ORIGINAL ARTICLE

Utilizing AI for Identifying and Addressing Health Disparities in Communities: A Public Health Nursing Approach

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ABSTRACT

Background: Persistent health inequities disproportionately affect marginalized and underserved communities. Public Health Nurses (PHNs) are instrumental in bridging these gaps through localized, community-based interventions. With the advent of Artificial Intelligence (AI), new possibilities have emerged for more accurate identification and resolution of health disparities.

Objective: This article examines the evolving role of AI in public health nursing and proposes a structured framework for the equitable integration of AI to address community health disparities.

Methods: A narrative review approach was used to synthesize findings from national health datasets, global pilot programs, and current academic literature related to AI in healthcare, public health disparities, and nursing practice.

Results: The use of AI in nursing and public health includes applications such as predictive analytics, personalized care planning, health education via chatbots, and wearable health monitoring. However, AI tools often carry risks of bias, lack of transparency, and inequitable deployment, especially in low-resource settings.

Conclusion: AI, when ethically and inclusively implemented, can enhance the ability of PHNs to identify, address, and monitor community health disparities. A community focused, PHN-led framework is essential for AI to serve as a tool for equity rather than exclusion.

KEYWORDS

• Artificial Intelligence • Health Disparities • Public Health Nursing • Health Equity • Community Health • AI

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INTRODUCTION

Health disparities unequal health outcomes across social, economic, and demographic groups has always remain one of the major challenges faced by health care teams today which is often influenced by race, ethnicity, gender, language preferences, disabilities, socioeconomic status, environmental conditions, and other factors rooted in systemic bias and structural health inequities. This multifaceted challenge in India is grounded in historical, social, and economic inequities. As a result, pronounced disparities in health outcomes persist among various groups particularly Scheduled Castes and Tribes, religious minorities, rural populations, and economically marginalized communities. For example, infant and under five mortality rates have historically remained significantly higher among SC/ST groups than among non-SC/ST populations, even after adjusting for socioeconomic status.[1] Recent national surveys reflect these disparities clearly. In Punjab, for example, the infant mortality rate among SC populations stands at 40 per 1,000 live births, significantly higher than the general population rate of 29 per 1,000.[3] Additionally, the prevalence of anaemia among SC children and women exceeds the state average, indicating persistent nutritional and care disparities[2] Healthcare access also varies widely between Indian states. Institutional delivery rates exceed 99% in better-performing states like Kerala and Tamil Nadu, whereas states such as Bihar and Uttar Pradesh lag behind, with rates closer to 64–68%. Immunization coverage tells a similar story. While the national average for full childhood immunization has risen to 76.6% in recent years, states like Gujarat and Uttar Pradesh remain below this average, highlighting persistent regional and systemic disparities.[3,4] Geographical disparities also play a role. While urban areas often report higher rates of non-communicable diseases due to lifestyle factors such as an 18.3% prevalence of hypertension versus 15.5% in rural areas the rural population suffers from poorer access to diagnostic and treatment services.[5] National data show that around 12% of Indians reported unmet healthcare needs, with the rate rising to 15.3% among the poorest income quintile, and higher among SC/ST groups due to affordability and acceptability barriers.[6] These health inequities are not only due to lack of infrastructure or resources but are also a reflection of systemic social exclusion. Factors such as caste based discrimination, low health literacy, and poor health workforce distribution reinforce disparities. Delayed diagnoses, unequal treatment quality, and financial barriers contribute to poor health outcomes for marginalized populations.[7,8] Public Health Nurses (PHNs) work directly within communities and play an important role in reducing health differences. They watch for health problems, speak up for patients, and provide care that meets community needs. Using Artificial Intelligence (AI) tools like machine learning and data analysis can help them do their work better. AI can find groups of people who are at higher risk, study how health services are used, and help direct resources where they are needed most. By combining AI with information on how people use healthcare, PHNs can create better, more focused plans to help those who need it the most.[10]

BACKGROUND

AI has been applied to healthcare for clinical decision support, risk stratification, and workflow optimization. Recent reviews emphasize its transformative potential for nursing practice while highlighting shortcomings such as limited nursingspecific tools and lack of tailored AI teaching in nursing curricula. Wei *et al.* (2025) critically analyze AI's current use in nursing and call for workforce education and ethical oversight.[11]

AI also enables integration of social determinants of health (SDOH) into predictive models, especially in emergency care, to identify highrisk groups earlier.[12] Park (2024) outlines how AI can reduce disparities by enabling personalized interventions, telehealth, and wearable monitoring, but warns of biases and transparency issues.[13]

AI in Identifying Health Disparities

Predictive algorithms trained on EHRs, SDOH data, and wearable devices can detect patterns indicating communities with elevated risk of chronic disease or unmet healthcare needs. Abbott *et al.* (2024) reviewed applications in emergency medicine and demonstrated how SDOH–AI integration improves risk assessment and equity.[14]

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However, numerous FDAapproved AI medical devices fail to report demographic or socioeconomic data. Muralidharan *et al.* (2024) found only 3.6% of approvals included race/ethnicity and 99.1% omitted socioeconomic information, raising serious bias concerns.[15]

AI in Addressing Disparities via Interventions

AIpowered chatbots, educational tools, and decision aids can augment PHN efforts. For instance, CedarsSinai's CS Connect has reduced administrative burden and improved care quality in diverse patient populations.[16] In Kenya, the "AI Consult" system significantly reduced diagnostic and treatment errors in primary care, improving access and reliability in a resourcelimited setting.[17] AI interventions such as "Meela," an empathetic virtual companion, have demonstrated reductions in loneliness and mental health symptoms among elderly populations, highlighting potential for community mental health support.[18]

Role of Public Health Nurses

PHNs are critical in contextualizing, validating, and applying AI outputs in community settings. They help tailor algorithmic insights into culturally appropriate and acceptable interventions, ensure informed AI governance, and maintain trust with vulnerable populations. Park (2024) positions nurses as key advocates for ethical AI governance and inclusive dataset development.[19] In LMICs, ethical AI deployment requires addressing data poverty, technology access, and avoiding technological colonization. A thematic analysis by the Royal Society for Public Health (2024) introduced the "AI Deployment Paradox," underscoring the potential to worsen disparities without local stakeholder engagement and ethical regulation.[20]

Ethical and Equity Considerations

Algorithmic bias remains a prime concern. Stanford research revealed that popular chatbots like GPT4 and Bard provided racially biased medical information, potentially amplifying disparities.[9] Fairnessaware machine learning frameworks such as proposed by Chinta *et al.* (2024) advocate for inclusive datasets, bias mitigation strategies, and transparency.[21]

EHR based models must avoid stigmatizing language, which has been shown to impair predictive performance, especially for Black patients.[22] Inequitable algorithm design or deployment can lead to underserving marginalized groups or reinforcing systemic biases.

Challenges and Limitations: Key barriers to equitable AI use include data quality, interoperability, digital literacy, resource constraints, and opacity of AI models. Frontiers reviews (2025) note constrained access to nursingspecific AI tools and insufficient longterm impact evaluation.[11] The lack of demographic reporting in device approvals further compounds these limitations.[14] In LMICs, costs, infrastructure challenges, and workforce capacity limit scalable adoption.[18,22]

A PUBLIC HEALTH NURSING FRAMEWORK FOR EQUITABLE AI IMPLEMENTATION

Drawing on Mehta *et al.* (2023), we propose a multiphase framework:

1. Inclusive Design: Engage communities and PHNs in AI tool development to ensure relevance and data representativeness.[22]

2. Data Governance: Collect and monitor demographic and socioeconomic attributes to audit fairness.[14,20]

3. Capacity Building: Provide AI literacy training embedded in nursing education and continuing professional development.[11,13]

4. Ethical Oversight: Establish transparent, explainable AI processes with robust regulatory support.[13,19]

5. Community Engagement: Validate AI outputs via PHN-led outreach and incorporate feedback loops.[18]

6. Monitoring & Evaluation: Continuously assess outcomes and recalibrate models to prevent drift and bias.[14,22]

DISCUSSION

The use of AI in public health has brought new possibilities for identifying at-risk populations and tailoring care. When combined with the grassroots efforts of Public Health Nurses, these tools can help uncover hidden trends in disease distribution and healthcare utilization across communities. However, the integration of AI is not without complications. A major limitation arises

from the underrepresentation of marginalized groups in health data, which can skew AI models and result in biased outputs. Studies have shown that many AI-driven medical technologies approved for use lack adequate demographic data reporting, particularly in terms of socioeconomic and racial variables.[14,15] This underreporting limits the ability of these tools to respond equitably across different populations.

PHNs, with their close ties to local communities, serve as essential intermediaries in the AI ecosystem. They can help translate algorithmic insights into actionable, culturally appropriate interventions. Their role also involves advocating for transparency, ethical data use, and community participation in the design and implementation of AI tools.[19,20] Without this localized validation and feedback, AI models risk becoming detached from the very populations they are meant to serve. Furthermore, barriers such as digital literacy gaps, limited technological infrastructure, and affordability constraints particularly in low-and middle-income countries must be addressed to ensure that AI tools do not exacerbate existing inequities.[18,22] The framework presented in this paper underscores the importance of participatory design, responsible data governance, and ongoing monitoring. Through sustained training, ethical oversight, and community engagement, PHNs can ensure that AI contributes to narrowing rather than widening the health equity gap.

CONCLUSION

AI offers novel avenues to identify and intervene upon health disparities at a community level. However, the benefits of AI hinge on ethical, inclusive designs, and sustained involvement from public health nurses. By adopting a communitycentered framework, PHNs can guide AI toward reducing, rather than reinforcing, health inequities.

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