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# **Personhood, Preimplantation Genetic Diagnosis (PGD) and its Ethical Implications: The Case of Savior Siblings**

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## **Abstract**

PGD has no doubt introduced significant ethical and moral challenges into the duties of parenthood. The concept of savior siblings further complicates the already ethically fraught circumstances surrounding PGD. Savior siblings are children resulting from the combined process of IVF and PGD, where the embryos are tested and selected for particular traits that are instrumental in the treatment of their older siblings who are suffering from severe diseases. The concept of savior siblings has since garnered widespread media attention and ethical controversies across different countries; however, research shows that there are no existing federal regulations concerning the creation and ‘use’ of savior babies in America today. This presents a significant gap that opens the combined use of PGD and IVF to exploitation and commodification of a human person, created as a means to an end, as well as concerns about

autonomy and respect for personhood. This paper evaluates savior siblings and PGD from the perspective of personhood, while providing important recommendations as it relates to ethical implications for public health.

Key words: Preimplantation genetic diagnosis, savior siblings, Personhood,

## **Introduction**

In today's world, the possibilities of selecting or deselecting certain qualities and traits in potential offsprings have been made possible by technologies and medical interventions like Preimplantation Genetic Diagnosis (PGD). While PGD is a force for good in deselection of potentially harmful genetic diseases, the challenge remains the possibility for such procedures to be used to commodify humanity, which may eventually lead to the creation of economic motivations, inequality and the perception of a human person based on the qualities or capacities they possess because of the parent's choice.

Preimplantation Genetic Diagnosis (PGD) is a diagnosis procedure that is predicated on other assisted reproductive technologies like In vitro Fertilization (IVF). According to the University of California San Francisco, Pre-implantation genetic diagnosis (PGD) is a "laboratory procedure used in conjunction with in vitro fertilization to reduce the risk of passing on inherited conditions" from parents to children. PGD was developed as a method for testing in vitro embryos or oocytes for several genetic defects as

an alternative for pre-natal diagnosis. Usually, it results in “selective termination of pregnancy in couples with a high risk of affected offspring.” (Geraedts and De Wert 2009, p318) Research has shown that advances in genetic technology and its applications could cause significant changes in how humans experience their world; and PGD being one of the breakthroughs of the current milieu, is a prime example (Baylis 2019). While PGD may be majorly used for preventing the heritability of harmful genetic traits, research has shown that many also use it for the selection of desirable traits, leading to what it called genetic designing, in offsprings. Ted Peters (2019), in his book *For the Love of Children: Genetic Technology and the Future of Family* argues thus:

“But choice at the level of genetic testing for acceptable embryos or engineering for superior genetic configurations may lead to the *perfect child syndrome* , wherein the neighborhood children conceived by sexual intercourse may be led to feel inferior. Or worse, something might go wrong – technology is seldom perfect – and something less than the perfect child will be produced causing the parents to deprive the child of unconditional affection...the possibility of treating children as commodities raises the specter that human dignity will be threatened.” (Peters 2019, p34)

In a society where offsprings are commodified and valued based on their genetic components, value for personhood and the inherent dignity of the human person is at stake. The effects also rub-off on collective societal value placed on people within the society, especially individuals with disabilities, if they become perceived as 'mistakes' within technological selection processes.

### **Personhood and Savior Siblings**

The concept of savior siblings further complicates the already ethically fraught circumstances surrounding PGD. Savior siblings are children resulting from the combined process of IVF and PGD, where the embryos are tested and selected for particular traits that are instrumental in the treatment of their older siblings who are suffering from severe diseases. The process typically involves the use of IVF to create embryos that are genetically tested; out of which any of the embryo that is a perfect tissue match for the ailing child is selected, implanted, and born for the purpose of having the bone marrow or cord blood stem cell transplanted to cure the ailing sibling (Ram 2006). This procedure was first carried out in 2000 and was used to successfully treat a 6-year old girl diagnosed with Fanconi anemia who got bone marrow transplantation from her savior sibling. (Verlinsky et al 2001)

In terms of regulatory oversight by different countries, the United Kingdom became the first country to formally regulate savior siblings under the Human

Fertilization and Embryology Authority (HFEA). In 2004, the UK and HFEA made the international news and headlines as being the first regulatory body in the world to officially sanction the use of preimplantation tissue typing to produce “Savior siblings” where children would be created to save an existing child ” (Agrawal et al, 2013, pp 364). In the same vein, early 2000s witnessed several clinics in the U.S, Australia, and parts of Europe began offering PGD with HLA typing leading to high profile cases which caught media attention. Subsequently, there were several cases of approvals and denials by HFEA that also made headlines. Out of the 15 countries in Western Europe, 13 have permitted PGD for several years with Germany granting permission in 2011 (Taylor-Sands, 2013). In Latin America, there is Brazil its *National Transplant System’s Technical Regulations* from Dec 2015 - which states that “the use of hematopoietic stem cells (bone marrow, peripheral blood, or umbilical cord blood) should consider the risks for the donor and the risks and the benefits for the recipient.” Spain and Australia mirrors this notion also, with the both of them permitting saviour siblings only for “therapeutic objective and if its complies with the “best interest” principle (Zúñiga-Fajuri, 2018).

However, the United States did not adopt federal regulations, leaving decisions to individual clinics and state-level policies (Shapiro 2018). This presents a significant gap that opens the combined use of PGD and IVF to exploitation and commodification of a human person, created as a means to an

end. Without a robust framework to regulate the creation of savior siblings, bioethicists have argued that the protection of the dignity and preservation of autonomy, which are fundamental principles in bioethics and medical ethics may be compromised (Shapiro 2018, pp 423).

One major recurring but unstated cause for concern is the potential for PGD and allied technologies to impact the diversity in future human societies and future offspring, since most people are either looking for or avoiding the same features. These understated effects will have significant impact on future human societies in ways that have not yet been understood. It should be noted that while the technologies for programming some specific desirable traits have not yet been fully developed due to the complexities of genetic correlation, there are prognostics about the marketability of these possibilities with huge private investments from multi-million-dollar biotechnological companies which will invariably increase commodification of the human person in the days ahead.

According to 2023 data presented by Grand View Research, the global genome editing market size was estimated at USD 9.78 billion in 2024 and is projected to reach USD 25.00 billion by 2030, showing a projected annual growth rate of 16.1% from 2025 to 2030. North America genome editing market dominated the global market and accounted for a 44.59% share in 2024, owing to the growing investments in the research and development (R&D) of gene editing

technologies. Furthermore, the U.S. held the largest market share for genome editing technology in North America and based on technology, the CRISPR/Cas9 segment held the largest market share of 44.36% of the global revenue in 2024. This exponential increase in market share rides on the commodification of human genetic characteristics and genetic designing presented as a laudable idea, not only for therapeutic purposes but also for enhancement/design purposes.

“The growth of the market is fueled by favorable government regulations related to synthetic biology, increasing demand for engineered genes and cells and rising investments from the government and large companies. The invention and implementation of various unconventional gene editing methods for editing purposes is another significant advancement in gene therapy and molecular biology that has contributed to the market's growth.”

### **Personhood in PGD and Savior Siblings: Some Ethical Considerations**

The major ethical concerns surrounding PGD and the creation of savior siblings are rooted deeply in questions of autonomy and consent—both of parents making reproductive choices and, more importantly, of the children born as a result of those decisions. These issues emerge at multiple levels,

both at the individual and societal levels, with important implications for public health that extend beyond individual family dynamics and into broader societal concerns.

One of the primary justifications for PGD, including PGD for HLA matching, is reproductive autonomy, which defends a parent's right to decide what kind of child they wish to bring into the world. In defense of parental autonomy, some scholars have argued that "human reproduction should be understood as a deeply personal project of self-making..." (Mills 2013, p 641). For example, several parents choose PGD to avoid transmitting serious genetic disorders or to save the life of an existing child, and these decisions are often framed as expressions of deep parental responsibility and care for ailing children, depending on the different contexts and situations that warrants such interventions to begin with.

However, autonomy in this context is complicated by several factors such as the consideration of the autonomy of the children involved, especially of the intended savior sibling to be born. Others include social pressures, in which some parents may feel morally obligated and socially pressured to use PGD to prevent suffering or save a child, which ultimately raises the question of whether those choices are truly free. Furthermore, in countries like the US where PGD is largely unregulated at the federal level, parental autonomy and choices operates without clear ethical boundaries, increasing vulnerability to

commercial exploitation and commodification (Shapiro 2018). As such, while parental autonomy is important, it exists within a matrix of social, financial, and institutional pressures that can constrain genuine voluntariness.

Another complex issue of autonomy arises with savior siblings as a means to an end which ultimately violates their personhood. Unlike PGD used solely to prevent disease, the purpose of creating a savior sibling includes meeting the medical needs of another person, the existing child with a serious illness. This raises questions about whether the savior sibling is being used instrumentally, and whether their own autonomy is subordinated to the welfare of their older sibling. Ethicists like Jurgen Habermas (2003) argue that this erodes the moral idea of humans as “authors” of their own life stories, because the child’s genetic parameters were actively chosen by others rather than given naturally, thus compromising future autonomy. According to Habermas, a person’s birth is meant to be free from direct human interference, in a natural sense (Hockings 2024, p81). Without such a birth or a body, a person may not see themselves as the “undivided author of their own life” (Habermas 2003, 63).

Some ethicists warn that the savior sibling may later perceive themselves as valued primarily for their therapeutic utility rather than for who they are as a person. In this context, the savior sibling is treated as a mere tool to treat its ailing elder sibling” (Kuek et al 2021, p170). This could impact their sense of

autonomy, identity, and self-worth, especially if family dynamics emphasize their instrumental role. Furthermore, there are arguments that the savior siblings may be treated differently from their other siblings, which could either be negative or positive depending on the parents. In other cases, the savior sibling may not even know that they were born for such purposes, depending on the level of privacy and confidentiality associated with the conditions of their birth. The most concerning is the potentially negative ways in which parents might treat the savior sibling as they grow, after the “purpose” for which they were born has been fulfilled (Althorpe and Finneron-Burns 2023, pp 55).

There are counter arguments that selecting health does not limit autonomy any more than vaccinating a child without consent does (Savulescu, 2002). Nonetheless, the absence of consent remains a significant ethical consideration. Initially, PGD-created savior siblings are intended to provide minimally risky donations like cord blood but in instances when this becomes insufficient for the treatment of the ailing sibling, pressure may rise to seek additional, riskier procedures such as bone marrow transplant and without clear legal or ethical safeguards, the savior sibling may face a progressive erosion of bodily autonomy and a prioritization of the ailing sibling’s welfare over and against that of the savior sibling.

## **Ethical, Social, and Regulatory challenges of PGD and Savior Siblings from a Public Health Perspective.**

As genetic technologies become more widely available, societal understandings of reproductive responsibility shift. If PGD becomes normalized as a way to prevent disease or save a sibling, parents may feel increasing moral pressure to use PGD, or be perceived as negligent. Furthermore, The European Society of Human Reproduction and Embryology (ESHRE) Joint Task Force on Ethics and Law<sup>22</sup>: Preimplantation Genetic Diagnosis highlights that concerns have been raised about societal perception of parents who decide not to yield to the pressure of using PGD leading to a situation in which some countries no longer expect that society is willing to pay for the care and treatment of possible affected children” (De Wert et al 2014, pp 1612). This can be further exacerbated by the social expectation placed on parents to avoid the birth of a child with disability which may eventually reinforce discrimination and ableist norms and prioritizing technological solutions over communal support systems at the societal level.

This further reinforces the fact that the creation of savior siblings has ripple effects on how health systems, populations, and public-health values for personhood have evolved over time. First, the creation of savior siblings reflects and reinforces a shift toward increasingly individualized and highly technologized medical interventions. Although these procedures can be

lifesaving, they may divert attention away from broader public-health priorities, such as ensuring equitable access to preventative care, strengthening donor-registry systems, and improving community-level health infrastructures. Public-health frameworks traditionally emphasize collective benefit, disease prevention, and population-level well-being; however, technologies like PGD paired with IVF may privilege individualized, high-cost solutions that are accessible only to wealthy or well-resourced families.

Second, savior siblings may indirectly influence public-health policy regarding organ and tissue donation. If families increasingly rely on reproductive technologies to create perfectly matched donors, this could reduce investment in public donor registries and tissue-matching databases. Such a trend could undermine collective systems that depend on broad public participation and solidarity, replacing them with private, family-based solutions to serious medical conditions.

Third, from a population-health ethics perspective, the normalization of savior siblings could create new forms of extant moral and psychosocial pressure on families (De Wert 2019). If this option is seen as a morally expected choice for parents with a sick child, families who cannot afford PGD or IVF, or who decline them on ethical or religious grounds, may face stigma. This dynamic, though subtle, may place emotional strain on already vulnerable families and indirectly question personal choices of people who are counter cultural.

Fourth, widespread use of PGD for tissue matching may shift public-health attention concerning children's rights and long-term well-being. A savior sibling's medical contribution typically poses minimal immediate risk when limited to cord-blood or compatible stem-cell donation, but as public health increasingly incorporates genetic and reproductive technologies into policy discussions, questions arise about the boundaries of acceptable medical use of minors. Public-health institutions must consider whether future policy should include safeguards to ensure that children conceived through PGD for therapeutic donation are protected from coercive medical requests beyond minimal-risk procedures.

In sum, while savior siblings represent a powerful and compassionate application of genetic technology, their growing use raises critical questions for public health. These include concerns about equity of access, the stability of public donor systems, the psychosocial pressures placed on families, the rights and protections of children involved, and the risk that individualized genetic interventions may overshadow collective, preventative approaches essential to the well-being of populations. Public health frameworks will need to adapt to ensure that the profound therapeutic possibilities offered by technologies like PGD do not deepen inequities or undermine the foundational communal responsibilities to public health or undermine the personhood of children born in order to be used as a means to an end.

## **Recommendations**

Given the complex ethical terrain surrounding PGD and the creation of savior siblings, particularly regarding personhood, autonomy, consent, and implications for public health, it is essential that regulatory bodies, medical practitioners, and policymakers develop clearer frameworks to safeguard the rights and dignity of all parties involved. The following recommendations aim to provide ethically grounded guidance for future policy and practice

**Establish Clear National Regulatory Frameworks:** Countries without comprehensive regulation, like the United States, should establish national guidelines governing PGD and HLA matching for savior siblings. Such frameworks should include comprehensive delineation of permissible medical indications for PGD and also require administration for any use of PGD intended for tissue matching. Such regulatory guidelines should also prohibit non-therapeutic or enhancement-based embryo selection which can further exacerbate societal inequalities and violate the personhood of children involved. Furthermore, mandatory reporting and transparent practice should be required from fertility clinics who are involved in the procedure. A national standard that would reduce clinic-by-clinic variability and protect families from commercialization-driven practices should also be enforced.

Another helpful guideline will be for hospitals and fertility centers offering PGD for HLA matching should have mandatory independent ethics committees that evaluate requests on a case-by-case basis. These committees would review the severity of the sibling's condition, the proportionality of the risk to the savior sibling, parental motivations and understanding of the process, availability of alternative donor sources amongst others. This approach ensures that decisions are ethically justified and not driven by desperation, coercion, or commercial pressures.

**Strengthening Protections for Savior Siblings' Personhood and Autonomy:**  
Legal safeguards should be enacted to limit the types of procedures that may be performed on savior siblings, ensuring that only minimally invasive or low-risk procedures (e.g., cord blood extraction) are permitted without individualized ethical review. Other more invasive procedures like bone marrow or peripheral stem-cell donation should mandatorily require best-interest assessments, conducted by child advocates independent of parental authority and interests of the medical facility. This ensures that no medical procedure is performed solely for the benefit of another unless it poses minimal risk to the donor child, thereby safeguarding the personhood of the savior sibling and to reduce the propensity to treat the children as mere instruments.

Promote Public Dialogue, Deliberation and Education: Given that PGD and savior sibling technology affect societal values around disability, autonomy, and human dignity, governments and academic institutions should facilitate public forums and Bioethics panels which bring together important stakeholders to deliberate on the different dynamics of savior siblings and PGD. Such dialogue helps ensure that regulation aligns with societal values while guarding against eugenic tendencies and genetic commodification. Furthermore, Families considering PGD or the creation of a savior sibling should receive mandatory, non-directive genetic counseling, which includes informed consent process, discussion of medical risks and limitations, exploration of ethical considerations and family dynamics which varies from family to family as well as psychological support before and after the birth of a savior sibling. Furthermore, government should invest in long term research and longitudinal studies that evaluate the psychosocial well-being of savior siblings and children conceived through intensive genetic selection processes. These studies will ensure the availability of empirical data that makes for informed decisions, which is largely lacking in terms of sufficient data about savior siblings.

## **Conclusion**

The use of PGD and the creation of savior siblings represent remarkable scientific achievements capable of preventing suffering and saving lives in the 21<sup>st</sup> century. However, their application raises profound ethical concerns regarding personhood, autonomy, commodification, and public health. The recommendations outlined above aim to balance the therapeutic potential of these technologies with the imperative to preserve human dignity, protect vulnerable children, and ensure that reproductive choices occur within a framework of justice, transparency, and respect for personhood. Only through thoughtful regulation, sustained ethical reflection, and robust public engagement can society navigate the complexities posed by these transformative biotechnologies.

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# **Deep Learning for Musculoskeletal MRI Interpretation: Systematic Review of ACL and Meniscal Tear Detection**

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## **Abstract**

For diagnosing anterior cruciate ligament (ACL) and meniscus tears, knee MRI is the method of choice, relying heavily on the expertise of a specialized radiologist and extensive reading time, leading to delays in diagnosis and limiting access in various socio-economic settings. Deep Learning (DL) has emerged as a potentially promising system for improving diagnostic efficiency and enhancing access to high-quality musculoskeletal imaging. The objective of this systematic review was to appraise studies in which DL models were directly compared with radiologist performance in knee MRI interpretation. Following the recommendations of PRISMA 2020, multicase, multi-reader, and reader-assist study designs were collected by structured search, investigating DL diagnostic performance for ACL and/or meniscal tear detection against radiologists. The screened studies reported quantitative metrics of diagnosis

and used standardized reference tests, usually with surgical confirmation or consensus from musculoskeletal radiologists. Study quality was assessed with QUADAS-2, and data was extracted to summarize the diagnostic performance along with interpretation time and reader impact. Across the screened studies, DL systems generally demonstrated diagnostic results for tears similar in accuracy to those of an experienced radiologist, suggesting a potential similarity in efficiency within this setting. In many of these studies, DL support improved clinician sensitivity, specificity, overall accuracy, and agreement between readers, with the most significant benefit identified for less-experienced readers. Moreover, several studies showed a reduction in interpretation times when using DL assistance, indicating the possible role that DL can play in improving workflow at the clinic. Overall, current evidence seems to indicate that DL models can be effective tools in the diagnosis of ACL and meniscal tears, supporting the need for further prospective research in order to clarify clinical integration, generalizability, and the potential application in underserved healthcare environments where access to musculoskeletal radiology may be limited.

## **1. Introduction**

Knee injuries such as Anterior Cruciate Ligament (ACL) and meniscal tears are common causes of pain and disability in adults, often requiring

musculoskeletal magnetic resonance imaging (MRI) for a definitive diagnosis. Major guidelines endorse MRI as the preferred method of diagnosis for ligamentous injuries such as these tears, as the MRI is able to clearly visualize the soft-tissue directly (Tran et al., 2022). These MRI scans have to be interpreted by radiologists, who may not always be available. Due to the sheer volume of MRI images and the constraint of the radiologist workforce, backlogs can occur, causing a concern for a timely diagnosis and care. These constraints provide interest for the use of other diagnostic tools such as deep learning systems to assist in improving the efficiency of diagnosing knee injuries by interpreting the MRI. Deep Learning (DL) has come up as a promising approach for interpreting musculoskeletal MRI in various studies, and can provide a significant assistance in tackling the shortage of radiologists for interpreting and diagnosing these injuries.

Deep Learning algorithms, especially Deep convolutional neural networks (DCNNs), are being trained and developed as a possible alternative to a proficient radiologist in order to aid in reducing the workload of radiologists and improve efficiency in diagnosis (Bien et al., 2018). DCNNs are a group of deep learning models that are designed to analyze images by learning different features directly from the pixel data. Using multiple layers of filters to detect simple patterns like edges and textures in early layers, and progressively detect more complex structures such as anatomical shapes and

tissue abnormalities in deeper layers (Bien et al., 2018). By training these models with large datasets, DCNNs improve their parameters to reduce prediction error, allowing these models to classify and diagnose different images without the need for the conventional use of a specialized person. This makes DCNNs especially useful for medical imaging tasks such as diagnosing MRIs, as they are built to analyze these images and improve from every dataset.

In the context of knee MRIs, there have been recent studies that have shown the potential of training DL models with MRI data in order to help radiologists and clinicians with assessing knee injuries (Siouras et al., 2022). This systematic review aims to collect the data from multiple similarly-designed studies that use DL models for diagnosis of knee injuries, and compile the information in order to summarize the status of these models and determine its effectiveness.

## **2. Methods**

### *2.1 Selection Study*

This systematic review was designed around the review question: When deep learning systems evaluate knee MRI for anterior cruciate ligament tears, meniscal tears or both, do they achieve non inferior diagnostic performance

(measured by AUC, sensitivity, specificity) and lower interpretation time compared to radiologists or clinicians? In this systematic review, we conducted a quantitative analysis and primarily focused on similarly-designed studies. Our search was conducted using the database Pubmed, originally using the terms 'Deep Learning AND Knee injuries AND Imaging'. Following the screening process, 715 studies were excluded based on irrelevance, primarily due to content that did not match the study designs needed for the review, and studies that were review articles itself. Out of the 24 studies chosen from the screening, 3 could not be retrieved. From these selected studies, 9 had to be excluded due to key differences in the studies such as the section of the knee being researched and how some of the data was analyzed. Our predefined inclusion and exclusion criteria required a range of specific metrics and a reference standard. The 12 studies included in the review have been read by two researchers and noted were compared. The PRISMA 2020 flow diagram visualizes the selection process.

Besides the 24 studies we selected, another 3 articles were used in order to contextualize and interpret our findings. These additional articles were found via Google and in selected articles' references.

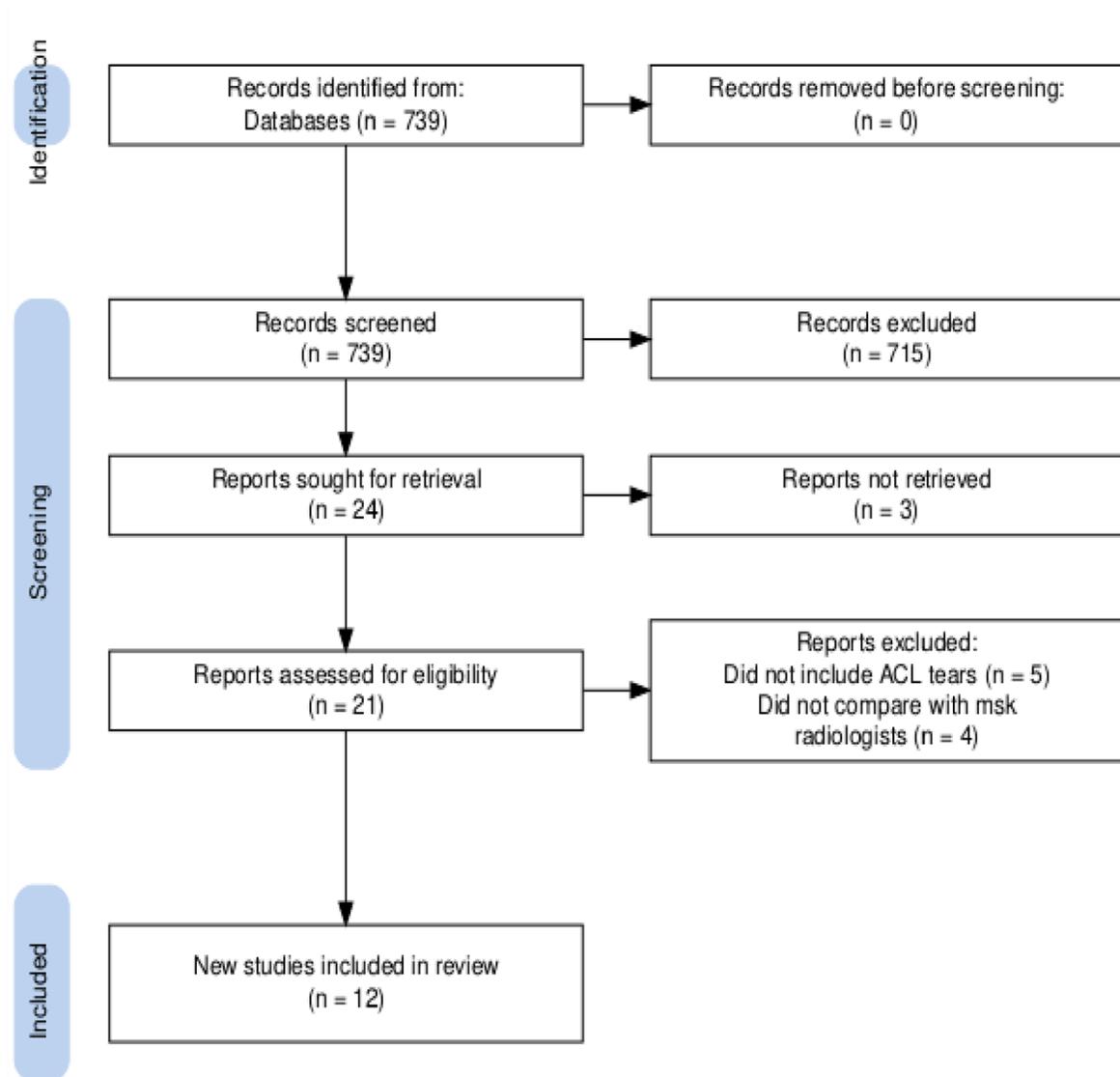


Fig. 1. PRISMA 2020 flowchart

## 2.2 Criteria and Structure

Despite the specified search of articles of similar structure for comparability, each study presented with varying design, datasets, reference standards, and

reported results. As a one pooled meta analysis would be incomplete, we extracted the same fundamental outcomes from each study observing patterns within study groups, conducting a structured qualitative analysis. The extracted measures were, AUC, sensitivity, specificity, accuracy, and reading time when available.

With just as demonstrated methodological differences, each of the 12 articles were categorized into three groups. The primary group consisted of studies yielding the highest clinical relevancy by design (reader-assist studies). It experimented how clinicians perform when reading MRIs, both with and without AI. This format conveys how helpful AI is to medical personnel in terms of improved decision making and speed. The second group (AI vs. clinician comparison studies), brings forth a direct comparison between AI performance and clinician performance, as the clinicians are unaware of the AI interpretation during their measurement. It puts into display how AI may be as good or even better than human execution. The final group narrows down on just AI performance (algorithm only diagnostic studies). This method utilizes a reference standard for comparability to AI.

Across the literature the deep learning models were engineered for either ACL tears, Meniscus tears, or both. This was an essential aspect within our study selection as the detection of injuries vary in difficulty; ACL tears read easier compared to meniscus tears in fact.

### 2.3 Bias Assessment

We judged the quality of each study and the risk of bias with the QUADAS-2 tool. Four areas were defined; patient selection, index test, reference standard, and flow and timing. The pertinency of each study to the central review question was considered. The QUADAS-2 results aided in the interpretation of the evidence but we did not exclude studies on those grounds.

		Risk of bias domains				Overall
		D1	D2	D3	D4	
Study	Bien 2018 (MRNet)	-	-	X	-	X
	Chen 2022 (JMIR AI)	-	-	-	-	-
	Fritz 2020 (Meniscus vs surgery)	+	+	+	+	+
	Germann 2020 (ACL heterogeneous MRI)	+	+	+	+	+
	Liu 2019 (Radiology:AI ACL)	X	-	+	-	X
	Minamoto 2022 (BMC MSD ACL)	-	-	-	-	-
	Tran 2022 (Eur Radiol external val)	-	-	X	-	X
	Wang 2024 (Arthroscopy clinicians+DL)	-	-	+	-	-
	Yang 2025 (QIMS plane comparison)	-	-	-	-	-
	Sun 2025 (Front Bioeng Biotech)	-	-	+	+	-
	Herpe 2025 (Eur Radiol AI assistance)	-	-	-	+	-
	Behr 2025 (IO arthroscopy crossover)	X	-	X	X	X

Domains:  
D1: Patient selection.  
D2: Index test.  
D3: Reference standard.  
D4: Flow & timing.

Judgement  
X High  
- Some concerns  
+ Low

Fig. 2. QUADAS-2 results

### **3. Results**

#### *3.1 Reader Assist and MRMC Studies: How AI Changed Clinician Performance*

The assistance perspective of the deep learning models were demonstrated in four studies, with an overall positive affirmation in clinical workflow. Throughout the literature, clinician performance benefited in at least one aspect with the reinforcement of AI. The specificity for ACL tear detection was enhanced with AI interpretation leading to a reduced quantity of false positives within the MRNet study. (Bien et al., 2018) Additionally there was a more analogous read and interpretation between multiple clinicians. One study that included six radiologists, conveyed that AI assistance optimized every diagnostic metric that they had reported. Pooled sensitivity increased from 81 % to 86 %, specificity increased from 88 % to 93 % and overall accuracy increased from 86 % to 91 % (Herpe et al., 2025). Agreement between readers was once again strengthened as AI support reduced variability between radiologists (Herpe et al., 2025). Another study demonstrated how AI assistance significantly increased clinician diagnostic accuracy for ACL rupture detection above a notable 96 %, with improvements seen in readers of a variety of experience levels (Wang et al., 2024). The most substantial improvements clearly were amongst less experienced clinicians. This brings forth the idea that AI assistance can truly narrow performance

gaps related to training level. The crossover study including both ACL and meniscal tears, demonstrated how AI assistance produced refined and targeted improvements rather than a general more standardized improvement. AI raised clinician sensitivity for medial meniscal tears and also significantly raised specificity for ACL tear detection reducing false positive diagnoses (Behr et al., 2018) The only study that reported interpretation time also noted a positive difference. According to Herpe et al. (2025) reading time was reduced by 38%, decreasing from around 92.1 to 57.7 seconds for each MRI examination. Although other studies had qualitatively described a similar pattern suggesting the overall timely efficiency of AI assistance as well.

### *3.2 AI Versus Clinician Studies: Standalone Performance Comparisons*

Five studies evaluated if AI would be able to reach the level of performance of a trained clinician; placing AI interpretation counter to human interpretation. Overall throughout the ACL-focused studies, deep learning models yielded high diagnostic performance quite consistently. Reported AUC values ranged from 0.935 - 0.98 (Germann et al., 2020; Luo et al., 2019; Minamoto et al., 2022). Sensitivity and specificity values were commonly above 0.90 conveying AI duality in its ability to both identify ACL tears effectively and exclude intact ligaments. One study reported very high accuracy (0.9943) for AI-based ACL detection, a limiting factor arose as a direct comparison with other studies was not attainable as AUC values were not provided (Chen et al., 2022). More

variation was observed in meniscal tear detection than ACL detection. In a refined study that separated medial and lateral meniscal tears, AI conveyed enhanced interpretation on medial meniscus tears compared to lateral tears. Medial meniscus detection had higher sensitivity and lateral meniscus detection had lower sensitivity but still displayed a high specificity (Fritz et al., 2020); this establishes how the DL model missed lateral meniscal tears more consistently than medial ones.

### *3.3 Algorithm-Only Studies: Model Performance*

Deep learning models for ACL and meniscal tears were put against standard references than a clinician read within three studies. The literature narrowed in on how efficiently the algorithms score on benchmarks, how image choices can alter results, and how well the models generalize. Tran et al. ran a large multicenter experiment in which the model reached an AUC of 0.939 inside controlled training centers, however when the model was utilized in hospitals, the AUC shifted between 0.922 but also 0.962 dependent on aspects such as the hospital and on the network, revealing its inconsistent nature. Yang et al. investigated the choice of MRI plane and its impact on accuracy. When sagittal, coronal as well as axial images were provided, ACL tear detection improved. The best run reached 0.944 sensitivity, 0.909 specificity and 0.925 accuracy for ACL tears. However, the same environment scored 0.783 accuracy for

meniscal tears. Sun et al., utilizing the public MRNet set as standard reference, measured a 0.968 overall accuracy on ACL or meniscal tears.

### *3.4 Average Diagnostic Performance by Study Design Category*

Taking all the data collected, we categorized and identified the effectiveness of each study based on the study design. These were separated into reader-assist studies, AI vs clinician comparison studies, and algorithm-only diagnostic studies. Overall, reader-assist studies demonstrated the highest combined clinical relevance, showing consistently strong diagnostic performance alongside measurable improvements in clinician sensitivity, specificity, and interpretation time. The AI v.s clinician reported similarly high AUC values, which shows that DL models can achieve performance that is in comparison to that of a trained radiologist. For Algorithm-only studies there were high AUCs, but greater variability, which reduces clinical strength when there is no human interaction. This pattern shows that even though the DL models can be strong in controlled conditions, integrating them with clinical interpretation may lead to more stable and accurate results.

## 4. Discussion

### *4.1 Clinical Relevance and Implications on Workflow*

This systematic review combines and synthesizes the current evidence on DL diagnoses of knee MRIs for ACL and meniscal tear detection, focusing on studies that directly compare the algorithms' performance with experienced clinicians. From the researched literature, DL models have been seen to demonstrate similar diagnostic performance to experienced radiologists, especially for ACL tears, with the reported AUC values typically being more than 0.90 (Bien et al., 2018; Germann et al., 2020; Liu et al., 2019; Minamoto et al., 2022). These findings suggest that modern DCNNs have reached a level of understanding that can allow reliable diagnosis of some common injuries on an MRI, which supports the potential role of them in a clinical setting. Furthermore, the most clinically relevant evidence came from reader-assist and multi-reader, multi-case study designs, where AI was integrated into the clinician's workflow. In these studies, the assistance of AI improved diagnostic accuracy, sensitivity, specificity, and inter-reader agreement, with the greatest benefit being seen when comparing the DL models with less experienced readers (Herpe et al., 2025; Wang et al., 2024). This pattern shows that DL models can function effectively as supporting tools to enhance consistency

and reduce variable interpretations, instead of outright replacing conventional diagnosis.

Besides the diagnostic accuracy, workflow efficiency is another important clinical improvement from DL-model interpretation. Reducing interpretation times were reported with the use of these DL models, which suggests a potential role for DL models to help reduce workload for radiologists and improve efficiency in high-volume clinical settings (Herpe et al., 2025). However, this diagnostic performance was not uniform across injury types. Meniscal tear detection had more variability and a lower sensitivity in comparison with ACL tear detection, emphasizing the continued importance for clinician oversight and the cautious use of DL models (Fritz et al., 2020; Yang et al., 2025).

#### *4.2 Strengths and Limitations*

The primary strength of this systematic review is its focus on clinically relevant study designs, including reader-assist and clinician-comparison studies, which provide insight into real-world applications of DL systems. The use of the QUADAS-2 framework further strengthens the interpretation of results by systematically addressing risk of bias across diagnostic domains. Even with promising results, there were several methodological limitations noted across the researched studies. The assessment using the QUADAS-2 tool

showed recurring concerns in regards to patient selection, index test interpretation, and reference standards. Many studies had used retrospective designs or public datasets, which could have introduced selection bias and reduced generalizability (Bien et al., 2018; Sun et al., 2025). Furthermore, blinding procedures and prespecified decision thresholds for the DL models were usually insufficiently reported, leading to uncertainty in the index test domain.

Reference standards substantially varied across the studies, with some using arthroscopic confirmation and others relying on a consensus among radiologists. While this consensus is commonly accepted in imaging research, it still remains an imperfect alternative to surgical confirmation and can inflate the estimates of diagnostic performances (Tran et al., 2022). The flow and timing were reported inconsistently, specifically in regards to the interval between MRI collection and confirming the reference standard. These methodological inconsistencies show the importance for more standardized reporting and study design in future research regarding DL models and diagnosing MRIs.

#### *4.3 Future Directions and Need for Research*

Despite the present proof which indicates that DL models can reach the same diagnostic level as medical experts in the case of ACL and meniscal tear

recognition in knee MRI, still there are considerable gaps that need to be filled before frequent clinical use could be achieved. Most of the current research is retrospective and constrained by the use of internal validation or specially selected sets of data, which results in that the confidence in the hypothesis of being applicable in the real-world is quite limited (Bien et al., 2018; Germann et al., 2020; Sun et al., 2025). There is a consensus in the literature that the foremost priority for the future research is to conduct prospective, multicenter studies for validation of the DL models across various patient populations and imaging protocols to ensure that there is performance similar to the one under the real clinical conditions (Kelly et al., 2019; Tran et al., 2022).

In addition, the reader-assist trials that are to be conducted prospectively would be necessary to indicate what the impact of DL models would be on the decision-making process of the clinicians, their confidence in the diagnosis, and the efficiency of the workflow. The current body of evidence seems to suggest that AI support can be most beneficial for less experienced readers, while at the same time prolonging the diagnosis time (Herpe et al., 2025; Wang et al., 2024). So, future research directions will not only include but will also focus on an analysis based on the readers' level of experience, predetermined decision thresholds, and a reference standard using surgical

confirmation whenever possible in order to uncover the real impact of these improvements in clinical practice.

Lastly, the successful absorption of the technology in the clinic will mainly depend on the acknowledgment of the large-scale implementation issues like the doctors' trust, the comprehensibility of the model outputs, and the smooth incorporation into the current radiology routines. The deep learning models should be created to support but not to take over the role of clinician's expertise, with clearly specified performance metrics and clinical accountability.

## **5. Conclusion**

This systematic review summarizes evidence on the deep learning based interpretation of knee

MRIs for ACL and meniscus tear detections; conveying the well-supported diagnostic performance of AI models in a variety of study designs. Throughout reader-assist, AI vs. clinician, and algorithm-only studies, deep learning models consistently conducted high discrimination for ACL tears and variable performance for meniscal tears. Significantly, in clinical settings AI is a crucial factor in increasing clinician specificity, inter-reader agreement, and, where applicable, reduction in interpretation time, with an advantage for less

experienced readers. From a public health point of view, such improvements can truly help the quality of musculoskeletal care. It can eliminate the prominent gap in healthcare that we see within under-resourced regions, where access to subspecialty radiologists may be limited. The rapid growth of artificial intelligence should be harnessed effectively to our benefit. With research that prioritizes driven evaluation, deep learning systems can successfully improve access and quality of musculoskeletal imaging care.

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### **Ethics**

This article does not involve primary data or human subjects; formal ethics approval was not applicable.

### **Conflict of Interest**

Author(s) have no conflicts of interest relevant to this article to disclose.

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# **Nudging the Needle: Using Behavioral Intervention to Reduce Vaccine Hesitancy Among Healthcare Providers**

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## **Abstract**

**Background:** Vaccine Hesitancy among healthcare workers (HCWs) remains a critical challenge to public health. These challenges are especially prevalent during periods of infectious disease outbreaks such as COVID-19, HPV, and Influenza. This meta-analysis investigates vaccine hesitancy among HCWs based on various factors, including race, age, and occupational hierarchy within the healthcare environment. This article brings findings from behavioral science, public health, medical ethics, and health systems research together to understand the effectiveness of nudging, a type of behavioral interventions, to improve vaccine uptake. Nudging involves using subtle changes to influence people's decisions in predicted ways, without removing autonomy from the decision-making process.

**Methods:** A systematic literature search was conducted, yielding a final sample of 10 articles consisting of large-scale surveys, randomized control

trials (RCT), and observational studies to understand the determinants of hesitancy and the impact of nudging strategies on mitigating this hesitancy. Nudging techniques analyzed included reminders, default option, social norms, emotional appeal, information framing, and education.

**Findings:** Our meta-analysis demonstrated significant prevalence of vaccine hesitancy among Black and Hispanic/Latino HCWs as well as ancillary or non-medical staff in the occupational hierarchy. Vaccine hesitancy among HCWs was mainly due to concern of potential side effects, distrust towards the effectiveness of vaccines, and misinformation about the vaccine. Evidence revealed that reminders, default-setting interventions, and social norm interventions were the most effective nudging techniques to increase vaccination. Overall, findings suggest that using situationally adapted behavioral intervention strategies can effectively reduce vaccine hesitancy among HCWs, encouraging an increase in the uptake of vaccines via a relatively inexpensive, scalable approach.

## **Introduction**

The World Health Organization (WHO) characterizes vaccine hesitancy as one of the top 10 threats to global health (Terrell et al., 2012). Vaccination behavior is often determined by three main factors: individual's views about

vaccines and disease, social networks, and interventions that directly impact behavior without altering an individual's beliefs (Bewer, 2021). Vaccine hesitancy is defined as not planning on, being unsure about, or planning to delay vaccination (Momplaisir et al., 2021). Research has found that reasons why individuals may delay or refuse vaccination include reduced vaccine availability or accessibility, poor health literacy, difficulty or inconvenience scheduling a vaccination appointment, fear of adverse effects to the vaccine, mistrust of health authorities and providers, and personal or religious beliefs (Terrell et al., 2012). Vaccine hesitancy poses threats to the success of vaccination programs since the effectiveness of vaccines is limited by the rate of vaccine uptake by populations (Terrell et al., 2012).

The Center for Disease Control (CDC) urges healthcare workers to get vaccinated to protect themselves, in addition to their family and patients (Hoven, 2020). In addition, WHO encourages healthcare workers to get vaccinated to minimize disease-generated mortalities, prevent nosocomial outbreaks, and limit absenteeism in the healthcare workplace (Cantarelli et al., 2021). In European nations, the average vaccination rate among healthcare workers is less than 30% (Hoven, 2020). Previous research also suggests that vaccine hesitancy differs based on the race of healthcare workers, with hesitancy being the greatest among Black and Hispanic/Latino healthcare workers (Momplaisir et al., 2021). Vaccination trends among healthcare

workers closely reflect those of the general public since healthcare workers are often seen as role models by society, thus, by increasing vaccination among healthcare workers, it is likely that this will also encourage an increase in vaccination among the general public (Hoven, 2020).

Behavioral intervention techniques have been used to combat vaccine hesitancy. Nudging is a form of behavioral intervention that alters people's behavior in a predictable manner without using direct persuasion or financial incentives (Barbaroux et al., 2021). Types of nudging tools include reminders, educational videos, incentives, and formatting a decision choice to appear to be the default option. This low-cost technique has been found to promote a variety of healthy behaviors, such as healthy eating and exercise in addition to vaccine uptake (Dai et al., 2021).

However, the effectiveness of nudging has been found to be limited by a person's preexisting desire to live a healthier lifestyle (Hoven, 2020). In addition, previous research has criticized nudging to be manipulative and disrespectful to the autonomy of decision-making individuals and can even be seen as a violation of personal liberty when the government employs this method (Hoven, 2020). Thus, research suggests that in order to maintain ethical uses of nudging, the nudgee (a person on which nudging techniques are used on) must be able to easily opt-out of decisions and be presented with transparent choices that are as least intrusive as possible (Hoven, 2020).

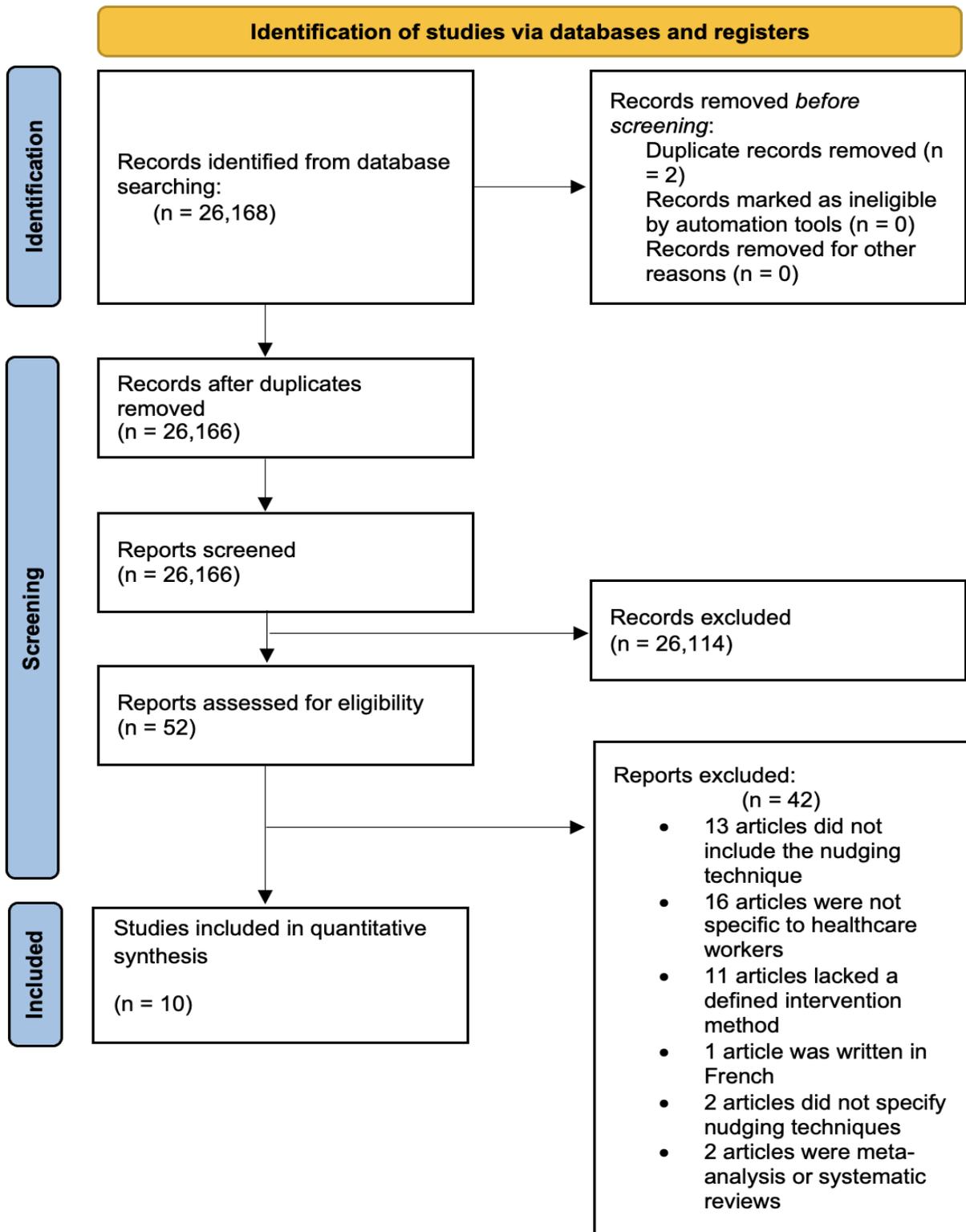
## **Methods**

In this meta-analysis, a systematic literature review was conducted to identify studies evaluating vaccine hesitancy among healthcare workers and the impact of behavioral interventions on reducing this hesitancy. Specifically, articles that included nudging strategies, a type of behavior intervention, on vaccine uptake were examined. Using the PubMed database in this search strategy, the usage of predefined keyword combinations such as “Vaccine Hesitancy,” “healthcare workers,” “vaccination,” “nudging intervention,” “behavioral nudges,” “racial/ethnic differences,” and “vaccine uptake” were used. We selected these key words based on prior research examining the patterns of vaccine hesitancy, adapting the key words by understanding the effectiveness of nudging techniques used in other studies.

Through further review, we assessed that studies were only eligible if they were published in English, peer-reviewed, and primarily focused on vaccination rates among the healthcare worker population. Articles that did not meet this specified criterion (i.e. editorials, non-healthcare populations, non-English language studies, and lack of measurable outcome on vaccine hesitancy) were excluded during the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) screening. Both randomized controlled trials (RCTs) and the non-RCTs were included to capture the

variations in intervention types (Bahar Madran et al., 2023; Cantarelli et al., 2021).

A total of 26,168 studies were identified using the search terms described. After eliminating two duplicate records, 26,166 studies underwent title and abstract screening. As a result of this screening process, 26,156 studies were excluded based on irrelevance primarily because sources excluded information relating to nudging techniques, limited emphasis on vaccine hesitancy intervention among healthcare workers specifically, or nondefinitive intervention techniques. This resulted in 10 studies being analyzed in this meta-analysis.



**Figure 1.** Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) flowchart demonstrating the article selection process.

The risk of bias assessment for each study analyzed was conducted through the Cochrane Risk of Bias framework (RoB). This tool is used to check how reliable and trustworthy study results are by identifying possible sources of error. This helps highlight whether findings are affected by issues such as participant selection or lack of control over outside factors (Terrell et al., 2023). The randomized controlled trials (RCTs) were evaluated through RoB 2 (Barbaroux et al., 2021; Dai et al., 2021), as the randomization reduces the point of confounding variables. The non-randomized and observational studies were screened through ROBINS-I due to the fact that these designs are more prone to bias from voluntary participation and lack of random sampling.

		Risk of bias domains					
		D1	D2	D3	D4	D5	Overall
Study	Barbaroux et al., 2021						
	Belle & Cantarelli, 2024						
	Dai et al., 2021						
	Diaz et al., 2025						
	Santos et al., 2021						
	Schmidtke et al., 2019						
	Ugarte et al., 2022						

Domains:  
D1: Bias arising from the randomization process.  
D2: Bias due to deviations from intended intervention.  
D3: Bias due to missing outcome data.  
D4: Bias in measurement of the outcome.  
D5: Bias in selection of the reported result.

Judgement  
 Some concerns  
 Low

**Figure 2.** Assessment of risk of bias in RCTs using RoB 2. Green indicates a low risk, yellow indicates some concern, and red indicates a high risk of bias.

		Risk of bias domains							
		D1	D2	D3	D4	D5	D6	D7	Overall
Study	Bahar et al., 2023	-	+	+	+	-	+	+	-
	Daicampi et al., 2025	-	+	+	+	+	+	+	+
	de Vires et al., 2022	X	-	+	+	-	-	+	-

Domains:  
D1: Bias due to confounding.  
D2: Bias due to selection of participants.  
D3: Bias in classification of interventions.  
D4: Bias due to deviations from intended interventions.  
D5: Bias due to missing data.  
D6: Bias in measurement of outcomes.  
D7: Bias in selection of the reported result.

Judgement  
 Serious  
 Moderate  
 Low

**Figure 3.** Assessment of risk of bias in observational studies using ROBINS-I. Green indicates a low risk, yellow indicates some concern, and red indicates a high risk of bias.

Data extraction include the study design, participant demographics, and the types of behavioral intervention strategies examined in each study. These elements were linked to primary outcomes such as vaccine hesitancy and

uptake. Studies focusing on vaccine hesitancy related to influenzas, HPV, and COVID-19 to name a few were included in this meta-analysis

## **Results**

Understanding the intervention studies, three of the primary nudging strategies that were most frequently implemented: 1. *Reminder and scheduling-based interventions*, 2. *Setting vaccination as the default option*, and 3. *Reframing information*. Reminder-based strategies such as automated messaging and simplified appointment scheduling was prevalent among two studies and assessed to produce the strongest behavioral shift. It resulted in a vaccination uptake increasing by 38.2%. Other peer endorsement campaigns like mentorship or leadership encouragement showed moderate effectiveness which was between a 15.6-21.4% increase. In contrast, educational prompts occupied two articles but had only a small portion of influence which was 13.9% of hesitant responses which showed limited standalone impact (Dai et al., 2021).

Further subgroup analysis revealed that the response varied based on the professional role. Among the nursing personnel, 47.8% indicated an increase in vaccination likelihood after reminder-based interventions compared to the 28.4% for peer-based strategies and 11.2% for informational measures (Bahar Madran et al., 2023). Physicians demonstrated a higher

responsiveness to education focused approaches compared to administrative staff which were most influenced by simplified access and scheduling support (Bahar Madran et al., 2023). A specific note goes to the Turkish mixed methods study which implemented multiple nudging strategies simultaneously. This helped prevent isolation of individual effects and had the highest uptake change of 52.6% of hesitant participants.

Reference	Method	Disease Discussed	Intervention Method Used	Outcome
<b>Bahar et al., 2023</b>	Mixed-methods observational study	COVID-19	Nudging: weekly PCR testing for unvaccinated staff every 2 days (default setting) Small group education seminars	Among the 156 vaccine hesitant individuals, 83.3% were vaccinated after weekly PCR 8.3% additionally vaccinated after intensified PCR and seminar phase Staff vaccination increased from 95.5% to 99.67% Key drivers were distrust, uncertainty, and media influence

<b>Barbaroux et al., 2021</b>	RCT	Influenza	Digital reminder nudges	Reminders were well accepted but did not lead to a significant increase in vaccination uptake  Concluded that acceptance of nudges does not guarantee behavioral impact
<b>Belle &amp; Cantarelli, 2024</b>	RCT	Influenza	Emotional appeal	No significant probability of getting vaccinated between medical doctors and administrative staff  Emotional appeal included the personal benefits of vaccination, protection for loved ones, and protection of HCWs' patients  Nurses were most likely to vaccinate to protect patients
<b>Dai et al., 2021</b>	RCT	COVID-19	Text-based reminders  Education  Reframing information	30% of American adults are unwilling/uncertain about getting vaccine in late June 2021  Findings suggest that the biggest barrier to increasing COVID-19 vaccinations is getting people to schedule an appointment for their first dose

<b>Daicampi et al., 2025</b>	Clustered quasi-experimental study	Influenza	Default settings	<p>Vaccination rate increased as a result of nudging technique</p> <p>Reasons why people still refused vaccination included that participants were already vaccinated (29%), concerns about potential adverse effects (14%), doubts about vaccine's efficacy and safety (11%), other doubts (4.8%)</p>
<b>De Vries et al., 2022</b>	Cross-sectional survey	Influenza	<p>Default settings (opt-out)</p> <p>Digital reminders</p> <p>Rewards</p> <p>Education</p>	<p>Most nudges were rated as acceptable</p> <p>The peer vaccination and digital reminders were the most successful</p> <p>Reward-based incentives were least successive</p> <p>Nudge acceptability was positively associated with being vaccinated</p>
<b>Diaz et al., 2025</b>	RCT	HPV	<p>Text-message reminders</p> <p>Information framing</p> <p>Social norms</p>	<p>Significant increase in vaccination rates in all intervention groups compared to control</p> <p>Calculates that for every dollar spent on intervention, \$3.6 to \$5.75 of economic benefit are generated</p> <p>Digital nudges are a scalable, inexpensive strategy that can be implemented in healthcare settings with limited resources</p>

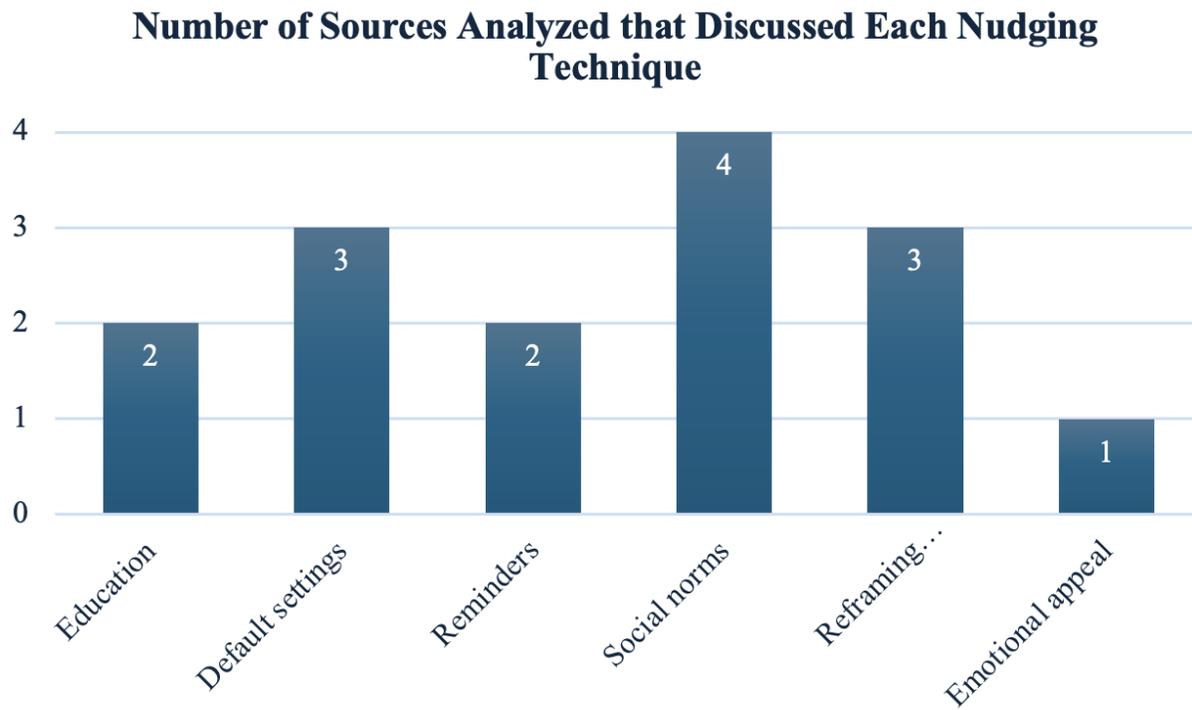
<b>Santos et al., 2021</b>	RCT	COVID-19	Information reframing Social norms	No significant difference between the nudging technique used Nudging technique led to a greater amount of vaccination among HCWs compared to the control
<b>Schmidtke et al., 2019</b>	RCT	Influenza	Education Social norms	Study found no statistically significant evidence that social norm nudges affected vaccination uptake Found that nudges work differently based on a person's profession within healthcare
<b>Ugarte et al., 2022</b>	RCT	COVID-19	Social norm	The methods used in this study increases requests for vaccine-related information, potentially reducing vaccine hesitancy While the intervention group showed greater information-seeking behavior, the study found that there is no statistically significant difference in vaccination rates between the intervention and control groups.

**Figure 4.** Summary table discussing the study method, diseases discussed, intervention methods used, and outcomes of each study analyzed in this meta-analysis.

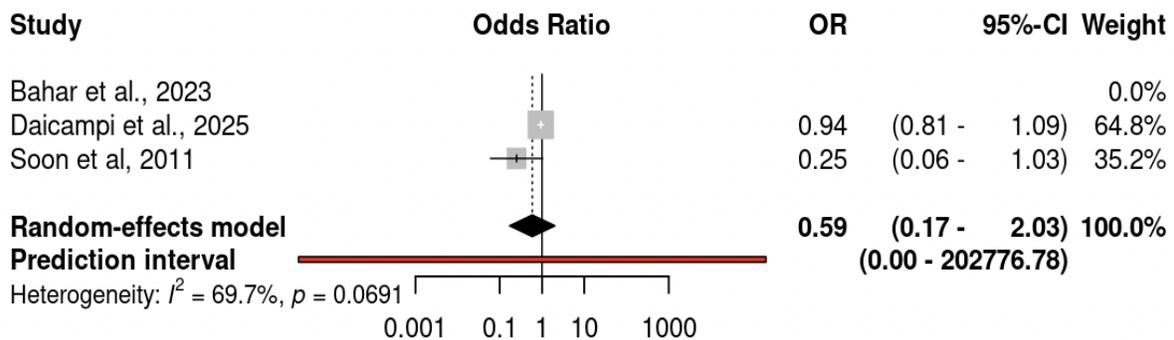
NUDGING TECHNIQUE	STUDIES ANALYZED	TOTAL STUDIES
<b>Education</b>	<ul style="list-style-type: none"> <li>• Bahar et al., 2023</li> <li>• Diaz et al., 2025</li> </ul>	2
<b>Default settings</b>	<ul style="list-style-type: none"> <li>• Bahar et al., 2023</li> <li>• Dai et al., 2021</li> <li>• Daicampi et al., 2025</li> </ul>	3
<b>Reminders</b>	<ul style="list-style-type: none"> <li>• Barbaroux et al., 2021</li> <li>• Dai et al., 2021</li> </ul>	2
<b>Social norms</b>	<ul style="list-style-type: none"> <li>• Diaz et al., 2025</li> <li>• Santos et al., 2021</li> <li>• Schmidtke et al., 2019</li> </ul>	4

	<ul style="list-style-type: none"> <li>• Ugarte et al., 2022</li> </ul>	
<b>Reframing information/outcomes</b>	<ul style="list-style-type: none"> <li>• Dai et al., 2021</li> <li>• Diaz et al., 2025</li> <li>• Santos et al., 2021</li> </ul>	3
<b>Emotional Appeal</b>	<ul style="list-style-type: none"> <li>• Belle &amp; Cantarelli, 2024</li> </ul>	1

**Figure 5.** Nudging techniques used in each study analyzed.



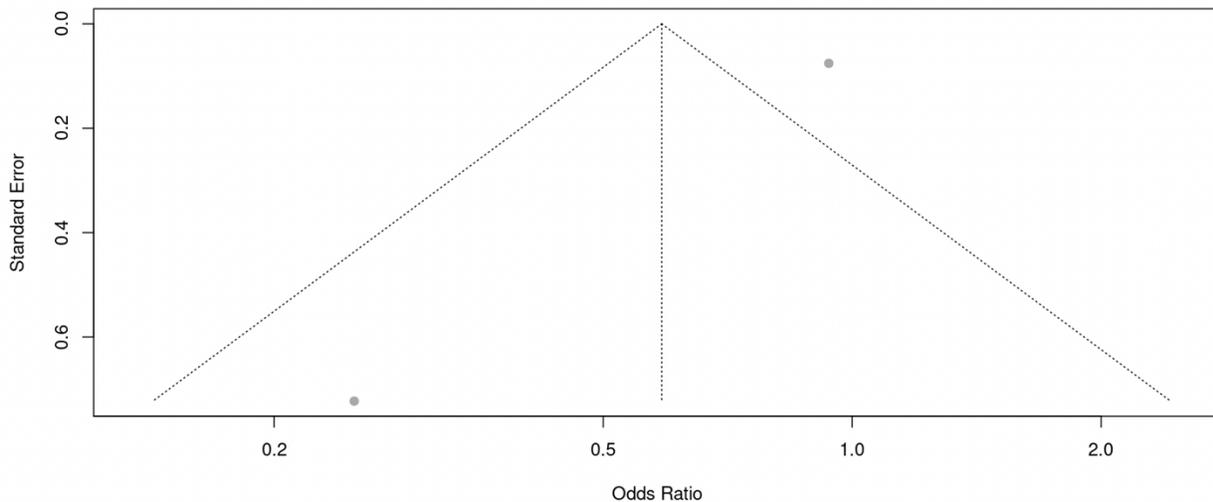
**Figure 6.** Number of times nudging techniques were mentioned in the studies analyzed to reduce vaccine hesitancy and instead increase vaccination uptake among healthcare workers.



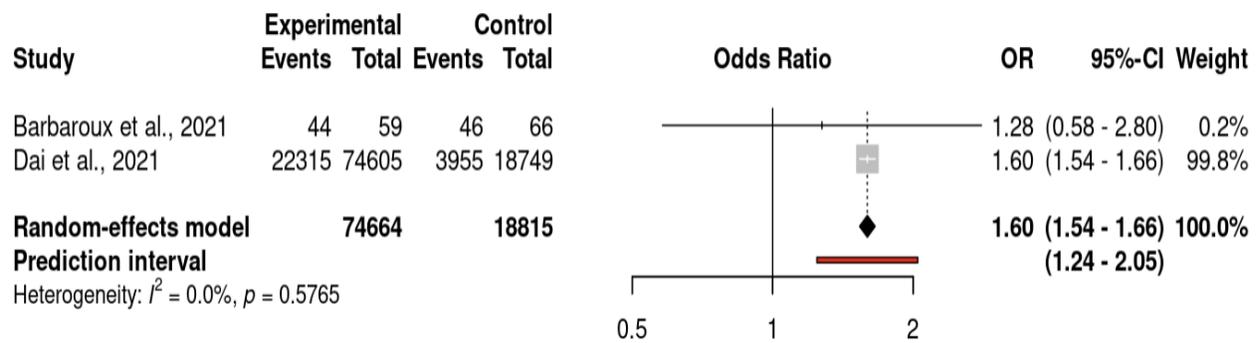
**Figure 7.** Forest plot for the observational studies analyzed in this study that discuss default settings as an intervention method to reduce vaccine hesitancy among HCWs.

According to Figure 7, the pooled OR of 0.59 with a 95% confidence interval of (0.00, 202776.78) for observational studies that analyzed default

settings demonstrates that this nudging technique resulted in lower odds of vaccine acceptance compared with the control condition by 41%. The large confidence interval provides substantial uncertainty about the true effect of default settings as a nudging technique in reducing vaccine hesitancy among HCWs. An  $I^2$  value of 69.7% represents substantial heterogeneity and that 69.7% of the variability in the observed effect sizes reflects true differences between studies rather than sampling error. The association did not reach statistical significance ( $p = 0.069$ ). There is a 6.91% probability of overserving an effect as large or larger than the one found by chance in terms of the odds of the outcome associate with the default settings intervention.

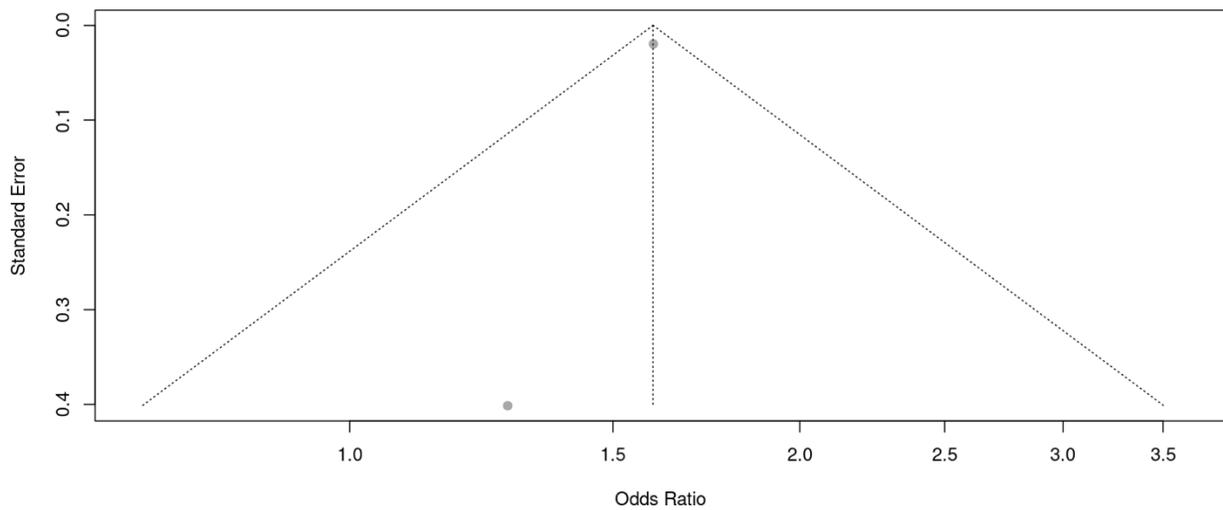


**Figure 8.** Funnel plot for the observational studies analyzed in this study that discuss default settings as an intervention method to reduce vaccine hesitancy among HCWs.

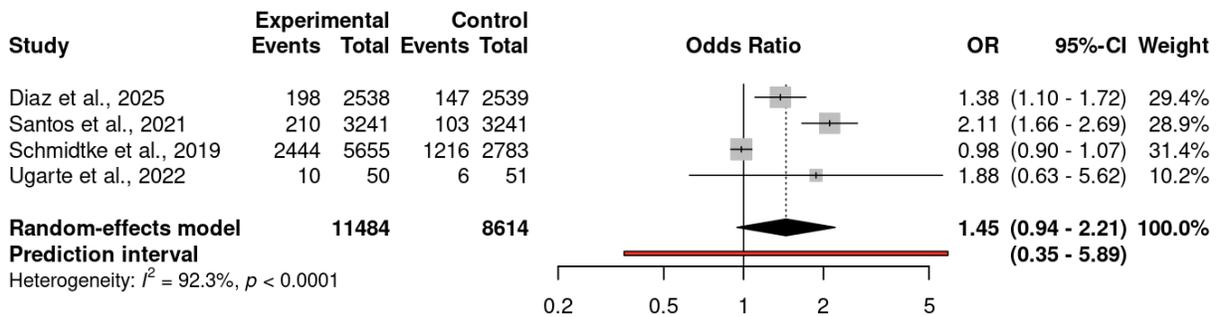


**Figure 9.** Forest plot for the RCTs analyzed in this study that discuss reminders as an intervention method to reduce vaccine hesitancy among HCWs.

According to Figure 9, the pooled OR of 1.60 with a 95% confidence interval of (1.24, 2.05) for RCTs that analyzed reminders demonstrates that this nudging technique resulted in higher odds of vaccine acceptance compared with the control condition. This value indicates that HCWs are 60% more likely to become vaccinated with the reminder nudge, highlighting the potential effectiveness of reminders as a behavioral intervention to improve vaccine uptake. An  $I^2$  value of 0.0% indicates no observed heterogeneity, meaning the effect of reminders as a nudging technique on vaccine hesitancy was consistent across all included studies. The association did not reach statistical significance ( $p = 0.5765$ ). There is a 57.65% probability of overserving an effect as large or larger than the one found by chance in terms of the odds of the outcome associate with the reminder intervention.



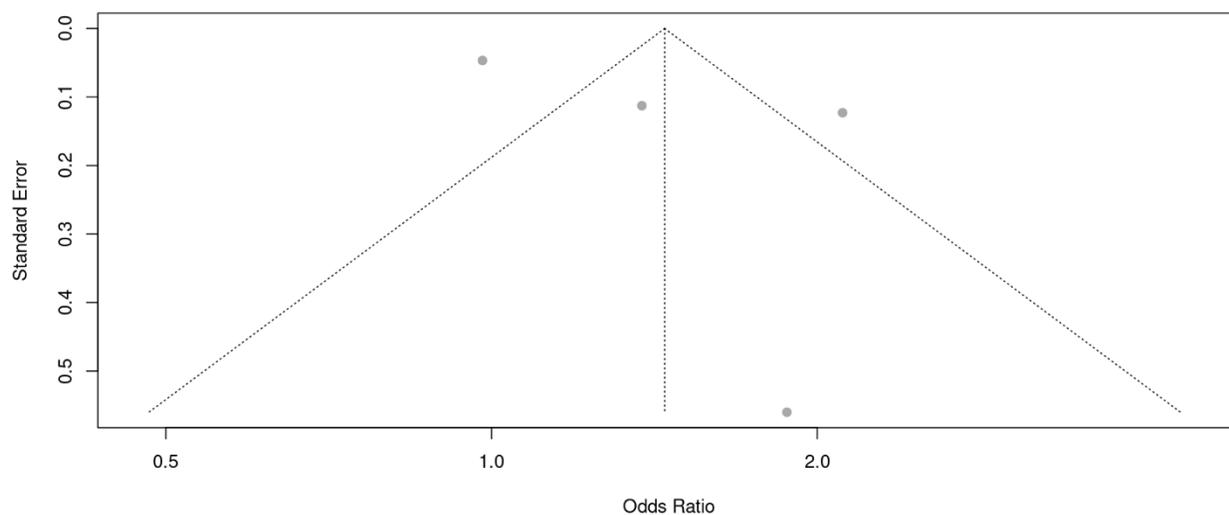
**Figure 10.** Funnel plot for the RCTs analyzed in this study that discuss reminders as an intervention method to reduce vaccine hesitancy among HCWs.



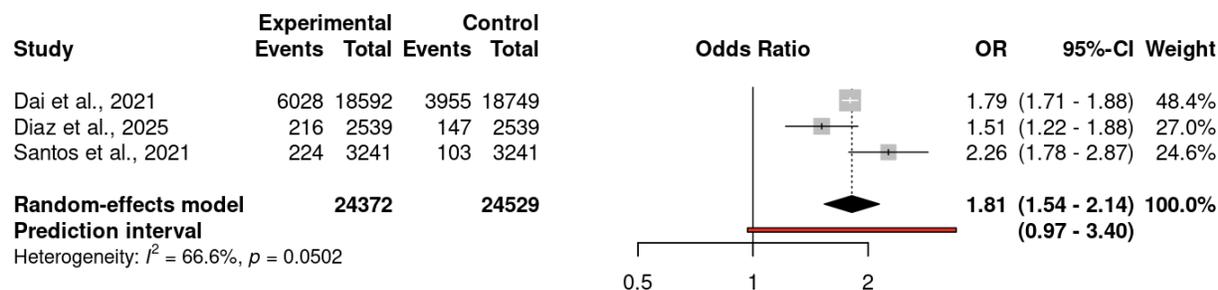
**Figure 11.** Forest plot for the RCTs analyzed in this study that discuss social norms as an intervention method to reduce vaccine hesitancy among HCWs.

According to Figure 11, the pooled OR of 1.45 with a 95% confidence interval of (0.35, 5.89) for RCTs that analyzed social norms demonstrates that this nudging technique resulted in higher odds of vaccine acceptance

compared with the control condition by 45%. Since the confidence interval contains 0, the effects of these studies are not statistically significant. An  $I^2$  value of 92.3% represents very high heterogeneity and that 92.3% of the variability in the observed effect sizes reflects true differences between studies rather than sampling error. The association reached statistical significance ( $p < 0.0001$ ). However, the wide confidence interval and very high heterogeneity indicate substantial variation in effect size across studies, suggesting that effectiveness of the social norms nudge may depend on study-specific factors such as implementation method or population.



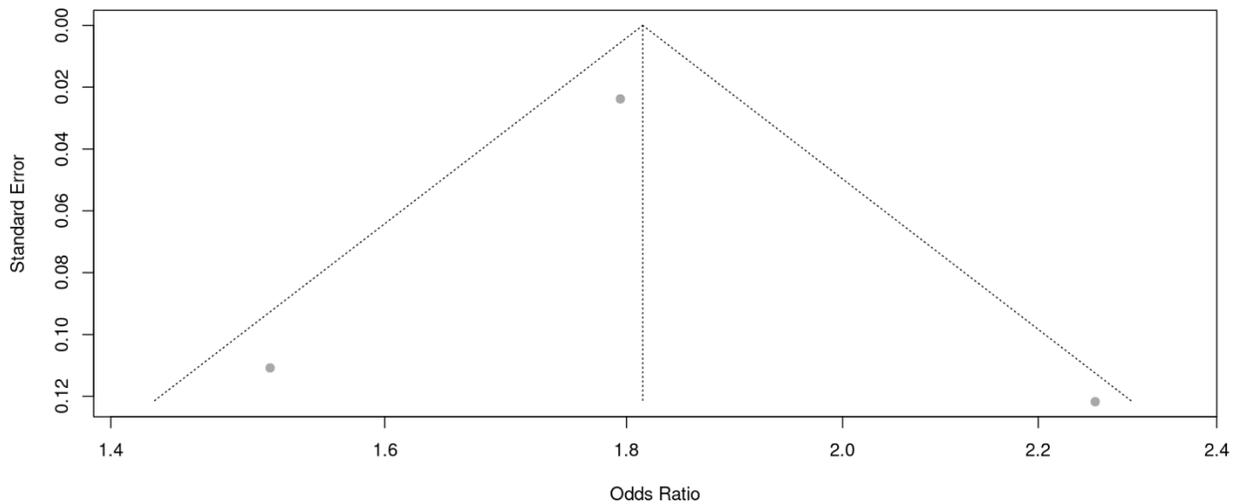
**Figure 12.** Funnel plot for the RCTs analyzed in this study that discuss social norms as an intervention method to reduce vaccine hesitancy among HCWs.



**Figure 13.** Forest plot for the RCTs analyzed in this study that discuss reframing as an intervention method to reduce vaccine hesitancy among HCWs

According to Figure 13, the pooled OR of 1.81 with a 95% confidence interval of (0.97, 3.40) for RCTs that analyzed reframing demonstrates that this nudging technique resulted in higher odds of vaccine acceptance compared with the control condition by 19%. The large confidence interval provides substantial uncertainty about the true effect of default settings as a nudging technique in reducing vaccine hesitancy among HCWs. An  $I^2$  value of 66.6% represents substantial heterogeneity and that 66.6% of the variability in the observed effect sizes reflects true differences between studies rather than sampling error. The association did not reach statistical significance ( $p = 0.0502$ ). There is a 5.02% probability of overserving an effect as large or larger than the one found by chance in terms of the odds of the outcome associate with the default settings intervention. Overall, this information

indicates that the effectiveness of nudging varies across studies and may be dependent on factors such as intervention type or study population.



**Figure 14.** Funnel plot for the RCTs analyzed in this study that discuss reframing as an intervention method to reduce vaccine hesitancy among HCWs.

## Discussion

The findings from this meta-analysis synthesizes current evidence on vaccine hesitancy among healthcare workers and highlights the effectiveness of low-cost nudging techniques as a behavioral intervention method to encourage vaccine uptake. Across these studies, a consistent pattern emerged, showing that even though HCWs who have high levels of medical knowledge

and experience direct exposure to vaccine-preventable diseases still express vaccine hesitancy. This hesitancy is shaped by the interactions between their professional role, perceived level of risk, cultural and ethnic background, and trust in vaccines. These findings reinforce the idea that information about vaccines alone is insufficient in influencing the vaccination behavior of HCWs, but also requires situationally adjusted behavioral intervention strategies.

Our analysis demonstrates that the nudging strategy, which includes default appointments, reminders, setting vaccination as a social norm, education, emotional appeal, and framing techniques, can effectively reduce hesitancy in diverse healthcare environments. Overall, our analysis found that interventions that minimize friction (e.g. simplifying vaccination appointments via reminders and automatic appointment scheduling) and emphasizing vaccination norms demonstrated some of the most consistent gains. These results align with previous behavioral science literature that suggest that small changes can create meaningful decision shifts without limiting the autonomy of the decision-making process, an important ethical responsibility in public health practices.

A key contribution of this review is that it uses a multidisciplinary lens, bringing findings from behavioral science, public health, medical ethics, and health systems research together. This approach highlights that the vaccine choices made by HCWs are shaped not only by clinical reasons, but also by

personal, institutional, societal, and cognitive biases. This idea explains why we conclude that nudging is most effective when situationally adjusted.

Despite these promising findings, there are several limitations to this meta-analysis. To start, many studies include an observational or quasi-experimental design, limiting the inferences that could be made. Similarly, most of the other studies used randomized controlled trials (RCTs), which are limited by their poor ability to be generalized and potential for bias. Additionally, the vast heterogeneity across the populations studied within the sources used for this meta-analysis, whether based on race and ethnicity, geolocation, cultural norms, occupational subgroups, vaccine types, and healthcare settings may influence the generalizability of the results of this meta-analysis.

Given this information, future research should prioritize evaluating randomized trials to evaluate the long-term sustainability of behavioral interventions similar to those identified in this study, exploring how nudges can be tailored to diverse HCW populations. In addition, gaps in research continue to exist when researching these effects in developing countries (Ellingson et al., 2019). Based on the results of this study, the most durable impact would likely be yielded if nudging was integrated with broader institutional strategies, such as transparent risk communication, to maintain ethical implementation of vaccine encouragement.

While the pooled log odds ratio provides an overall estimate of the effect of behavioral nudges as an intervention technique to increase vaccine uptake among HCWs, the high heterogeneity suggests that caution is advised when generalizing this average effect to any single context. Subgroup analyses by study design, vaccine type, and intervention method may help clarify sources of variability and identify conditions in which nudges are most effective.

Overall, this review supports the conclusion that nudging offers a practical and scalable approach to mitigate vaccine hesitancy among healthcare workers, encouraging the uptake of vaccines to promote public health and decrease future disease outbreaks. By understanding how to embed behavioral techniques into healthcare systems, institutions can better support the decision-making process of HCWs when it comes to confidence in vaccination, increasing resiliency among populations suffering from disease outbreaks.

## **Disclaimers and Declarations**

### **i. Funding**

External funding was not secured for this study.

### **ii. Financial Disclosure**

The authors have no financial relationships relevant to this article to disclose.

### **iii. Ethics**

This article does not involve primary data or human subjects; formal ethics approval was not applicable.

### **iv. Conflict of Interest**

The authors have no conflicts of interest relevant to this article to disclose.

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# **Challenges in Addressing Cardiovascular Disease Among Immigrant Populations: A Literature Review**

Harshavardhini Nallakannu, MD, MPH

## **ABSTRACT**

**BACKGROUND:** Cardiovascular disease (CVD) is the leading cause of death in the United States. Despite advances in prevention and treatment, immigrant populations continue to experience disproportionate cardiovascular risk due to social, economic, and systemic barriers. **OBJECTIVE:** This review examines cardiovascular disease burden among immigrant populations, identifies disparities in care, and highlights social determinants and strategies to reduce these inequities.

**METHODS:** A narrative literature review was conducted using PubMed, Scopus, Web of Science, Google Scholar, and NIH databases. English-language studies published between 2013 and 2023 focusing on adult immigrant populations and cardiovascular outcomes were included. **RESULTS:** Immigrant populations face higher cardiovascular risk influenced by socioeconomic disadvantage, limited healthcare access, language barriers,

and acculturation-related changes. Culturally tailored, community-based interventions demonstrated improvements in cardiovascular risk factors and preventive care use.

**CONCLUSIONS:** CVD disparities among immigrants are driven by systemic and social determinants. Multilevel, culturally sensitive interventions are essential to improving cardiovascular outcomes and reducing inequities.

## **INTRODUCTION**

Heart disease remains the leading cause of death and disability in the United States, encompassing conditions such as heart disease, stroke, heart failure, and atrial fibrillation (Centers for Disease Control and Prevention [CDC], 2023). It affects men, women, and most racial and ethnic groups. In 2023, approximately 919,032 deaths were attributed to cardiovascular disease, representing one in three deaths. Beyond the human toll, heart disease also imposes a substantial economic burden, costing \$417.9 billion from 2020 to 2021 in healthcare services, medications, and lost productivity (CDC, 2024).

Although advances in acute care and cardiovascular risk prevention have improved outcomes in Europe and North America, these benefits are not equally distributed. Migrants experience higher rates of cardiovascular morbidity and mortality compared with host populations (Hacker et al.,

2015). Addressing cardiovascular health among migrants is particularly important given the projected growth in global migration. In 2020, international migrants numbered approximately 281 million, representing 3.6% of the world population, a figure expected to rise in the coming years (International Organization for Migration [IOM], 2020). Immigrants in the U.S. face substantial barriers to quality cardiovascular care, including language challenges, limited access to affordable healthcare, and underrepresentation of certain racial and ethnic groups in the cardiovascular workforce. Tackling these issues through increased workforce diversity, improved language accessibility, and culturally sensitive care is essential to reducing disparities (American College of Cardiology [ACC], 2025).

In this paper, I conducted a literature review to examine the burden of cardiovascular disease among immigrant populations, identify disparities in care, explore social and systemic factors affecting cardiovascular health, and highlight strategies to reduce these disparities and improve outcomes.

## **METHODS**

### **Search Strategy**

I conducted a systematic search of peer-reviewed articles published between 2013 and 2023 to capture recent trends in cardiovascular care among

immigrant populations. The databases searched included PubMed, Scopus, Web of Science, Google Scholar, and NIH. Search terms combined keywords related to cardiovascular disease, immigrant populations, and health disparities, including: “cardiovascular disease” OR “heart disease” AND “immigrant” OR “migrant” OR "migrant" OR “refugee” AND “health disparities” OR “healthcare access” OR “social determinants of health”.

### **Inclusion and Exclusion Criteria**

I included studies focusing on adult immigrant populations that addressed cardiovascular disease, including prevalence, risk factors, healthcare access, or interventions aimed at improving cardiovascular outcomes. Only studies published in English between 2013 and 2023 were included to ensure relevance. I excluded studies that focused on non-immigrant populations, pediatric populations, or conditions unrelated to cardiovascular disease. Studies that lacked clear data on cardiovascular outcomes or did not provide sufficient information on barriers or interventions were also excluded.

### **Data Extraction and Analysis**

I extracted relevant information from each study, including study design, sample size, population characteristics (age, sex, country of origin, migration

status), cardiovascular outcomes, barriers to care, and interventions. Data were organized systematically to allow comparison across studies and identify patterns or trends. Findings were synthesized narratively, highlighting recurring themes, gaps in the literature, and the effectiveness of various interventions. This approach helped identify key factors contributing to disparities in cardiovascular care among immigrant populations and potential strategies to improve access, quality, and equity.

*(Make sure to insert flowchart here)*

## **RESULTS**

### **1.1 Socioeconomic, Systemic, and Policy-Related Factors**

Access to healthcare emerged as a major social determinant influencing cardiovascular outcomes among immigrant populations. Systemic barriers, including restrictive health policies, exclusion from insurance programs, language barriers, and fear related to immigration enforcement, were consistently reported as impediments to care. Immigration status itself was identified as a structural barrier, affecting eligibility for preventive and chronic disease services (Wallace et al., 2021).

In 2019, approximately 44.9 million foreign-born individuals lived in the U.S., with over half from Latin America and substantial numbers from Asia, including roughly 11 million undocumented immigrants concentrated in states such as California, Texas, Florida, and New York (Office of the Assistant Secretary for Planning and Evaluation [ASPE], 2022). Socioeconomic factors, such as low income, unstable employment, limited education, and housing insecurity, further constrained healthcare utilization. These socioeconomic, systemic, and policy-related barriers were associated with delayed diagnosis, reduced use of preventive services, and poorer management of chronic cardiovascular conditions (National Academies of Sciences, Engineering, and Medicine, 2019).

## **1.2 CVD Prevalence and Risk Factors among Immigrants**

Cardiovascular disease risk and major risk factors vary widely among immigrant populations and often diverge from host population patterns. In the U.S., an analysis of 15,965 adults from the National Health and Nutrition Examination Survey found that 80.1% of foreign-born adults had at least one CVD risk factor, compared with 86.4% of U.S.-born adults (Rodriguez et al., 2023). However, those living in the U.S. for more than 15 years had higher prevalence of diabetes (15.4% vs. 11.2%) and hypercholesterolemia (29.4% vs. 30.0%), suggesting acculturation effects on risk accumulation. Evidence

from Europe and North America shows ethnic and regional variation, with South Asian migrants having higher odds of type 2 diabetes (Amsterdam UMC, 2022, Rodriguez et al., 2023). In a large cohort of immigrants from Europe, Latin America, Africa, and the Caribbean, 4.3% of women and 4.6% of men had three or more cardiovascular risk factors, with prevalence rising with age and low income (Amsterdam UMC, 2022).

### **1.3 Barriers to Healthcare Access**

Immigrants face multiple barriers limiting access to cardiovascular care. Insurance coverage gaps are prominent, with up to 40% of immigrants uninsured, compared to 15% of the U.S. born adults (Derose et al., 2024). Language barriers are critical; immigrants with limited English proficiency are twice as likely to report difficulty accessing care and understanding medical instructions (Derose et al., 2024). Only 60% of immigrants report a regular healthcare provider compared with 85% of U.S. born individuals. Socioeconomic constraints, including low income, transportation challenges, and irregular work schedules, further impede timely care, with low-income immigrants 1.5 times more likely to delay seeking medical attention (Derose et al., 2024). Cultural differences and limited healthcare knowledge reduce preventive service utilization; immigrant women are 30% less likely to receive recommended screenings such as mammograms and Pap smears.

Environmental and lifestyle factors, such as unsafe neighborhoods, limited access to healthy foods, and work-related stress, further reduce opportunities for physical activity and adherence to healthy diets (Gany et al., 2021). Limited access to preventive care, including blood pressure and cholesterol screening, contributes to delayed diagnosis and suboptimal risk management (Gany et al., 2021). The absence of culturally tailored interventions and health system policies exacerbates these disparities.

#### **1.4 Interventions and Strategies to Reduce CVD Disparities**

Multifaceted, culturally tailored, and community-engaged interventions have been effective. Community Health Worker programs improved blood pressure and medication adherence, with one trial reporting a 12% reduction in systolic blood pressure and a 15% increase in adherence over 12 months (Islam et al., 2024). Nutrition workshops and physical activity programs increased fruit and vegetable intake by 1.5 servings per day and added 35 minutes of weekly activity. Programs combining education, preventive screening, and navigation support improved completion of blood pressure and cholesterol screenings by 25% (Islam et al., 2024).

Integrating community-based strategies with healthcare systems and policy-level interventions, such as insurance expansion, workforce diversity, and access to healthy foods, further enhances outcomes (American Heart

Association [AHA], 2024). Overall, culturally sensitive, community-engaged, and multilevel strategies are most successful in reducing cardiovascular risk and improving care utilization among immigrant populations.

## **DISCUSSION**

Immigrant populations in the U.S. experience a disproportionate burden of cardiovascular disease, shaped by a complex interplay of social determinants, systemic barriers, and behavioral factors. Socioeconomic and policy-related factors, including low income, unstable employment, limited education, restrictive health policies, and lack of insurance, consistently reduce access to preventive services, delay diagnosis, and contribute to suboptimal management of chronic conditions (ASPE, 2022; National Academies of Sciences, Engineering, and Medicine, 2019; Wallace et al., 2021). Cardiovascular risk varies by region of origin, length of stay, and acculturation, with longer residence linked to higher diabetes and hypercholesterolemia prevalence, and South Asian migrants showing elevated metabolic risk (Amsterdam UMC, 2022; Rodriguez et al., 2023). Barriers such as uninsurance, limited access to a regular provider, language and cultural challenges, transportation issues, and work schedule constraints exacerbate these disparities (Derose et al., 2024; Gany et al., 2021).

Encouragingly, multifaceted interventions have demonstrated effectiveness in mitigating these disparities. Community Health Worker programs, culturally tailored lifestyle interventions, and combined education and navigation support improved blood pressure control, medication adherence, dietary habits, physical activity, and preventive screening completion (Islam et al., 2024; American Heart Association [AHA], 2024). Integrating community-based strategies with system- and policy-level approaches further enhances effectiveness. These findings highlight the importance of culturally sensitive, context-specific approaches that address both systemic and individual barriers to improve cardiovascular outcomes among immigrant populations.

## **LIMITATIONS**

Several limitations exist in this review. Many studies examining prevalence and risk factors were cross-sectional, limiting the ability to draw causal conclusions or assess changes over time. However, intervention studies, including Community Health Worker programs and lifestyle interventions, provided longitudinal evidence. Certain subgroups, such as undocumented immigrants, recent arrivals, and migrants in rural areas, were underrepresented, limiting generalizability. Biological, epigenetic, and microbial contributors to CVD disparities remain understudied. Additionally, this review focused on English-language publications from 2013 to 2023,

potentially excluding relevant studies. Variability in study designs, outcomes, and population characteristics further complicates direct comparisons.

## **CONCLUSION**

Immigrant populations in the U.S. face a disproportionate burden of cardiovascular disease due to social determinants, systemic barriers, and evolving risk factors. Socioeconomic disadvantages, limited healthcare access, language and cultural challenges, and environmental constraints contribute to disparities in prevention, diagnosis, and management. Evidence shows that multifaceted, culturally tailored, and community-engaged interventions, including Community Health Worker programs, lifestyle modification initiatives, and policy-level strategies, effectively reduce cardiovascular risk and improve care utilization (Islam et al., 2024; AHA, 2024).

Despite progress, gaps remain, particularly regarding underrepresented subgroups, longitudinal outcomes, and biological contributors. Addressing these gaps through inclusive research, culturally sensitive healthcare delivery, and equitable policies is essential. Future efforts should

integrate community, healthcare system, and policy-level approaches to achieve sustainable reductions in cardiovascular disparities among immigrant populations.

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## APPENDIX

Table 1. Key Words Used in Literature Search

Category	Key-word Used
Cardiovascular Disease	"cardiovascular diseases"[MeSH Terms] OR ("cardiovascular"[All Fields] AND "diseases"[All Fields]) OR "cardiovascular diseases"[All Fields] OR ("cardiovascular"[All Fields] AND "disease"[All Fields]) OR "cardiovascular disease"[All Fields]
Population	"emigrants and immigrants"[MeSH Terms] OR ("emigrants"[All Fields] AND "immigrants"[All Fields]) OR "emigrants and immigrants"[All Fields] OR "immigrant"[All Fields] OR "immigrants"[All Fields] OR "emigration and immigration"[MeSH Terms] OR ("emigration"[All Fields] AND "immigration"[All Fields]) OR "emigration and immigration"[All Fields] OR "immigration"[All Fields] OR "immigrations"[All Fields] OR "immigrant s"[All Fields] OR "immigrate"[All Fields] OR "immigrated"[All Fields] OR "immigrates"[All Fields] OR "immigrating"[All Fields]
Health Disparities	"socioeconomic disparities in health"[MeSH Terms] OR ("socioeconomic"[All Fields] AND "disparities"[All Fields] AND "health"[All Fields]) OR "socioeconomic disparities in health"[All Fields] OR ("health"[All Fields] AND "disparities"[All Fields]) OR "health disparities"[All Fields] OR "healthcare disparities"[MeSH Terms] OR ("healthcare"[All Fields] AND "disparities"[All Fields]) OR "healthcare disparities"[All Fields] OR "health status disparities"[MeSH Terms] OR ("health"[All Fields] AND "status"[All Fields] AND "disparities"[All Fields]) OR "health status disparities"[All Fields] OR "health inequities"[MeSH Terms] OR ("health"[All Fields] AND "inequities"[All Fields]) OR "health inequities"[All Fields]



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# **The Silent Burden: Stoicism and Underreporting in**

## **Heart Failure Patients**

Kaitlyn Frichtel and Jasmine Kaur

### **Abstract**

Patient reported outcome measures, also known as PROMs, are important tools for assessing quality of life, symptoms, and effectiveness of treatments for heart failure patients. Tools like the Kansas City Cardiomyopathy Questionnaire (KCCQ) depend on patients' self evaluation of their health, but these evaluations can be affected by cultural and psychological factors. This paper examines how stoicism, resistance to vulnerability, and social pressure to appear "fine" contribute to the underreporting of symptoms, ultimately tarnishing the accurate assessment of patient needs and heart failure as a whole. Using findings from social and public health research, we can see how ideas like toughness, independence, and vulnerability affect how people report their health.

When symptoms are underreported, it can cause real problems. Doctors might underestimate how serious a condition is, delay crucial treatment, or

collect biased data in clinical trials that rely on patient reported outcomes. We talk about why this underreporting happens from psychological, social, and cultural perspectives. Finally, we suggest ways to reduce these biases, like combining PROMs with objective data, training providers to recognize gender related differences, and reframing the way people experience vulnerability. We need patients to view it as important participation rather than weakness or embarrassment. Acknowledging the impact of stoicism is important for providing more accurate, gender-equitable and timely cardiovascular care for the patients.

### **Introduction: PROMs and the Patient Voice in Cardiology**

The patient's own involvement in their care plan has been increasing significantly; therefore, the patient's perspective is imperative in measuring the health of the patient using patient reported outcome measures along with other parameters to measure health outcomes (Meadows, 2011). The questionnaires created that measure patients' health status/data directly from the patients who are experiencing them are called patient reported outcome measures (PROMs). PROMs are essential tools that take subjective information directly from patients and turn it into quantitative, measurable data (Krogsgaard et al., 2021). It is data that comes straight from the patient.

Modern care increasingly values the patient's perspective in measuring their health alongside other clinical parameters (Meadows, 2011). While oncology has demonstrated that consistent PROM collection deepens clinician–patient interactions and enhances symptom recognition, leading to better management and greater patient satisfaction, cardiology has not incorporated PROMs to the same extent (Wilkinson et al., 2024). In cardiology specifically, patient care depends heavily on technology-driven data from blood pressure measurements to echocardiography determining how strong the heart muscle is and how effectively it supports the rest of the organs (Wilkinson et al., 2024). These procedures make it easier to assess a patient's cardiac status and have therefore been prioritized over PROMs (Wilkinson et al., 2024).

However, in contrast to well-known clinical measures such as blood pressure, health-care professionals are less familiar with PROMs and the interpretation of PROM scores is therefore perceived as challenging (van der Willik et al., 2021). Whilst these are important measurements, it is worth remembering that the first question in every physician–patient interaction is: *How are you feeling?* This is the patient's own evaluation of their condition in their own words. It is the foundation of history taking and the point at which patients gain the agency to describe their symptoms, engage in shared decision-making, and influence their overall care experience (Wilkinson et al., 2024).

In research especially, the importance of PROMs has been increasing exponentially as a key determinant of patient health. There is now an abundance of PROM options present in cardiology research, especially as interest in patient-centered care grows in clinical trials. To effectively use PROMs in cardiovascular research and clinical practice, it's important to consider how valid, reliable, and responsive they are. Widely adopted examples include the Kansas City Cardiomyopathy Questionnaire for heart failure and the Seattle Angina Questionnaire for coronary artery disease (Biondi-Zoccai et al., 2025). These tools are highly reliant on self-reported data from patients.

Against this backdrop, it becomes crucial to consider how culture, gender norms, and stoic attitudes shape the way patients, especially men, answer questions about their symptoms and quality of life. When men with heart failure are asked to rate their health on the Kansas City Cardiomyopathy Questionnaire (KCCQ), their answers may not always reflect reality. On paper, they may appear stronger, healthier, and less burdened than they actually are. But behind those higher scores lies a cultural pattern: stoicism, that has long shaped the way men talk about their health.

## **The KCCQ and What It Measures**

The Kansas City Cardiomyopathy Questionnaire (KCCQ) captures how patients themselves rate their symptoms, limitations, and quality of life while living with heart failure. It is an important tool for clinicians to evaluate how heart failure patients are truly doing in various aspects of their lives. KCCQ specifically captures data about how heart failure affects a patient's symptoms, physical function, social interactions, quality of life, and confidence in managing their condition (Biondi-Zoccai et al., 2025).

However, self-reporting is not only shaped by clinical status alone, but also by social and psychological influences, such as culturally ingrained masculine ideals and a reluctance to acknowledge personal vulnerability. These parameters can heighten vulnerability and evoke a fear of being perceived as needing extra help or not being fully capable. Men might not be asked questions about their mental health or experiences of weakness very often, and when they do get asked these questions, some experience embarrassment, shame, denial, or disappointment. This raises an important question: does this lead to men not being completely honest while completing the KCCQ?

Research focused specifically on the KCCQ supports the idea that understanding health-related quality of life (HRQoL) can vary based on

gender. A qualitative study of 25 adults with heart failure (56% women) examined how men and women interpret KCCQ-23 items; results showed very little evidence that participants interpreted items differently based on gender, but some had difficulty distinguishing whether their experiences were due to heart failure, medication side effects, or age. The authors suggest that some modifications could improve clarity for a wider range of patients (Coles et al., 2023).

Why does this matter? If men tend to underreport their limitations or symptoms on widely used tools like the KCCQ, clinicians and researchers might not get a full picture of how their disease really affects them. This raises concern for patient care because this could make the care team underestimate the severity of their disease, and it could delay treatment that might be necessary for the patient. It also can affect research, like setting trial endpoints or comparing outcomes by gender. Researchers might miss out on crucial information if men do not feel comfortable being completely honest about their symptoms. The evidence is mixed: masculine norms may make men less likely to acknowledge symptoms, but the KCCQ itself appears generally interpreted in similar ways by men and women (Coles et al., 2023). This suggests the issue may be less about the measurement tool itself and more about how people choose to report their symptoms.

## **Stoicism and Masculine Norms**

With a culture that promotes stoicism in males and discourages vulnerability, it is interesting to see how, in situations of healthcare where patients are vulnerable, they show up in health-seeking situations. The idea of stoicism or stoic philosophy has remained fairly consistent over centuries, and today the term is widely used in everyday language as well as academic writing. In health research, it commonly refers to a pattern of coping marked by quiet endurance and emotional restraint.

Despite its relevance, stoicism hasn't received much sociological attention and is discussed more often in behavioral psychology. Scholars have pointed out that this is a missed opportunity, since stoic attitudes can help explain certain health behaviors. For example, studies show that many older adults manage chronic pain by minimizing or downplaying their symptoms. This form of stoicism often involves a reluctance to describe discomfort as "painful," which contributes to under-reporting mild or moderate pain to others (Moore et al., 2012; Murray et al., 2008). It is interesting to see how stoicism plays a role in not just reporting of pain, but the vulnerability of dependence on other people, the ability to do tasks, carry out day-to-day functions, and help-seeking behavior.

One study on chronic pain found that stoic attitudes such as believing one shouldn't complain or should endure pain quietly can have a greater impact on how individuals describe their pain than their actual age (Yong, 2006). Men scored much higher in stoicism than women in another study, and stoicism was linked with being less open to new experiences and slightly with older age (Murray et al., 2008). Interestingly, being stoic wasn't directly related to feeling more distress, but it was linked to lower quality of life, mostly because people high in stoicism were less likely to seek help when they needed it (Murray et al., 2008).

Men, more than women, are often conditioned to minimize or dismiss their struggles. Cultural norms around masculinity encourage toughness, independence, and resilience values that can clash with openly admitting vulnerability. Saying "I'm fine" or downplaying shortness of breath can feel more acceptable than acknowledging the extent of limitations. As a result, men may report fewer symptoms and less impairment, even when objective measures like ejection fraction, exercise testing, or biomarker levels suggest otherwise. Their KCCQ scores can look deceptively high, masking the true burden of disease.

One of the studies conducted on Canadian veterans deduced that gender norms within military culture emphasize toughness, emotional control, and

endurance. This culture of stoicism can discourage veterans, especially men, from acknowledging distress or seeking help, ultimately limiting access to the care they need, with some taking themselves out of programs that were designed to address trauma (Shields, 2015).

First, research on masculine norms shows that men's self-reporting of their health may be different from their actual condition. In one prospective cohort study of young men (ages 18–25), higher endorsement of traditional masculine qualities like “toughness” and “anti-femininity” was directly associated with lower utilization of mental health services, even when they experienced symptoms of depression (Sileo & Kershaw, 2020). The authors found that masculine norms can act as deterrents to being vulnerable and seeking help. This implies that men may underreport certain mental and physical symptoms to maintain viewing themselves as strong and masculine. Although this study is in the mental health sector and involves younger men, its logic is relevant for chronic illness contexts like heart failure: being vulnerable and honest can conflict with gender and cultural norms.

### **Mechanisms of Underreporting**

Underreporting in patient-reported outcomes reflects a complex interplay of psychological, social, and cultural factors that influence how individuals perceive and communicate their health status. This phenomenon holds

particular importance in cardiovascular care, where accurate assessment of symptoms and quality of life is essential for guiding management and understanding patient experiences especially in clinical research where assessments like KCCQ hold immense power and determine the endpoint in the research process.

Research suggests that in general patients are likely to experience more symptoms than they state, revealing a persistent gap between lived experience and expressed symptom burden (Hertler et al., 2020). Most guidelines of patient-reported outcome assessments have not taken into consideration the gender and sex aspect, and may lead to biases and different interpretation and might even miss influences of these factors on over or underreporting of symptoms (Hertler et al., 2020). Recent studies have identified a disparity in health status, with women reporting lower KCCQ scores than men in outpatient cardiology settings (Li et al., 2025).

In a recent study done by collecting normative data in the general population in Europe, Canada, and the USA, which was stratified by sex, men reported better scores for overall quality of life and emotional function compared to women, thereby confirming the influence of sex and gender despite the state of disease (Hertler et al., 2020). There are some factors that help in understanding the mechanism of underreporting with respect to gender.

Gender differences in illness are not uniform. They vary depending on the type and severity of the disease (Oksuzyan et al., 2019). There are differences seen in the morbidity of diseases in men and women for example, women are more affected by chronic, non-acute disabling conditions (like arthritis), whereas men more often experience acute, life-threatening events (like myocardial infarction) (Oksuzyan et al., 2019).

Gender differences in health reporting also vary by education level. Women with lower education show a stronger “disadvantage” in self-rated health than those with higher education. One study concluded that the overall effect of education on health-reporting bias appears similar for men and women, meaning that while education influences how people report, it doesn’t systematically differ by gender (Oksuzyan et al., 2019). After statistically adjusting for reporting heterogeneity (differences in how people interpret and respond to questions), the female disadvantage in poor health became more evident, especially among lower-educated groups (Oksuzyan et al., 2019).

Reporting accuracy changes with age: younger women (50–59) and younger men (50–69) tend to over-report poor health, while older women (60+) and very old men (80+) tend to under-report it (Oksuzyan et al., 2019). Men aged 70–79 tend to report poor health most accurately compared with other

groups (Oksuzuyan et al., 2019). These differences may reflect gender-based variations in symptom perception or reporting, not necessarily true differences in health outcomes (Li et al., 2025). Recognizing these mechanisms is essential for ensuring that PROMs and related instruments measure what they intend to patients' lived experiences, fairly and accurately across genders.

### **Clinical and Research Implications and Gaps**

In the research available, it is imperative to distinguish between patient outcomes that are clinically relevant and those that are not (Zini & Banfi, 2021). Bias has been identified as a key factor influencing how patients interpret and respond to PROMs. Therefore, such biases should be carefully considered by developers of new PROM instruments and critically evaluated by regulatory bodies and scientific associations, particularly when PROMs are used in drug and medical device clinical trials (Zini & Banfi, 2021). Routine collection of patient-reported outcomes is also essential to better understand differences across populations and to identify disparities that may otherwise remain hidden (Li et al., 2025).

Interpretation of PROMs can vary widely across individuals and should be examined through a gender-sensitive lens. Understanding these variations ensures that results reflect authentic patient experiences rather than

cultural or social expectations. A holistic approach to patient assessment is important, patients reporting their health status over the phone, for instance, often describe better health than they do in person, suggesting that mode of administration and recall bias can affect responses (Johnson et al., 2004).

Enhancing clinician–patient communication through education about social, psychological, and gender-based differences in how health is experienced and expressed can help clinicians deliver more comprehensive, empathetic care. Furthermore, patient education and empowerment initiatives that address vulnerability and stoicism can encourage more open and honest reporting, leading to more equitable and personalized care.

### **Toward More Accurate Assessment**

Underreporting can mislead clinicians regarding the severity of heart failure, potentially delaying necessary interventions and biasing clinical trial outcomes when PROMs such as the KCCQ are used as primary endpoints. Routine collection and gender-sensitive interpretation of PROMs are essential to identify disparities and ensure that patient experiences are authentically represented.

To mitigate bias, PROMs should be supplemented with objective clinical data, and clinicians should receive training in gender-sensitive interpretation.

Additionally, reframing vulnerability as a sign of active engagement in care, rather than weakness, may encourage more honest symptom reporting and support equitable treatment. Patients need to view vulnerability and honest reporting as an essential contribution to their care, rather than as something embarrassing or shameful.

## **Conclusion**

Patient reported outcome measures are now a key part of heart failure care and research. They help us understand how patients experience heart failure beyond what clinical tests show. Tools like the Kansas City Cardiomyopathy Questionnaire help to capture these experiences, but they depend on patients being willing and able to share their symptoms, limitations, and changes in quality of life. Recognizing the influence of stoicism enables clinicians and researchers to interpret self-reported data with greater nuance, ultimately supporting more equitable and accurate assessment and management of heart failure. This paper shows that stoicism, especially when shaped by masculine social and cultural norms, can affect how much patients are willing to share. When men downplay their symptoms to appear strong, independent, or in control, their true level of distress and impairment may be hidden.

It is important to see this underreporting not as a personal failing, but as a behavior shaped by social expectations about masculinity and vulnerability. The evidence suggests that men may report fewer symptoms on tools like the KCCQ, not because they are less affected by heart failure, but because cultural norms make it hard to admit to weakness or needing help. If clinicians do not recognize this, they may underestimate how sick a patient is, delay needed treatment, or misunderstand changes in a patient's condition. In research, relying on PROMs as main outcomes can create bias, especially when comparing men and women, and this can affect the fairness and accuracy of study results.

To address these challenges, both clinical practices and research methodologies need to shift. Patient reported outcome measures (PROMs) should be analyzed through a gender sensitive perspective and paired with objective clinical data to achieve a more thorough and precise evaluation of patient health. Training for clinicians that focuses on gender sensitive communication and the impact of sociocultural factors can create environments where patients can express their vulnerabilities. At the same time, redefining vulnerability as an active and vital aspect of patient care, rather than a weakness, may encourage patients to report their symptoms more honestly.

Finally, important research gaps still exist. More work is needed to examine how stoicism operates across different age groups, cultural backgrounds, and disease severities. It is also important to examine how PROM design and administration might better account for reporting heterogeneity. By acknowledging stoicism as a meaningful social determinant of health reporting, clinicians and researchers can improve the interpretability of PROMs like the KCCQ and move toward more equitable and accurate heart failure care.

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# **Eco Anxiety, Ecological Grief, and Public Health: Understanding Sociomedical Impacts in a Changing Climate**

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## **Abstract**

### Background:

Climate change poses a serious public health challenge, contributing to rising anxiety, depression, PTSD, and broader psychological distress. Emotional responses such as eco anxiety, ecological grief, solastalgia, climate worry, and eco guilt are increasingly documented, especially among youth, Indigenous groups, and populations in highly exposed regions.

### Methods:

This narrative review searched PubMed, Scopus, and Web of Science for studies examining eco anxiety, ecological grief, and other climate related psychological impacts. Eligible articles focused on emotional, behavioral, or sociomedical responses to climate stressors. Findings were synthesized narratively.

## Results:

Eco anxiety is linked to elevated depression, anxiety, stress, and reduced wellbeing, while ecological grief and solastalgia reflect deep emotional impacts of environmental loss. Structural inequities heighten vulnerability, as observed in marginalized communities and climate stressed countries. Eco emotions can encourage pro environmental behaviors, though severe anxiety may limit engagement. Coping strategies, social support, and neurobiological processes influence how individuals respond.

## Conclusion:

Eco anxiety and ecological grief represent important public health concerns shaped by environmental change and social inequality. Integrating climate related mental health considerations into public health and adaptation strategies is essential to support resilient communities.

**Keywords:** Eco anxiety, Ecological grief, Solastalgia, Psychoterratic syndromes, Climate change, Mental health, Public health, Climate vulnerability, Environmental distress, Climate adaptation, Health equity, Sociomedical pathways, Climate related emotions, Community resilience

## **Introduction**

Climate change is now recognized as a major public health threat, with both extreme events and ongoing environmental degradation linked to rising anxiety, depression, PTSD, suicidality, and psychological distress (Sodiq et al., 2025; Cianconi et al., 2020). These impacts have drawn attention to climate related emotional responses such as eco anxiety, ecological grief, solastalgia, climate worry, and eco guilt, collectively described as psychoterratic syndromes (Panu, 2020; Cianconi et al., 2023; Betro', 2024).

Eco anxiety, marked by persistent fear and worry about climate change, is associated with higher levels of depression, anxiety, stress, and reduced wellbeing (Boluda Verdú et al., 2022; Cosh et al., 2024; Barbosa and Fonseca, 2024). Young people are particularly affected, as shown in Filipino youth (Reyes et al., 2021) and adolescents shaped by socioeconomic pressures (Di et al., 2024). Ecological grief and solastalgia capture emotional responses to environmental loss, especially in Indigenous and Global South communities with strong connections to land (Cunsolo and Ellis, 2018; Comtesse et al., 2021; Rousseau, 2023). Bangladesh exemplifies heightened vulnerability, where climate hazards and displacement intensify mental health burdens (Dock, 2025).

Inequality further shapes climate distress. Marginalized groups in São Paulo experience greater fear and uncertainty due to exclusion and limited support (Couto et al., 2025). Eco emotions can motivate pro environmental behavior, with ecological worry, grief, and guilt linked to sustainable actions (Boluda Verdú et al., 2022; Csilla et al., 2022). Eco anger promotes activism, whereas eco anxiety may inhibit collective engagement (Stanley et al., 2021). Coping strategies and social support can buffer distress (Rai, 2023), and neurobiological research points to salience network involvement in climate related fear responses (Ikiz and Carlson, 2025).

Although research faces definitional and geographic limitations (Boluda Verdú et al., 2022; Panu, 2020; Cosh et al., 2024; Cunsolo and Ellis, 2018), the literature shows that eco anxiety and ecological grief are significant sociomedical issues. This narrative review aims to synthesize current evidence on eco anxiety, ecological grief, and related climate driven emotional responses, and to examine the sociomedical pathways through which these emotions influence mental health and community wellbeing. It also seeks to identify vulnerable populations and highlight key public health implications for climate adaptation and resilience planning.

## **Methods**

This narrative review drew on an interdisciplinary search of peer reviewed literature examining the mental health impacts of climate change. Relevant studies, systematic reviews, and theoretical papers on eco anxiety, ecological grief, solastalgia, psychoterratic syndromes, and climate related psychological distress were identified through searches in PubMed, Scopus, and Web of Science. Search terms included “eco anxiety,” “ecological grief,” “solastalgia,” “climate anxiety,” and “climate change mental health.”

Articles were selected based on their focus on emotional, behavioral, or sociomedical responses to climate stressors, with particular attention to vulnerable populations and public health implications. Additional sources were identified through manual screening of reference lists. The included literature was synthesized narratively to integrate conceptual themes, summarize empirical findings, and identify gaps requiring further research.

## **Results**

Climate change is increasingly recognized as a major public health threat, associated with higher rates of anxiety, depression, PTSD, suicidality, and overall psychological distress (Sodiq et al., 2025; Cianconi et al., 2020). In response to accelerating environmental change, a growing literature describes

new emotional phenomena including eco anxiety, ecological grief, solastalgia, climate worry, and eco guilt (Panu, 2020; Cianconi et al., 2023; Betro', 2024).

Eco anxiety is widely understood as fear, worry, and helplessness about climate change (Boluda Verdú et al., 2022; Barbosa and Fonseca, 2024).

Reviews show consistent links between eco anxiety and elevated depression, anxiety, stress, insomnia, and lower self-rated mental health (Boluda Verdú et al., 2022; Cosh et al., 2024). Studies among youth confirm these patterns, as climate anxiety predicted psychological distress among Filipinos (Reyes et al., 2021), and socioeconomic and cultural conditions shaped climate related emotions in adolescents (Di et al., 2024). Although many forms of eco anxiety are non-clinical, severe forms can impair functioning (Panu, 2020). Neurobiological evidence suggests involvement of the salience network, including the midcingulate cortex and insula, in heightened climate threat perception (Ikiz and Carlson, 2025).

Ecological grief and solastalgia describe mourning for environmental loss and distress tied to degradation of home environments (Cunsolo and Ellis, 2018; Comtesse et al., 2021; Cianconi et al., 2023). These experiences are pronounced among communities dependent on land-based identities, including Indigenous peoples and Global South populations (Rousseau, 2023). Bangladesh demonstrates this intersection, with one fifth of adults

experiencing mental health conditions worsened by heat, flooding, and sea level rise and with projections of 13 million climate migrants amplifying future psychological risks (Dock, 2025).

Climate distress is shaped by inequality. In São Paulo, marginalized and predominantly Black communities described climate related fear and uncertainty intensified by inadequate support and social exclusion (Couto et al., 2025). Such findings position climate grief as both psychological and socio-political.

Eco emotions can also motivate action. Ecological worry, grief, and guilt are tied to pro environmental behavior (Boluda Verdú et al., 2022; Csilla et al., 2022). Eco anger predicts better mental health and greater activism, while eco depression supports collective action and eco anxiety reduces participation (Stanley et al., 2021). Coping strategies including social support, cognitive reframing, and meaning focused approaches help individuals manage climate distress (Rai, 2023), and eco hope may transform anxiety into engagement (Betro', 2024).

However, eco anxiety can also produce paralysis, avoidance, hopelessness, and reduced future planning (Boluda Verdú et al., 2022; Rousseau, 2023; Sharma, 2024). Loss of urban green and blue spaces heightens distress and undermines coping (Barbosa and Fonseca, 2024). Structural determinants

including poverty, racism, and limited health resources shape both exposure to climate hazards and mental health burdens (Cianconi et al., 2020; Couto et al., 2025).

Although research faces limitations including inconsistent definitions, cross sectional designs, Global North bias, and limited culturally grounded tools (Boluda Verdú et al., 2022; Panu, 2020; Cosh et al., 2024; Cunsolo and Ellis, 2018), evidence consistently shows that eco anxiety and ecological grief are significant public health concerns. Their origins lie at the intersection of ecological disruption, social inequality, and community identity, requiring integrated mental health and climate policies that strengthen resilience while acknowledging these emotions as rational responses to an unstable climate.

## **Discussion**

This review shows that eco anxiety, ecological grief, solastalgia, and related psychoterratic emotions are significant public health consequences of climate change. Both rapid climate disasters and slow environmental degradation are linked to increased anxiety, depression, PTSD, and psychological distress (Sodiq et al., 2025; Cianconi et al., 2020). Eco anxiety varies from adaptive concern to debilitating worry, especially among youth and those facing socioeconomic pressures (Boluda Verdú et al., 2022; Cosh et al., 2024; Reyes et al., 2021; Di et al., 2024). Ecological grief is particularly acute in Indigenous

and Global South communities where environmental loss threatens identity and livelihoods (Cunsolo and Ellis, 2018; Comtesse et al., 2021; Rousseau, 2023; Dock, 2025). Inequities intensify climate distress, as seen in marginalized groups in São Paulo (Couto et al., 2025).

Eco emotions can hinder wellbeing but also motivate pro environmental behavior; ecological worry, guilt, and grief support sustainable action, while eco anger predicts activism and eco anxiety may reduce collective engagement (Boluda Verdú et al., 2022; Csilla et al., 2022; Stanley et al., 2021). Coping strategies and social support promote resilience (Rai, 2023), and emerging neurobiological evidence highlights salience network involvement in climate related fear (Ikiz and Carlson, 2025). Despite definitional and methodological limitations (Panu, 2020; Cosh et al., 2024; Cunsolo and Ellis, 2018), the literature clearly identifies climate related emotional distress as a key sociomedical issue requiring integration into public health and climate adaptation efforts.

This narrative review benefits from drawing together a wide range of interdisciplinary evidence, integrating epidemiological findings with psychological, cultural, and neurobiological perspectives to offer a broad understanding of eco anxiety, ecological grief, and their relevance to public health. It also incorporates research from both Global North and Global South

settings, helping to illuminate how social and structural inequities influence climate related distress. Nonetheless, several limitations should be noted. As a narrative review, the approach does not follow systematic procedures and may be subject to selection bias. The existing literature is further limited by inconsistent terminology, heavy reliance on cross sectional designs, and a predominance of studies from high income countries. Many findings depend on self-reported measures, restricting the ability to draw causal conclusions. These limitations underscore the need for more robust longitudinal and culturally diverse research to strengthen understanding of climate related mental health impacts.

## **Conclusion**

This review highlights that eco anxiety, ecological grief, solastalgia, and other climate related emotional responses represent important public health issues shaped by both environmental disruption and social inequities. These forms of distress disproportionately affect vulnerable groups yet can also foster adaptive engagement when supported by effective coping and community networks. Despite gaps in definitions and methods across existing studies, the evidence underscores the need to embed climate related mental health considerations into public health strategies and climate adaptation policies to strengthen resilience in an increasingly unstable climate.

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# **Healthcare Exclusion and Migrant Mobility: The Emergence of Medical Refugees**

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## **Abstract**

### Background:

Migrants and refugees often become medical refugees when discrimination, documentation barriers, language challenges, and fragmented health systems restrict access to care. Studies across Africa, Europe, North America, and Asia consistently show medical xenophobia, cultural discordance, and spatial inequities that shape these experiences.

### Methods:

A narrative review approach was used. Relevant studies were identified through broad database searches and citation tracking, then synthesized narratively based on their focus on discrimination, structural barriers, and healthcare-related mobility.

### Results:

Evidence shows that linguistic, cultural, financial, legal, and geographic obstacles frequently drive people to seek care elsewhere. Patterns appear in emergency care in Germany, neighborhood and transport conditions in Atlanta, and spatial and hukou constraints in Shanghai. Additional mobility is documented among agricultural workers in Italy, cancer patients traveling to France, refugee physicians in the United States, and patients navigating uneven service planning in Turkey. Proposed solutions include inclusive policies, interpretation services, culturally competent care, mobile clinics, and trauma-informed training.

### Conclusion:

Systemic discrimination, spatial disadvantage, and fragmented care contribute to healthcare-driven mobility among migrants and refugees. Strengthening equity through inclusive policy reform and culturally and linguistically responsive services is essential to reducing the emergence of medical refugees.

**Keywords:** Medical refugees; migrant health; refugee health; healthcare access; medical xenophobia; structural barriers; health inequities; patient mobility; forced migration; spatial inequality; culturally responsive care;

discrimination in healthcare; health system fragmentation; global health; healthcare exclusion.

## **Introduction**

Global research increasingly shows that many migrants and refugees become *medical refugees* when health systems deny or obstruct access to needed care. In Africa, medical xenophobia results in refusal of treatment, verbal abuse, and documentation-based exclusion (Harerimana et al., 2025). Similar patterns appear across Europe, where language barriers, discrimination, unclear entitlements, and the pressures of the 2015 migration crisis reveal systemic gaps (Mangrio & Forss, 2017; Chiarenza et al., 2019). In Canada and the United States, refugees encounter language obstacles, transportation challenges, cultural discordance, high costs, and fragmented services that impede access and worsen health outcomes (Pandey et al., 2021; Floyd & Sakellariou, 2017; Morris et al., 2009; Ho et al., 2023; Lee et al., 2025). Structural and spatial factors also influence care-seeking, as seen in improved neighborhood conditions in Atlanta (Haley et al., 2017), differential emergency department pathways in Germany (Irorutola et al., 2025), and the influence of transit and hukou status in Shanghai (Shen & Tao, 2022). Additional studies document medically driven mobility among agricultural workers in Italy who rely on mobile clinics (De Virgilio Suglia et al., 2025),

foreign cancer patients seeking care in France (Pian, 2015), refugee physicians facing unique licensure barriers in the United States (Bell & Walkover, 2021), and patient flows in Turkey that expose mismatches between policy and practice (Koylu et al., 2018). Work on cross-border care measurement and public attitudes toward relocated services further demonstrates the complexity of medical mobility (Mainil, 2015; Damen et al., 2024; L. J. Damen et al., 2024). Scholars emphasize inclusive policies, cultural and linguistic responsiveness, trauma-informed care, mobile services, and community-centered models to reduce inequities (Gruner et al., 2021; Chuah et al., 2018).

This narrative review aims to synthesize global evidence on how systemic discrimination, legal precarity, and spatial inequities compel migrants and refugees to move in search of healthcare. It also seeks to examine the sociological significance of medical refugees and highlight interventions that can reduce healthcare-driven displacement.

## **Methods**

This narrative review used an iterative, interpretive approach to synthesize evidence on healthcare-driven mobility among migrants and refugees. Relevant studies were identified through broad searches of major databases referenced in the included literature, including PubMed, CINAHL, Medline,

Scopus, and Web of Science, using terms related to migration, healthcare access, and patient mobility. Additional sources were located through citation tracking.

Studies were selected for their relevance to discrimination, structural barriers, spatial factors, and experiences of seeking care across regions. Data were extracted narratively to identify recurring patterns shaping the phenomenon of medical refugees.

## **Results**

Research across regions shows that many migrants and refugees become medical refugees when health systems are discriminatory or inaccessible. In Africa, medical xenophobia leads to denial of care, verbal abuse, cultural insensitivity, and documentation-based exclusion (Harerimana et al., 2025). In Europe, language barriers, racial discrimination, and unclear entitlements limit access, and the 2015 crisis revealed major systemic gaps (Mangrio and Forss, 2017; Chiarenza et al., 2019). In Canada, newcomers struggle with language, transportation, long waits, and communication (Pandey et al., 2021), while non literate refugee women face dependence and fear but also develop resourceful strategies (Floyd and Sakellariou, 2017). In San Diego, communication difficulties and cultural expectations hinder care (Morris et al., 2009). Reviews in the United States highlight fragmentation, cost, and

cultural mismatch, calling for integrated models (Ho et al., 2023; Lee et al., 2025).

Within countries, mobility shapes access. In Atlanta, improved neighborhoods reduce unmet need though transportation remains a barrier (Haley et al., 2017). In Germany, migrants show higher urgency triage but fewer admissions and outpatient visits (Irorutola et al., 2025). In Shanghai, spatial access, transit, and hukou status drive long distance travel or self-treatment (Shen and Tao, 2022).

Other studies highlight medically driven mobility among agricultural workers in Italy who rely on mobile clinics due to poor conditions and irregular status (De Virgilio Suglia et al., 2025), cancer patients seeking care in France whose movement reflects structural inequality (Pian, 2015), and refugee physicians in the United States who face unique licensure barriers (Bell and Walkover, 2021). Analyses of Turkey's patient flows show mismatches between planned and actual service use (Koylu et al., 2018), and commentary stresses better measurement of cross border care (Mainil, 2015). European and Dutch studies show support for relocating care closer to home while noting concerns about expertise and quality (Damen et al., 2024; L J Damen et al., 2024).

Proposed solutions include inclusive health policies, better interpretation, culturally competent care, mobile services, and trauma informed medical

training (Gruner et al., 2021; Chuah et al., 2018). Together, these studies show that discrimination, legal precarity, and spatial and systemic barriers repeatedly push people to move in search of adequate healthcare, defining the sociological reality of medical refugees.

## **Discussion**

Across the reviewed literature, migrants and refugees frequently become medical refugees when health systems reinforce discrimination and structural exclusion rather than offering equitable care. In Africa, medical xenophobia produces refusals of treatment and mistrust (Harerimana et al., 2025). European studies highlight language barriers, racialized interactions, and service gaps that were particularly visible during the 2015 migration crisis (Mangrio and Forss, 2017; Chiarenza et al., 2019). Refugees in high income countries also face linguistic, cultural, financial, and organizational obstacles that delay or disrupt access to care (Pandey et al., 2021; Floyd and Sakellariou, 2017; Morris et al., 2009; Ho et al., 2023; Lee et al., 2025). Structural factors further shape mobility, as seen in emergency department patterns in Germany (Irorutola et al., 2025), neighborhood and transport effects in Atlanta (Haley et al., 2017), and spatial and hukou constraints in Shanghai (Shen and Tao, 2022).

Medically driven movement is also evident among agricultural workers in Italy who rely on mobile clinics (De Virgilio Suglia et al., 2025), cancer patients seeking treatment in France when services are unavailable at home (Pian, 2015), refugee physicians confronting licensure barriers in the United States (Bell and Walkover, 2021), and patients in Turkey navigating mismatches between planned and actual care pathways (Koylu et al., 2018). Research on cross border care and relocated services underscores the need for better measurement and more responsive system planning (Mainil, 2015; Damen et al., 2024; L J Damen et al., 2024).

A key strength of this narrative review is its ability to draw together evidence from a wide range of countries and research designs, allowing for a broad understanding of how discrimination, spatial inequality, and system fragmentation contribute to medically driven mobility. The inclusion of qualitative, quantitative, clinical, and policy focused studies provides a rich and multi-dimensional perspective on the experiences of migrants and refugees within different health systems.

However, this approach also has limitations. The narrative method does not follow systematic search procedures, which limits the ability to ensure comprehensive coverage or assess study quality in a standardized way. The included studies vary in rigor and scope, and some findings may not be

generalizable across settings. In addition, important experiences may be missing since the review relies on published research and may not capture insights from communities whose perspectives remain undocumented.

## **Conclusion**

This review highlights that many migrants and refugees are pushed into seeking care elsewhere because discrimination, spatial inequities, and structural barriers persist across health systems. These challenges create conditions in which mobility becomes necessary rather than optional. Improving access requires more inclusive policies, stronger cultural and linguistic responsiveness, and coordinated reforms that directly address the systemic factors restricting care. Building such foundations is essential for advancing equity and safeguarding the health and dignity of all individuals.

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**Conflict of Interest:** Author has no conflicts of interest relevant to this article to disclose.

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# **Reducing The Stigma in Mental Health Among First Responders**

Samantha Frey

## **Abstract**

There is no question when it comes to a person's health or safety. When an emergency arises, the first human instinct is to find help when their lives are in danger. The professionals who respond to these life-or-death situations are first responders. Police, Fire, Ems or Emergency Dispatchers, are the first ones to get the call and arrive on scene to assist in these dire situations. The first responders are more at risk with mental burnout than the average office worker due to the nature of their environment. They put their own lives in traumatic situations to protect and save others while also putting their own mental health on the line. However, there is a stigma that first responders shouldn't need access to help, and it is the driving force as to why many of them resort to addiction, and suicide, to cope. In this perspective piece, it will show how negating the overall stigma and providing proper resources within the home and workplace will reduce the psychological toll and thus reduce the percentage of burnout, addiction and suicide.

## **Introduction**

Dispatch personnel, Police, Fire and EMS, are the men and women sworn to protect our society and ensure lifesaving measures when needed. They are what makes up a first responder. However, despite being the heroes, they are also held to an unbelievable standard that they should not feel the need to seek out any mental health assistance if they need it (Lily, 2023). There are heavy stigmas that first responders should be seen helping the public and nothing should bother them. This can no longer be the case. First responders handle traumatizing situations that every day civilians do not witness and carry the weight of more than they should. There needs to be a change that allows the acceptance of mental health assistance so the stigma can be broken and the first responders can get the help they need.

### **Developed Conditions**

For many first responders can develop different conditions and coping mechanisms if their mental health is left untreated. Being a first responder is the most stressful career anyone can put themselves through. It's self-sacrifice on a multitude of levels. Anxiety, Depression and Post Traumatic Stress Disorder (PTSD) are the most common risks a first responder can develop if they are overly stressed and don't take care of their mental health (Relief Mental Health, 2024).

According to the Relief Mental Health, "Depression and PTSD are five times more common in first responders than the general population" (2024). The

reason for this is because of the traumatic situations that first responders deal with on a “normal” workday. The day could range between dealing with a death, a building fire, overdose, shooting, etc. The days are unpredictable and first responders have to be vigilant at all times, if not the consequences are too high. That’s a lot of pressure put on a first responder therefore the stress can increase tenfold. An astounding 20% of police officers reported having symptoms of depression whereas 11% of career firefighters and 37% paramedics reported it (Relief Mental Health, 2024).

PTSD is a psychiatric disorder that happens when someone has been through, or witnessed, a traumatic event or experienced “a set of traumatic set of circumstances” (Shores, 2025). A lot of the traumatic events that police officers can be faced with range between fatal accidents, crime, child abuse, homicide, suicide, rape etc (Hem et al., 2004). These are situations a normal person shouldn’t have to see or witness, but yet first responders are the ones that handle them the most. The Relief Mental Health states that a study done on 387 EMS personnel in York County, PA, showed that 35% of those personnel met the clinical criteria for PTSD (2024). This would mean that approximately 135 personnel met those criteria and the remaining 255 could have some other combination of other mental health disorders. Because of these issues with depression, anxiety and PTSD, some first responders have found themselves coping in different ways. Some have turned to alcoholism,

especially with police officers as 48% of male officers and 40% of female officers expressed drinking alcohol in excess (Hem et al.,2004). In other instances, some officers show a change in behavior as an alternate outcome. For example, a recent interview was conducted with Lt. Thomas Flemmig of the Reading Police Department in PA to gain a personal insight on how working in law enforcement has changed his behavior. Flemming expressed that since working for the police force has made him very antisocial. He's been an officer for 14 years and before working for the police department he was very sociable. Fleming loved to go out and do activities while spending time with friends and family. However, it came to a point that after being around people all day and dealing with the stress of the job, he would rather stay at home and not go out as much as he used to.

### **Mortality**

The stress of making sure everyone else is happy and healthy puts a strain on first responders. In order to cope with a lot of the issues they face many seek out alcohol, drugs and sometimes suicide when things on their mind become too great. Suicide, or suicide ideation, can happen or develop at one point in a first responders' career, especially if there are no resources or support amongst their departments and community. According to Relief Mental Health, there was "one study found officers who reported job burnout had a 117% greater likelihood of suicidal thoughts than officers who did not report

job burnout” (2024). Who knows what percentage of officers that are going through burnout and not saying anything. Most professions, like law enforcement, are supposed to be heroes and protect our society, but civilians often forget that they are just human. Job burnout from departments that don't help is usually the cause of why most of them quit the profession before they reach retirement age.

Relief Mental Health also explained that a study done in 2015 of 1,027 current and retired firefighters, 49% of them developed some sort of suicide ideation, 19% made a plan and 16% attempted suicide. In addition to this, 24% of police officers engaged in suicidal ideation and 54% are more likely to commit to suicide than non-law enforcement careers (2024).

### **Accessible Health Care & Services**

Most departments have mental health advocates or programs in place to help the first responders, but most of the employees don't know what they are. A few of these services could include Employee Assistance Programs (EAPs), therapy and counseling and peer support groups. Old Vineyard Behavioral Health Services advised that EAPs are confidential counseling services that help with dealing issues that pertain to personal or work-related issues (2025). With therapy and counseling, Cognitive-behavioral therapy (CBT) is useful in treating PTSD and anxiety by helping to change the negative thought patterns. Peer support groups is another option for first responders as it's

considered a “welcoming space to share experiences and offer mutual support” (Old Vineyard Behavioral Health Service, 2025). No matter what, there are sources that are available to help with the coping of traumatic situations that first responders experience and that their departments need to make these services known and provide the information instead of ignoring the issues at hand.

### **Ways to Improve**

One of the most important ways to reduce the percentages of suicide ideation, burnout and suicide, is identifying the signs and predict potential issues. John M. Violanti, coauthor of *Predictors of Police Suicide Ideation*, suggests that trauma exposure intervention like psychological debriefings and suicide prevention training can help reduce PTSD therefore, reducing the percentages of suicidal ideation or suicide (2004). Not to mention identifying the signs that the first responder is having these thoughts is the best preventative measure for agencies to practice.

70% of first responders say they never, or almost never, use mental health services and resources. 57% don't ask for help because they think there will be negative repercussions and 40% fear being demoted or fired (Relief Mental Health, 2024). Education, communication and support are the fundamental pillars needed to reduce these percentages drastically. Families should be educated and be a part of the conversation with the agencies to recognize the

signs of burnout and suicidal ideation. As mentioned before by Lt. Flemming, even though he dealt with the public all day and worked in traumatizing situations, he carried that weight home making him unsociable in doing activities that involve the public. Having family be educated on the signs can lead to prevention with the agency's support.

Civilians should also be educated that first responders are still human and need support. There needs to be an understanding that first responders can only do so much and they aren't invincible. Notices, newsletters and other awareness tactics should be disseminated to the public on a regular and rolling basis. If the civilians are more educated on the mental health issues and awareness when it comes to first responders, then they might develop some more sympathy that helps reduce the stigma. There also needs to be a better way to encourage first responders to speak out if they need help and not be looked down to or have a fear of losing their job. Zach Lilly explains that one of the most important steps for any agency to take is to offer "prevention and wellness programs that encourage officers to speak out about their mental health issues" (2023). Funding might be an issue, but if the agencies don't try something as simple as talking to the employees, then nothing will progress forward.

Prevention and assistance should be more educated and available at the agency. There needs to be more check-ins with staff, considering most of the

first responders that don't admit something is wrong are the ones higher at risk. Especially evaluations after a high stress induced incident. These check-ins don't have to be super extensive but introducing the conversation in a safe and healthy environment is the first step in prevention. Should any of the first responders exhibit, or express, issues with their mental health, then intervention by the agency will help give the first responders the help they need. Either it be seeking counseling, or administration leave to assist in getting them on the right path. The more proactive they are with assistance, the better it will be to reduce turnover rate in employment and overall morale.

## **Conclusion**

First responders are important to the communities that they serve, but they also need to know and understand that there should be no shame in asking for help. They are a mother, father, sister, brother, wife, husband, or friend. They are more than just the badge and need to start feeling like that within their agencies. With the improvement of better access to programs and improving mental health within the first responder, it will only result in less stress and reduction in mental health illnesses and the suicide rate. By also providing resources, education and having important conversations, the stigma against mental health in first responders can be eliminated.

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# **The Role of Social Support in Shaping Mental Health, Well-being, and Treatment Outcomes Among People Living with HIV**

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## **Abstract**

Despite advances in antiretroviral therapy, stigma and social isolation continue to undermine treatment success and well-being for people living with HIV (PLWH). This paper examines how social support: emotional, financial, and community-based, shapes mental health, treatment adherence, and quality of life in this population. It explores the complex relationship between HIV-related stigma, psychological distress, and the protective role of supportive networks.

HIV-related stigma, both internal (self-blame, guilt, shame) and external (discrimination and social rejection), contributes to depression, anxiety, and poor engagement in care. Women and transgender women often experience

heightened stigma due to gender norms and discrimination, leading to poorer mental health outcomes. Children and older adults living with HIV also face unique emotional and social challenges that influence their treatment and well-being.

This paper examines the various forms of social support experienced by people living with HIV (PLWH) and highlights the vital roles of family members, partners, peers, and community health workers in promoting well-being. These support systems play a critical role in reducing distress and promoting adherence; however, the COVID-19 pandemic disrupted these networks, particularly in older adults, by limiting opportunities for connection and access to community and digital support networks.

Through this paper, we emphasize that addressing stigma and reinforcing social networks are vital components of holistic HIV care. Integrating psychosocial interventions, community-based programs, and gender-sensitive approaches can significantly improve both mental health and treatment adherence. Recognizing social support as a central pillar of HIV management not only promotes compassion and empowerment but also fosters equity and resilience among PLWH.

## **Introduction**

Mental health plays a significant role in the well-being of humans, more so in vulnerable populations like PLWH. Our mental health depends on various factors, including social support. As social beings, relying on support from the people around us drives our motivations and purpose. This social support also has a crucial role to play in different strides of life of PLWH, such as treatment seeking, treatment adherence, and quality of life.

The relationship between mental health and HIV seems to be bi-directional in the way of association. Such impaired health manifests as substance abuse or other risk-taking behaviors like the increased risk of getting HIV infection; on the other hand, being diagnosed with HIV increases the likelihood of facing discrimination and stigma (external and internal), which are associated with depression, anxiety, and PTSD. (1) Not only is depression among PLWH associated with poor outcomes, it is also reported to be associated with an increased risk of HIV transmission. (21)

Research supports that social support in the form of emotional support, financial support, community building, etc., can moderate the mental health of the PLWH by limiting the effects of stigma; such interventions of social support should be given importance in a holistic HIV care approach. (2)

## **Mental Health and Stigma**

The rates of occurrence of depression and anxiety are higher during the early diagnostic stage and are associated with feelings of shock, grief, sadness, denial, and sadness. The shorter the duration of the diagnosis, the higher the prevalence of anxiety and depression in PLWH. The stigma associated with HIV diagnosis is the main culprit behind the mental health issues faced by PLWH after the diagnosis.

Stigma is of two types- internal and external. Internal stigma is mainly what the person personalizes themselves due to shame, guilt, and embarrassment. It manifests when people see themselves with negative beliefs, attitudes, and practices. (4) External stigma, however, depends on how others behave toward you. It's the other people's negative beliefs, attitudes, and practices toward an individual. (4,5) Both types of stigmas have a debilitating effect on the lives of PLWH and their friends and family, affecting the need for and supply of social support. The internalized stigma is as significant, if not more, in determining the mental health and wellness in PLWH. (4,5)

Women with HIV perceive higher stigma due to social norms and roles that do not work in favor of their mental health, respect, and status in society. (5) Discrimination against women in society and healthcare settings, including stigmatization and judgment by clinicians, creates significant barriers to care.

This is especially pronounced for sex workers, who are frequently shamed for their condition and consequently avoid accessing health services. The expectation of self-sacrifice placed on women has been consistently associated with depression across cultures. (1,7)

Stigma does not only have its grasp on women but also profoundly affects Trans women. A study conducted in Chiwoos concluded that nearly half of trans women reported signs and symptoms of clinical depression and PTSD. Trans women with HIV experience mental health problems like depression and anxiety at a much higher rate than the general population. (5) However, the research is limited in determining what other factors moderate the influence of HIV-related stigma on mental health (8).

With HIV being a chronic condition, people who come across any level of stigma related to HIV diagnosis, experience mild, moderate, or severe anxiety. (3) This along with the lack of social support, people reported feelings of disconnection, loneliness, sadness, and isolation, which have been noted to cause significant distress. These feelings can have adverse effects on a person's health and wellness. (3)

## **Effects on Children, Older Adults, and Those with a History of Trauma**

The mental health of children with HIV is also significantly impacted by the diagnosis of HIV and plays a crucial role in their health outcomes. (9) Children have shown the development of emotional problems and conduct problems and are more likely to exhibit anti-social behaviors, with females showing more severe emotional problems and males having more peer problems and destructive pro-social behaviors. The involvement of their families and their social circle in improving these children's mental health status for positive treatment outcomes becomes crucial. (9)

People with a history of childhood abuse benefit from various coping strategies and empowering them to focus on the support from their loved ones has proven to be beneficial. (10) Promoting psychological interventions in the pediatric departments to address children's mental health is imperative to ensure positive treatment outcomes. (9)

Support for such people who have experienced any kind of trauma can also look like providing easy access to resources that help with coping strategies in the community with the general population. Community building in the form of social support plays a vital role in the health and well-being of older adults with HIV. These people depend on their family members for community

services for various reasons such as financial needs, social gatherings, and family dynamics. (10)

### **Effects of COVID-19 Pandemic and Social Isolation**

The COVID-19 pandemic and the lockdown situation made things worse for the emotional health of the people, especially the vulnerable people in the general population. People diagnosed with HIV and their immunity status increased the stress and anxiety about their immunocompromised health status and increased the intensity of emotions and fear due to the uncertainty of the future. Especially older people who lack the resources and functionality of technology fall victim to isolation due to the inability to use technology to maintain social interaction with their loved ones and even fail to access telehealth services. (11)

### **What Does Social Support Look Like?**

Social support can look like an emotionally safe space to vent, share thoughts, and express feelings from family, friends, partners, etc. (11) It can also be from community health workers, therapists, psychiatrists, social workers, religious leaders, etc. This support can also take the form of financial or housing support through additional resources and support systems. (10) According to some research, PLWH most desire emotional and instrumental

support over any other kind. Some people also benefitted from the social support provided by navigators of mental health support to fight the shame and feelings of guilt. (10)

Relationship and partner support, especially sexual satisfaction in a relationship, showed lower levels of anticipated stigma. Poor communication and sexual dissatisfaction led to more stigma-related problems in mental health. This dynamic also had a significant impact on ART adherence. Therefore, prioritizing support in couples through couple therapy and improving communication can prove helpful in treatment adherence and HIV care in PLWH. (12)

Focusing on human interactions and improving communication skills between intimate couples can help facilitate the disclosure of status in couples and even have a crucial impact on public health outcomes at a community level. (13) Improving relationship quality and communication positively impacted HIV testing and help-seeking behaviors. People with positive interpersonal relationships and support from their partners, friends, and family also benefit from virological suppression. (14)

With recent advances in understanding the role of mental wellbeing and psychosocial support in HIV care, new interventions have demonstrated promising outcomes. One such intervention, IDEAS for Hope, utilized a

telehealth-based model to connect people living with HIV with nurses trained to provide counseling and emotional support via WhatsApp. In a pilot study conducted in 2023 among 60 individuals living with HIV in Tanzania, the intervention was associated with reductions in suicidal ideation and no reported suicide attempts. Participants also demonstrated improved adherence to antiretroviral therapy, providing evidence that integrated mental health support can positively influence both psychological wellbeing and HIV-related treatment outcomes. (23)

A recent project, the Streamlined Treatment and Evidence-based Adolescent Counseling and Medication Support (STREAMS), evaluated a model that integrated streamlined interpersonal psychotherapy (IPT) with family-strengthening and adherence support components for adolescents and young PLWH. (22) HIV-related stigma was shown to contribute to social isolation, strained interpersonal relationships, unresolved grief, and difficult life transitions, all of which negatively affected mental wellbeing. (22) IPT, an evidence-based therapeutic approach, directly addressed these interpersonal stressors by strengthening social support and improving communication. Evidence from both group-based and individual IPT interventions demonstrated sustained reductions in depressive symptoms, including among adolescents aged 15–19, highlighting the relevance of stigma-responsive,

interpersonal-focused interventions for improving mental health and HIV-related outcomes. (22)

Creating a community based on strengths of values such as trust, respect, and belonging adds to the well-being of the vulnerable. The significance of being valued and heard without judgment and shame drives the motivation to keep moving forward in life. Even with limited research, it is easy to understand the long-term effects of social support in PLWH. (2) Not just that, but also throwing some light on how the support is offered and who offers that support that makes a difference. Both the quality and quantity of support (how many people offer their support) play a significant role in the mental health of PLWH. (15)

## **Conclusion**

Social support and positive mental health have a significant role to play in adherence to the treatment, seeking care, and early diagnosis of HIV. A positive state of mental health is indicative of better medication adherence and can be traced back to social support. (16) It is a clinical pillar essential for the wellbeing of PLWH.

Some studies suggest that even though social support and mental health are essential in treatment adherence and outcomes, they are crucial in the early

stage of diagnosis. At the time of diagnosis, a person can experience low social support, and it is at times like these that clinical and social services staff should address the barriers that link PLWH to HIV care. (17) Social isolation, feelings of worthlessness, and shame only increase the stigma and result in delayed diagnosis and poor outcomes. A partner's support has shown more association with treatment adherence than support from friends and family. (18) Therefore, government-supported interventions and policies should facilitate social support in the forms of advertisements, entertainment, etc., that can help tackle stigma with a gender sensitive approach (19) and lead to a social movement. All the barriers that limit the support should be addressed, and work should be put in to make living with HIV more acceptable in our society.

Despite the need for additional research to fully elucidate the relationship between inadequate social support and negative HIV-related outcomes, including quality of life, (20,21) the literature reviewed here highlights the central role of both the quality and quantity of support in determining disease outcomes. (15) However, progress cannot be limited to research alone; empowering vulnerable populations necessitates confronting discriminatory laws, policies, and persistent stigma. (1)

We need to talk about HIV more and empower PLWH and their friends and family to show courage and fight to address the stigma. It is when HIV is considered as another chronic disease that affects people around us that our friends and family can show compassion towards them, treat them with kindness, and offer support of which they are worthy. (15)

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# **Socioeconomic Disparities in Telepsychiatry and Digital Mental Health: A Systematic Review and Analysis**

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## Abstract

Following the COVID-19 pandemic, there was a massive increase in telepsychiatry and digital mental health usage in the United States (Zhang et al., 2021; Cantor et al., 2021). There was a lot of hope that these methods of mental health treatment would close gaps in terms of accessibility, especially for those from lower-income backgrounds and marginalized populations. However, evidence suggests that socioeconomic status (SES) disparities are prevalent and that there is a difference in how much someone benefits from telepsychiatry based on their socioeconomic status (Ostovari et al., 2023; Zhang et al., 2021). This literature review lists findings from evidence collected through ten PubMed studies published during and following the COVID-19 pandemic. People from higher-income backgrounds, those residing in higher-end neighborhoods, and those who have pursued higher levels of education, and those with private insurance had a much higher likelihood of

using telepsychiatry as a means of mental health treatment (Zhang et al., 2021; Ostovari et al., 2023). Rural and low-income people were also more likely to use telephone calls instead of the more immersive video chats for treatment (Zhang et al., 2021; Ostovari et al., 2023). This exposes the underlying issue of technology accessibility for lower income backgrounds. Wi-Fi is not as easily accessible in rural areas and the out-of-pocket costs that result from lack of insurance (Zhang et al., 2021). Telepsychiatry is definitely a step in the right direction as it offers an alternative form of health treatment, but an effort should still be made to close these SES gaps in public health.

## 1. Introduction

Telepsychiatry and digital mental health technologies have been integrated into the mental healthcare system in the United States over the last decade, especially growing rapidly during the COVID-19 pandemic (Cantor et al., 2021; Zhang et al., 2021). Encouragement of staying indoors and maintaining safety protocols by scientists and the government meant restrictions on in person care. The transition to telehealth was mainly seen optimistically for its opportunity to reduce barriers for healthcare inconveniences such as transportation and geographical isolation.

Despite the optimism, mental health care in the United States has a record of carrying large socioeconomic disparities. Those from low-income households and areas along with certain racial groups face higher levels of unmet mental health need (Zhang et al., 2021; Day et al., 2024). This is driven by numerous factors such as insurance coverage, neighborhood-level deprivation (NLD), and unequal access to resources (Ostovari et al., 2023).

As the optimism grew, so did the concern for telepsychiatry. As telepsychiatry grew, there was fear that this mode of health care would only further widen the inequities. Introducing telepsychiatry meant introducing new barriers for disadvantaged groups including reliable internet, internet accessing devices, and the ability to successfully navigate technological devices (Zhang et al., 2021; Tartaglia et al., 2024). This literature review analyzes recent literature to determine whether telepsychiatry has reduced mental health disparities in the COVID-19 and post-COVID context.

## 2. Methods

This literature review was done using PubMed, a literature database maintained by the U.S. National Library of Medicine. This solidifies it as a credible database filled with useful research for us to base our findings off.

Multiple searches were done using key words such as telepsychiatry, telehealth, digital mental health, SES, and COVID-19. The articles were selected to reflect evidence published during and following the COVID-19 pandemic, rather than being restricted to a single publication window. This aided with having relevant evidence and information to generalize findings to pandemic-era and post-pandemic mental health care delivery.

More specifically, the articles included information on mental health and telehealth usage in the United States and had a focus on SES. Attention was also brought to geographic, racial, and policy-related disparities to see if they impacted telepsychiatry effectiveness. Articles were overall selected based on their relevance to the topic at hand.

### 3. Results

#### 3.1 Telepsychiatry Expansion During the COVID-19 Pandemic

Across multiple studies, telepsychiatry and tele-mental health services expanded rapidly during the COVID-19 pandemic as in-person care became limited. Nationally, approximately 43% of U.S. adults reported using telehealth during the pandemic, representing an estimated 114.5 million individuals (Zhang et al., 2021). Facility-level data further showed that 43% of outpatient mental health facilities offered telehealth services at the outset of

the pandemic, indicating a substantial but incomplete infrastructure for remote care delivery (Cantor et al., 2021).

Evidence from health system–level analyses demonstrated that telepsychiatry was associated with improved engagement once implemented. In a community mental health setting, the proportion of kept outpatient appointments increased by 9.2% to 30.2% following telehealth implementation, suggesting that virtual care reduced traditional attendance barriers (Kris, 2023). These findings support the role of telepsychiatry as a durable component of mental health service delivery during and beyond the COVID-19 public health emergency.

### 3.2 Socioeconomic and Geographic Disparities in Telepsychiatry Access

Despite overall growth, telepsychiatry access was unevenly distributed across socioeconomic and geographic groups. National survey data indicated that individuals who were uninsured, had lower household income, or lived in communities with limited broadband infrastructure were significantly less likely to use telehealth services during the pandemic (Zhang et al., 2021). Limited community-level broadband access was associated with approximately 50% lower odds of telehealth use, highlighting the role of digital infrastructure as a structural barrier.

Neighborhood-level analyses further demonstrated disparities tied to socioeconomic context. Using the Area Deprivation Index (ADI), patients living in more socioeconomically deprived neighborhoods had lower odds of video-based visits and higher reliance on telephone-based care compared to those in less deprived areas (Ostovari et al., 2023). These patterns suggest that neighborhood-level deprivation constrains access to higher-quality telepsychiatry modalities.

### 3.3 Modality Differences: Video Versus Telephone-Based Care

Telepsychiatry modality differed systematically by socioeconomic status. Patients residing in high-deprivation neighborhoods were significantly more likely to rely on telephone visits rather than video visits, even when telemedicine was available (Ostovari et al., 2023). This modality gap reflects unequal access to broadband internet, devices capable of video conferencing, and digital literacy support.

Digital literacy studies reinforce this divide. In an urban outpatient psychiatry sample, older age and lower educational attainment were significant predictors of lower digital literacy, which may limit patients' ability to engage with video-based telepsychiatry platforms (Tartaglia et al., 2024).

While attitudes toward digital mental health tools were generally positive, disparities in skills and access remain a barrier to equitable use.

### 3.4 Racial and Ethnic Disparities in Digital Mental Health Use

Racial and ethnic disparities persisted throughout the pandemic period. In a large Veterans Health Administration cohort, non-Hispanic Black veterans consistently used video telehealth at lower rates than non-Black veterans, both before and during COVID-19, with the disparity widening over time (Day et al., 2024). Among Black veterans, video telehealth use was higher among younger, urban, female, and Hispanic individuals, suggesting intersectional patterns of access.

National survey data similarly showed lower telehealth utilization among East and Southeast Asian adults compared to non-Hispanic White adults, even after adjusting for socioeconomic factors (Zhang et al., 2021). These findings indicate that telepsychiatry expansion alone does not eliminate racial and ethnic inequities in digital mental health care.

### 3.5 Policy Context and System-Level Factors

Health policy played a significant role in shaping telepsychiatry access. States with telehealth payment parity laws demonstrated 23% higher odds of telehealth use overall and more than double the odds of video-

based telehealth use compared to non-parity states (Lee & Singh, 2023). These effects were observed across racial groups, though parity policies did not fully eliminate disparities.

System-level analyses also showed that tele-mental health utilization was associated with changes in healthcare utilization and spending. In Mississippi, tele-mental health users experienced a 190% increase in mental and behavioral health outpatient visits and a 12% decrease in all-cause medical expenditures, suggesting improved access without increased overall cost burden (Zhang et al., 2024). However, the benefits were not equally distributed, reinforcing the need for targeted equity-focused interventions.

#### 4. Discussion

Findings from this narrative review indicate that telepsychiatry expansion during the COVID-19 pandemic improved overall access to mental health services but did not eliminate socioeconomic disparities. While telepsychiatry increased appointment attendance and service availability, its benefits were disproportionately realized by individuals with greater financial, technological, and geographic resources.

Persistent reliance on telephone-based care among disadvantaged populations underscores the importance of addressing the digital divide. Without investments in broadband access, device availability, and digital literacy support, telepsychiatry risks reinforcing existing inequities. Policy measures, including payment parity and flexible modality options, appear to play a critical role in shaping equitable access.

## 5. Conclusion

Telepsychiatry and digital mental health services expanded rapidly during the COVID-19 pandemic and demonstrated potential to improve engagement and continuity of care. However, evidence from 2023–2025 indicates that socioeconomic, geographic, and racial disparities in access and modality use persist. Telepsychiatry alone is insufficient to reduce mental health inequities without targeted structural and policy-level interventions. Future efforts should prioritize digital infrastructure investment, equitable reimbursement policies, and culturally responsive telehealth design to ensure that digital mental health innovations benefit all populations.

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**Abhay Jamakayala** is a second-year Health Science major at the University of Florida with a strong academic and clinical interest in pain management, dementia, and internal medicine. As an undergraduate, he shadowed multiple physicians, including a specialist in laser therapy, where he gained firsthand exposure to patient care and developed a deeper understanding of human physiology and non-invasive treatment modalities. Through this experience, Abhay explored the clinical applications of laser therapy in alleviating musculoskeletal pain and supporting recovery, reinforcing his interest in integrative and evidence-based approaches to medicine. Beyond clinical shadowing, Abhay has investigated the intersection of movement and cognitive health, with a particular focus on the effects of dance on memory retention and dementia prevention. These experiences have shaped his appreciation for preventative medicine and the role of lifestyle-based interventions in improving long-term neurological outcomes. Abhay is also deeply committed to service and cultural engagement. He actively volunteers with Indian-serving organizations such as Asha Jyothi, a 5K fundraising initiative dedicated to supporting

children in India who lack access to basic necessities. Additionally, he is a member of the University of Florida's premier Bollywood fusion dance team, Gator Udaya, through which he promotes cultural inclusivity, mental well-being, and physical health. Looking forward, Abhay aspires to pursue a career in medicine that integrates compassionate patient care, clinical research, and community service. His lifelong goals include advancing innovative pain management strategies, contributing to dementia prevention research, and practicing medicine that emphasizes holistic health, accessibility, and long-term quality of life for diverse patient populations.



**Ronith Pasula** is a freshman Biology major at the University of Florida on the pre-med track, with plans to attend medical school and specialize in psychiatry. He is strongly committed to improving mental health care and hopes to build a career focused on helping others through both clinical practice and advocacy. He volunteers at a physician's clinic, where he assists nurses and doctors with patient

care, including physical exams, bloodwork, and routine treatments. This experience has strengthened his understanding of patient needs and the importance of empathy in medicine. Ronith also gained international healthcare exposure in the Bahamas, where he assisted in a pre-operative clinic and observed surgeries. Working within a free healthcare system in a developing setting gave him a valuable perspective on global health disparities and the challenges patients face when resources are limited. Outside of his academic and clinical work, Ronith competes on a dance team, balancing his passion for performance with his professional goals. He is known for being driven, compassionate, and dedicated to making a meaningful impact in the field of mental health.



## **Executive Editor: Kinjal Nayak**

She is an Executive Editor of this peer-reviewed scholarly journal, a Journal of Medical Sociology and Public Health. She is trained as a dentist and epidemiologist, with interdisciplinary expertise spanning clinical practice and population health. Her research interests focus on health equity, social determinants of health, and global health, with particular attention to how structural and social factors shape health outcomes. In her role as Executive Editor of a public health journal, she oversees editorial strategy, peer-review processes, and the dissemination of high-quality research that advances evidence-based public health practice and policy.