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Original Research Article

Digital literacy barriers and data privacy concerns in Ayushman Bharat Digital Mission: a community-based observational study in Tinwari village, Dehradun

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ABSTRACT

Background: The Ayushman Bharat Digital Mission (ABDM), launched in September 2021, aims to create a unified digital health ecosystem across India. Despite significant infrastructural growth, grassroots adoption among rural and vulnerable populations remains critically low. This study aimed to assess ABDM and ABHA awareness levels, identify barriers to adoption across demographic groups, and examine data privacy concerns among community members in Tinwari Village, Dehradun, Uttarakhand, India.
Methods: A cross-sectional observational study was conducted in Tinwari Village (January to March 2024). A total of 120 community members were purposively selected: senior citizens (60+ years; n=25), women (n=35), adults 25-59 years (n=38), and adolescents 13-24 years (n=22). Data were collected via structured informal interviews and field observations. No personal identifying information was recorded.
Results: Of 120 participants, 100 (83.3%) had zero awareness of ABDM or the ABHA application, despite all being confirmed mobile phone users. Among the 20 (16.7%) with some awareness, none were actively using the platform. The five principal barriers were: absence of community outreach (n=100, 83.3%), fear of Aadhaar-linked data fraud (n=94, 78.3%), entertainment-only digital behaviour (n=85, 70.8%), deferred adoption attitudes (n=78, 65.0%), and technology anxiety (n=66, 55.0%). Senior citizens demonstrated the highest non-awareness rate (24/25, 96.0%), followed by women (31/35, 88.6%), adults (30/38, 78.9%), and adolescents (15/22, 68.2%).
Conclusions: ABDM adoption failure reflects a systemic communication and outreach failure rather than an infrastructural one. Structured ASHA/ANM training in ABDM facilitation, plain-language multilingual data privacy communication, and population-specific awareness strategies targeting senior citizens and women are urgently needed.

Keywords: ABHA, ASHA workers, Ayushman Bharat Digital Mission, Data privacy, Digital health literacy, mHealth rural health

INTRODUCTION

India's healthcare system stands at a critical inflection point. While remarkable medical innovations have transformed clinical possibilities, access to these advancements remains deeply unequal across the country's vast geographic and socioeconomic spectrum. The Ayushman Bharat Digital Mission (ABDM), launched in September 2021 with an ambitious government outlay of Rs 1,600 crore over five years, represents India's most comprehensive policy response to this inequality - aiming to build a unified digital health information highway connecting every patient, provider, and institution within a single integrated ecosystem.[1,2]

A stark contrast exists between ABDM's quantitative achievements at the infrastructural level and its real-world penetration at the community level. Despite impressive registration figures and facility onboardings, rural populations across India continue to face dual and intersecting barriers: inadequate awareness of ABDM's existence and a profound lack of understanding about its relevance to their lives. These barriers extend well beyond technological access - they are fundamentally cognitive, cultural, and rooted in lived experiences of digital mistrust.[3] Tinwari Village, Dehradun District, Uttarakhand, was selected as the study site given its semi-rural character: basic mobile phone ownership is nearly universal, yet structured digital health awareness remains negligible. This setting offered an ideal natural context to examine real-world barriers to ABDM adoption at the grassroots level where connectivity exists but meaningful health-oriented digital engagement does not.

METHODS

Study design

A cross-sectional observational study design was adopted. Data were collected through structured informal interviews and direct field observation during community visits to Tinwari Village from January 2024 to March 2024. This design was selected as appropriate for generating preliminary community-level evidence on awareness and barrier patterns in an under-researched rural setting.

Study setting

The study was conducted in Tinwari Village, Dehradun District, Uttarakhand, India - a semi-rural community located approximately 20 km from the district headquarters. The setting is characterised by near-universal basic mobile phone ownership alongside a near-complete absence of structured digital health engagement, making it representative of many peri-urban and semi-rural Indian communities.

Study population and sample size

A total of 120 community members were purposively selected to ensure cross-generational and gender-inclusive representation across four major demographic groups: senior citizens (aged 60+ years), women of all age groups, adults aged 25-59 years, and adolescents aged 13-24 years. Purposive sampling was employed to ensure meaningful representation of vulnerable demographic groups most at risk of digital health exclusion.

Data collection

Data were collected through structured informal interviews conducted by the investigator during field visits. Each participant was asked a standardised set of open-ended questions covering: (1) awareness of ABDM and the ABHA application, (2) experience with or use of digital health platforms, (3) attitudes toward digital health services, and (4) specific concerns regarding data privacy and Aadhaar linkage. All interactions were conducted in Hindi (the local language). Responses were recorded contemporaneously through field notes. No voice recordings or personal identifying information were collected.

Inclusion and exclusion criteria

Participants were included if they were permanent residents of Tinwari Village, aged 13 years or above, and willing to provide voluntary informed verbal consent. Individuals who were temporary visitors, unwilling to participate, or cognitively unable to respond meaningfully were excluded.

Ethical considerations

Field observations were conducted with full voluntary participation and informed verbal consent. No personal identifying information was recorded at any stage. As this study involved non-invasive community observation without collection of sensitive personal data, formal institutional ethical approval was not mandated under applicable Indian ethical research guidelines. All participants were informed of the study's purpose, voluntary nature, and their right to withdraw at any point without consequence.

Data analysis

Descriptive analysis was performed for all collected data. Awareness and barrier prevalence rates were calculated as frequencies (n) and proportions (%). Demographic disaggregation was performed across the four pre-defined groups. Thematic saturation for qualitative responses was achieved at approximately 90 interviews, validating the adequacy of the final sample of 120.

RESULTS

Socio-demographic profile of participants

A total of 120 community members participated in the study. The sample comprised 25 senior citizens (20.8%), 35 women of all ages (29.2%), 38 adults aged 25-59 years (31.7%), and 22 adolescents aged 13-24 years (18.3%). All 120 participants were confirmed mobile phone users. Self-reported educational levels ranged from no formal education to graduate and above. The demographic distribution of participants is presented in Table 1.

ABDM awareness distribution

The most significant finding was the near-total absence of ABDM awareness among participants. Of 120 participants, 100 (83.3%) demonstrated no knowledge of ABDM, the ABHA application, or any associated digital

health services despite all being confirmed mobile phone users. This demonstrates that connectivity and device ownership alone are insufficient predictors of digital health awareness (Figure 1).

Table 1: Demographic profile of study participants - Tinwari village, Dehradun (n=120).

Demographic groups	Description	Number	% of sample
Senior citizens	60 years and above	25	20.8
Women	All age groups	35	29.2
Adults	25-59 years	38	31.7
Adolescents	13-24 years	22	18.3
Total	All groups	120	100.0

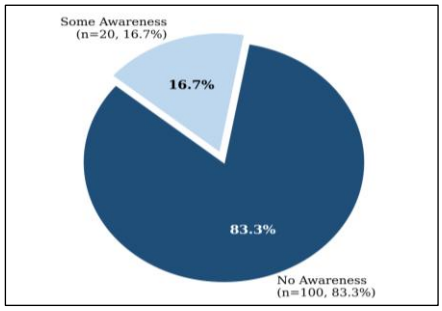

Figure 1: ABDM awareness distribution among study participants (n=120), Tinwari village, Dehradun.

Among the 20 (16.7%) participants who demonstrated any level of awareness, none were actively using the ABHA platform or any ABDM-linked service at the time of the study. These individuals had heard of ABDM or ABHA through incidental sources primarily news or social media but had not taken any steps toward registration or utilisation.

Barriers to ABDM adoption

Among all 120 participants, five major barriers to ABDM adoption were identified through structured informal interviews. Multiple responses were permitted; barrier prevalence rates are presented in Table 2.

Absence of community-level awareness and outreach emerged as the most prevalent barrier, reported by 100 participants (83.3%). Fear of Aadhaar linkage and data fraud was identified as the most critical concern in terms of severity, affecting 94 (78.3%) participants.

Entertainment-only digital behaviour characterised by exclusive use of mobile phones for social media and video consumption with no health-oriented applications - was reported by 85 (70.8%) participants. Deferred adoption attitudes were expressed by 78 (65.0%) participants, and technology anxiety or unfamiliarity with government digital applications was reported by 66 (55.0%) participants.

Table 2: Key barriers to ABDM adoption - primary field observation, Tinwari village (n=120; multiple responses permitted).

Barriers	Academic term	Number (%)	Severity
Absence of awareness and community outreach	Awareness deficit	100 (83.3)	Critical
Fear of Aadhaar linkage and data fraud	Digital trust deficit	94 (78.3)	Critical
Entertainment-only digital behaviour	Selective digital adoption	85 (70.8)	High
Deferred adoption attitude	Knowledge-barrier theory	78 (65.0)	High
Technology anxiety and unfamiliarity	Technology anxiety	66 (55.0)	Moderate

Demographic disaggregation of awareness

ABDM awareness levels varied across demographic groups (Table 3). Senior citizens (aged 60+ years) demonstrated the highest rate of non-awareness at 24/25 (96.0%), compounded by low digital literacy and minimal engagement with government digital platforms. Women of all ages recorded non-awareness in 31/35 (88.6%) cases, with additional barriers including restricted smartphone access and limited household decision-making autonomy consistent with the well-documented gender digital divide in India.[12]

Table 3: Demographic disaggregation of ABDM awareness and adoption, Tinwari village (n=120).

Demographic Groups	Number	No awareness, N (%)	Aware, not using, N (%)	Actively using, N (%)
Senior citizens (60+)	25	24 (96.0)	1 (4.0)	0 (0.0)
Women (all ages)	35	31 (88.6)	4 (11.4)	0 (0.0)
Adults (25-59 years)	38	30 (78.9)	8 (21.1)	0 (0.0)
Adolescents (13-24)	22	15 (68.2)	7 (31.8)	0 (0.0)
Total / overall	120	100 (83.3)	20 (16.7)	0 (0.0)

Adults aged 25-59 years demonstrated non-awareness in 30/38 (78.9%) cases. Adolescents aged 13-24 years, despite being the most digitally active group overall, showed non-awareness in 15/22 (68.2%) cases confirming that general digital fluency does not automatically translate into digital health literacy. No participant in any demographic group was actively using the ABHA platform at the time of study.

Education level and ABDM awareness

A critical finding was that ABDM awareness deficits were not restricted to participants with limited formal education. Even graduate-level participants demonstrated alarming rates of non-awareness (Table 4). This challenges the assumption that formal education alone bridges the digital health literacy gap.

Table 4: Self-reported education level vs ABDM awareness in Tinwari Village.

Education levels	No awareness, N (%)	Aware, not using, N (%)	Actively using, N (%)	Key barrier
No formal education	~98	~2	0	Total digital exclusion
Primary school (1-5)	~95	~4	~1	Low literacy + no outreach
Secondary (6-10)	~88	~9	~3	Awareness deficit + tech anxiety
Higher secondary (11-12)	~75	~20	~5	Perceived irrelevance
Graduate and above	~60	~30	~10	Health literacy gap despite education

(Note: figures are observational estimates from field interviews; ~ indicates approximation).

Data privacy awareness gaps

A cross-cutting finding was the profound gap between ABDM's policy commitment to data privacy and the lived reality of participants. Among the 20 (16.7%) participants with any ABDM awareness, none could articulate their data rights within the ABHA system, the consent mechanisms governing health data sharing, or the regulatory protections provided by the Digital Personal Data Protection Act (DPDPA) 2023.[6] These findings are summarised in Table 5.

Table 5: Data privacy awareness gaps in Tinwari village (n=120).

Privacy concerns	Field observation finding
Aadhaar linkage anxiety	94/120 (78.3%) participants expressed fear of biometric-health data linkage
Informed consent understanding	0/20 (0%) aware participants could explain the ABHA consent mechanism
Data utilisation awareness	0/120 (0%) participants knew who could access their health data
Third-party data sharing	Widespread fear of insurance or government misusing health data
Right to withdraw consent	0/120 (0%) participants were aware they could revoke health data consent

DISCUSSION

Principal findings

This community-based observational study documents a near-total absence of ABDM awareness in a semi-rural community where mobile phone ownership is universal. Of 120 participants, 100 (83.3%) had never heard of ABDM or ABHA, and among the 20 (16.7%) with minimal awareness, none were actively using the platform. Five key adoption barriers were identified: absence of community outreach, digital trust deficit, entertainment-only digital behaviour, deferred adoption attitudes, and technology anxiety.

Digital awareness is not a function of education alone

Perhaps the most analytically significant finding is that ABDM awareness deficits transcend educational boundaries. Graduate-level individuals in Tinwari Village remained largely unaware of ABDM - consistent with the Digital Health Literacy Gap concept, which is distinct from general digital literacy and formal educational attainment.[10] Policy responses must move beyond literacy-focused interventions and address the systemic absence of health-specific digital outreach. Kamath et al[3] similarly documented widespread ABDM confusion among health science postgraduates in Karnataka, suggesting this is a pan-India phenomenon.

The field evidence is unambiguous: ABDM adoption failure in this community is not a citizen problem - it is a systemic communication and training failure.

The role of frontline healthcare workers

The findings strongly support prioritising ASHA workers and ANMs as the primary vehicle for ABDM community adoption. Communities learn most effectively from trusted, proximate messengers who share their language, culture, and lived context.[4,5] The near-zero uptake of ABDM in Tinwari Village, despite universal mobile

phone ownership, confirms that in the absence of trusted intermediaries, even well-designed digital health platforms remain inaccessible to rural populations. Arjun et al[3b] found that primary care providers play a major role in educating patients regarding ABDM and facilitating early adoption.

"If our ASHA worker had explained this to us - the way she explains about vaccination and antenatal care - we would have registered for ABHA a long time ago. We trust her. We would have listened." - Female participant, Tinwari Village

Addressing the data privacy trust deficit

The pervasive fear of Aadhaar-linked data fraud identified among 94 (78.3%) participants reflects a broader crisis of digital trust. The DPDPA 2023 provides a robust legal framework for patient data sovereignty - but a law communities do not know exists cannot protect the people it was designed to safeguard.[6] ABDM must invest in plain-language, multilingual, community-delivered data privacy communication. Gupta et al documented similar informed consent comprehension challenges in Indian digital health contexts.[11]

The gender digital divide

Women in this study recorded non-awareness at 31/35 (88.6%) - second only to senior citizens. This is compounded by restricted smartphone access and limited household decision-making autonomy that characterise the Gender Digital Divide in rural India.[12] Targeted, women-focused ABDM outreach strategies ideally delivered through existing female health worker networks are urgently required.

Adolescents and the digital fluency paradox

The finding that 15/22 (68.2%) of adolescents - the most digitally active group demonstrated no ABDM awareness presents a critical opportunity. This cohort is reachable through school-based interventions, peer-to-peer outreach, and social media channels. Converting adolescents into ABDM-aware household advocates could serve as a scalable strategy for broader community adoption.

Comparison with prior work

These findings extend prior observations by Arjun et al, who documented that major ABDM information sources were television and internet institutional channels rather than trusted community intermediaries.[3] The near-zero data privacy literacy documented here aligns with Gupta et al[11] and confirms that the gap between ABDM's policy framework and community understanding persists across different Indian settings. The role of the Gender Digital Divide is consistent with broader evidence on rural mHealth adoption barriers.[12]

This study has few limitations. This study was conducted exclusively in Tinwari Village, Dehradun District a single community. Findings should be interpreted as community-specific observations rather than nationally representative data. The study employed purposive rather than random sampling, limiting statistical generalizability; however, this was appropriate given the exploratory observational design. Data collection relied on structured informal interviews rather than validated psychometric instruments such as the eHEALS scale, introducing the possibility of social desirability bias. Education level data were self-reported. The study reflects a cross-sectional snapshot, and education-level awareness figures are observational estimates. Notwithstanding these limitations, the consistency of findings strengthens the credibility of the core observations.

CONCLUSION

This community-based observational study offers ground-level evidence of a profound gap between ABDM's policy ambitions and its lived reality. In Tinwari Village, where mobile phones are universally present, 100/120 (83.3%) participants had never heard of ABDM or the ABHA health ID. Among the 20 (16.7%) with minimal awareness, none were using the platform held back by deeply rooted fears of data fraud, Aadhaar misuse, and rational hesitation rooted in incomplete knowledge.

The most policy-significant conclusion is that digital health unawareness is not a function of education level. Graduate-educated individuals demonstrated near-identical levels of ABDM non-awareness as those with primary or no formal schooling conclusively demonstrating that India's digital health literacy gap is independent of general educational attainment.

The path forward is clear: India's frontline health workforce - ASHA workers and ANMs represent the most powerful, trusted, and underutilised resource for ABDM community adoption. Structured ASHA/ANM training in ABDM facilitation, plain-language multilingual data privacy communication, and population-specific awareness campaigns are the three urgent imperatives required to bridge the gap between ABDM's infrastructure and its intended beneficiaries.

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