever, productive cough with mucopurulent-grey sputum, and altered sensorium for 2 days. She was drowsy, with elevated JVP, bilateral pitting edema, and oxygen saturation of 70%. Chest examination showed reduced movements and dullness on percussion on the right side, with bronchial breathing and coarse crepitations. Lab results showed elevated WBC (23,030/mm<sup>3</sup>), platelets (819,000/mm<sup>3</sup>), CRP (159 mg/dL), procalcitonin (1.16 ng/mL), and respiratory acidosis. Imaging revealed consolidation in the right lung and bilateral bronchiectasis. ECG showed sinus tachycardia and T-wave inversions. The patient was initially suspected to have tuberculosis or bacterial pneumonia, but culture results from an ET aspirate identified *Nocardia farcinica*. The patient was treated with Imipenem-Cilastatin, Amikacin, and later trimethoprim-sulfamethoxazole. (7)

Discussion: Differential diagnosis included community-acquired pneumonia, COPD exacerbation, tuberculosis, and lung carcinoma. Microbiological testing confirmed necrotizing pneumonia due to *Nocardia farcinica*. Despite no overt immunocompromise, her diabetes, hypertension, and age predisposed her to infection. This case emphasizes the importance of considering rare infections like *Nocardia* in severe pneumonia cases, highlighting the need for early diagnosis and targeted therapy to improve outcomes.



Portrait of Hippocrates (1787), by the  
Majorat of Setúbal.  
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**Science is the father of knowledge,  
but opinion breeds ignorance.  
- Hippocrates**