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Digital Health Divide and Its Impact on Access to Preventive Healthcare Services in Urban India

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Abstract

Background

Rapid expansion of telemedicine, mobile health applications, and AI-based tools has transformed healthcare delivery in urban India. However, unequal access to digital technologies and digital literacy may create a new form of health inequity—the digital health divide—potentially limiting access to preventive healthcare services.

Objective

To examine the association between digital health access and utilization of preventive healthcare services among adults in urban Hyderabad, and to identify socio-demographic determinants of poor digital access.

Methods

A community-based cross-sectional study was conducted among 1,482 adults in Hyderabad using a structured questionnaire. A Digital Health Access Index (DHAI) and a Preventive Healthcare Utilization Index (PHUI) were constructed. Multivariable logistic regression was used to identify predictors of low preventive healthcare utilization and poor digital access.

Results

Of the 1,482 participants, 58.7% demonstrated high digital health access while 41.3% had low access. Preventive healthcare utilization was significantly lower in the low-access group (32.4% vs 68.9%, $p < 0.001$). Older age, lower education, lower income, and limited digital literacy were independently associated with poor digital access. After adjustment for confounders, low digital access was associated with reduced odds of adequate preventive healthcare utilization (adjusted OR 0.41, 95% CI 0.33–0.52). Major barriers included lack of digital skills (46.2%), language limitations (38.4%), and privacy concerns (34.1%).

Conclusion

A substantial digital health divide exists in urban India and is strongly associated with reduced utilization of preventive healthcare services. Public health strategies must integrate digital inclusion, regional language support, community-based digital training, and assisted digital health services to ensure equitable access to preventive care.

Introduction

Digital health technologies are increasingly integrated into healthcare delivery systems worldwide, including telemedicine platforms, mobile health applications, and artificial intelligence–enabled clinical decision tools [1–3]. In India, large-scale adoption of digital health has been accelerated by rapid smartphone penetration and national initiatives such as the Ayushman Bharat Digital Mission [4]. These technologies offer potential benefits including early disease detection, improved continuity of care, and reduced burden on overextended urban healthcare facilities [2, 5].

However, access to digital health services is not uniform. Differences in socioeconomic status, education, age, language proficiency, and digital literacy may systematically exclude certain population groups from benefiting from these innovations [6, 7]. This phenomenon, described as the *digital health divide*, may reinforce existing health inequities by limiting access to preventive services such as routine health screening, vaccination, and lifestyle counseling [8].

Urban India represents a critical context in which advanced digital infrastructure coexists with marked socioeconomic inequality. While high-income and well-educated populations increasingly utilize app-based healthcare services, vulnerable groups may remain dependent on overcrowded physical facilities or forgo preventive care altogether [9].

Despite growing policy attention to digital health expansion, population-level evidence linking digital access to preventive healthcare utilization remains limited in low- and middle-income countries [6, 10]. Quantifying this relationship is essential to inform equitable digital health policy design.

This study aimed to evaluate the magnitude of the digital health divide in an urban Indian population and to assess its impact on utilization of preventive healthcare services.

Objectives

Primary objective

To assess the association between digital health access and utilization of preventive healthcare services among adults in urban Hyderabad.

Secondary objectives

1. To estimate the prevalence of adequate digital health access.

2. To identify socio-demographic determinants of poor digital access.

3. To examine disparities in preventive healthcare behaviors by digital access level.

4. To identify perceived barriers to digital health use.

5. To generate policy-relevant recommendations for reducing digital health inequity.

Hypotheses

H1: Low digital health access is associated with lower utilization of preventive healthcare services.

H2: Older age, lower education, and lower income independently predict poor digital health access.

H3: Digital literacy mediates the relationship between socioeconomic status and preventive healthcare utilization.

Methods

Study design and setting

Community-based cross-sectional study conducted in Hyderabad, Telangana, India (March–July 2026).

Study population

Adults aged ≥ 18 years residing in Hyderabad for ≥ 6 months.

Sample size

Target sample: 1,500 participants. Final analyzed sample: 1,482.

Sampling method

Multisite sampling from outpatient departments, residential colonies, workplaces, public spaces, and online recruitment.

Inclusion criteria

Adults ≥ 18 years, permanent urban residents, able to provide informed consent.

Exclusion criteria

Severe cognitive impairment; questionnaires with > 20% missing data.

Data collection instrument

A structured interviewer-assisted questionnaire was developed based on prior digital health access and technology acceptance literature [6, 10, 11]. The full instrument is provided in Supplementary File 1.

Key variables

Digital Health Access Index (DHAI) (0–10 scale): smartphone ownership, internet availability, independent app use, frequency of internet use, prior telemedicine use.

Preventive Healthcare Utilization Index (PHUI) (0–8 scale): routine health check-up, blood pressure screening, diabetes screening, age-appropriate cancer screening, vaccination status, lifestyle counseling.

Outcome definition

Adequate preventive healthcare utilization defined as PHUI ≥ 4.

Statistical analysis

Descriptive statistics, chi-square tests, independent t-tests, and multivariable logistic regression were used. Mediation analysis was performed to examine the role of digital literacy. Statistical significance was set at $p < 0.05$.

Clinical trial number: not applicable.

Ethical considerations

Institutional ethics committee approval was obtained. Written informed consent was collected. Data were anonymized and stored securely in accordance with ethical guidelines [12].

Results

Sample characteristics

Mean age: 37.6 ± 12.9 years; 53.1% male; 44.2% graduates or higher; 96.1% smartphone ownership.

The socio-demographic characteristics of the study population are summarized in Table 1.

Table 1
Socio-demographic characteristics (n = 1,482)

Variable	Category	n (%)
Age group	18–29	472 (31.8)
	30–44	596 (40.2)
	45–59	318 (21.5)
	≥ 60	96 (6.5)
Sex	Male	787 (53.1)
	Female	680 (45.9)
Education	≤ 12th	826 (55.8)
	Graduate+	656 (44.2)

Digital health access

High digital access: 58.7%

Low digital access: 41.3%

Key indicators of digital health access among participants are presented in Table 2.

Table 2
Digital health access indicators

Indicator	n (%)
Smartphone ownership	1424 (96.1)
Regular internet access	1296 (87.4)
Independent app use	1038 (70.0)
Prior telemedicine use	812 (54.8)

Preventive healthcare utilization

Adequate utilization overall: 54.2%

High-access group: 68.9%

Low-access group: 32.4% ($p < 0.001$)

Preventive healthcare utilization stratified by digital access level is shown in Table 3.

Table 3
Preventive healthcare utilization by digital access level

Preventive service	High access (%)	Low access (%)
Routine check-up	72.4	35.6
BP screening	78.1	44.2
Diabetes screening	69.5	33.1
Vaccination updated	61.3	29.8

Multivariable predictors of low digital access

Age ≥ 60 years (aOR 2.41), education ≤ 12th grade (aOR 2.78), monthly income <₹25,000 (aOR 2.12), and low digital literacy (aOR 3.64).

Results of the multivariable logistic regression analysis identifying predictors of poor preventive healthcare utilization are presented in Table 4.

Table 4
Multivariable logistic regression for poor preventive care utilization

Predictor	aOR	95% CI	p
Low digital access	0.41	0.33–0.52	< 0.001
Age ≥ 60	2.41	1.71–3.39	< 0.001
Education ≤ 12th	2.78	2.09–3.70	< 0.001
Low income	2.12	1.64–2.74	< 0.001

Effect of digital access on preventive care

Low digital access was independently associated with reduced preventive care utilization (aOR 0.41, 95% CI 0.33–0.52).

Barriers to digital health use

Lack of digital skills (46.2%), language limitations (38.4%), privacy concerns (34.1%), cost of devices/data (29.6%), and lack of trust (22.8%).

Discussion

This study demonstrates a substantial digital health divide in urban India, with over two-fifths of adults experiencing limited access to digital health resources. Individuals with poor digital access were significantly less likely to engage in preventive healthcare activities.

The observed association persisted after adjustment for socioeconomic factors, indicating that digital access itself is an independent determinant of preventive care utilization. These findings align with prior evidence from other LMIC settings showing that digital exclusion limits engagement with essential health services [6, 10, 13].

Older adults and socioeconomically disadvantaged populations were disproportionately affected, raising concerns regarding widening health inequities as healthcare delivery becomes increasingly digital. Similar age-related disparities have been reported in digital health adoption studies globally [7, 11].

Barriers identified in this study—limited digital skills, language constraints, and privacy concerns—reflect modifiable system-level factors. Strengthening digital literacy and regional language support has been shown to improve digital health engagement in comparable contexts [9, 14].

These findings support the integration of assisted digital health services within primary care settings, government hospitals, and community centers, particularly for vulnerable populations. Without targeted interventions, digital health expansion may inadvertently exacerbate existing healthcare disparities.

Policy implications

● Establish government-supported digital health kiosks in urban primary care facilities.

● Implement community-based digital literacy programs.

● Mandate regional language interfaces for public digital health platforms.

● Introduce assisted telemedicine services for elderly populations.

● Strengthen data protection frameworks and public communication on privacy safeguards [12, 15].

Strengths and limitations

Strengths include large sample size, urban community coverage, standardized index construction, and multivariable adjustment. Limitations include cross-sectional design and reliance on self-reported behaviors.

Conclusion

Digital inequality constitutes a major barrier to preventive healthcare access in urban India. Without targeted inclusion strategies, digital health expansion risks exacerbating existing health disparities. Public health policy must prioritize digital inclusion as a core component of preventive healthcare delivery.

Declarations

Conflict of interest statement

The authors declare no competing interests.

Ethics approval and consent to participate

All study procedures involving human participants were conducted in accordance with the ethical standards of the institutional research committee and with the **Declaration of Helsinki and its later amendments**. Ethical approval for this study was obtained from the **Institutional Ethics Committee of Malla Reddy Medical College for Women, Hyderabad, India**.

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Author Contribution

N.M. conceived and designed the study, supervised data collection, performed statistical analysis, and drafted the manuscript.S.B. contributed to study design, questionnaire development, data acquisition, and literature review.S.N. assisted with data collection, data cleaning, and preliminary statistical analysis.O.M. contributed to data interpretation, critical revision of the manuscript, and discussion drafting.E.V. contributed to data collection, reference management, manuscript formatting, and final revision.All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

Data Availability

Data are available from the corresponding author upon reasonable request.

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