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Water, Sanitation and Hygiene (WASH) Facilities in Sikkim: Findings from National Family Health Survey (NFHS) 5

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ABSTRACT

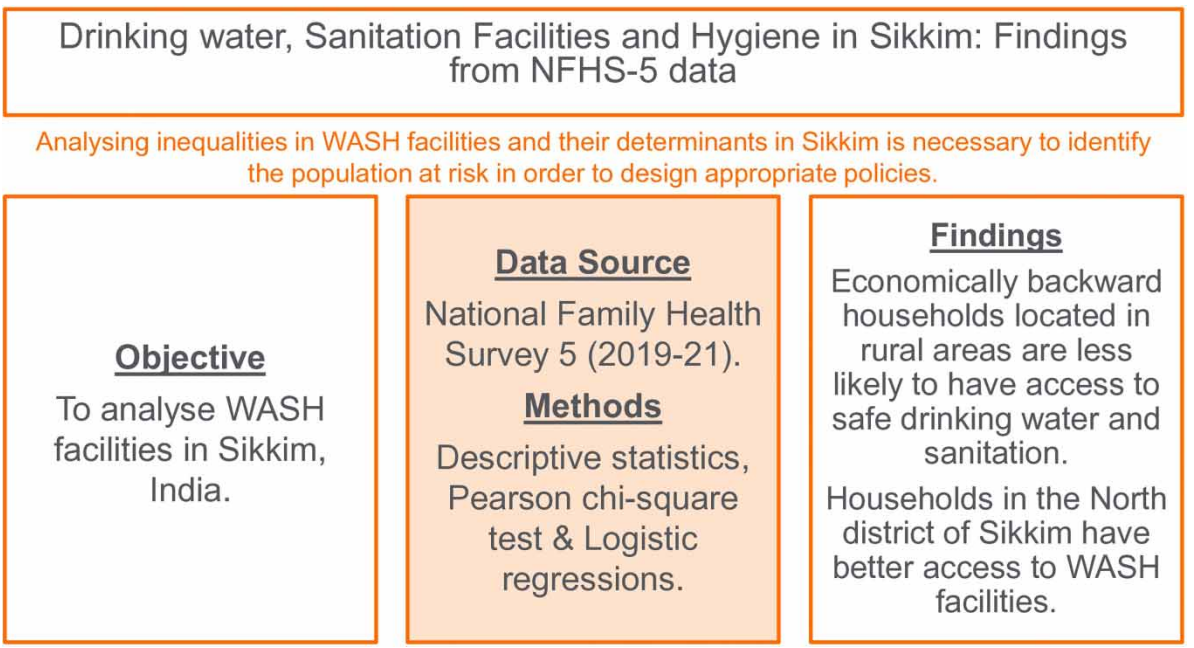
The UN General Assembly has recognized access to improved drinking water and sanitation as a fundamental right. Despite this, a significant portion of the global population lacked access to safely managed drinking water (around 25%) and improved sanitation (around 50%) in 2020. India, the second most populous country, has approximately 3.7% of its population without access to improved drinking water and 31% without access to improved sanitation. This article examines factors influencing household access to improved drinking water and sanitation in Sikkim, India, using National Family Health Survey (NFHS) 5 data. The findings reveal that urban households, older, unmarried, female-headed households, with smaller families, earning higher incomes, located in the North, West and South districts, were more likely to have access to improved drinking water. Similarly, households with unmarried heads, located in higher wealth quintiles, located in the East district, were more likely to have access to improved sanitation facilities. The study suggests subsidizing the cost of improved water and sanitation services for poor rural households and increasing public investment to make these facilities more affordable for them.

Key words: Hygiene, India, Sanitation, Sikkim, Water

HIGHLIGHTS

- People in developing and underdeveloped countries have poor access to WASH facilities.
- Studying the distribution and inequalities of WASH conditions and their determinants in Sikkim is necessary to design appropriate policies.
- Studies in the context of the Himalayan region are limited.
- This study employs national-level survey data from NFHS-5 (2019–2021) to analyse the WASH facilities in the Northeast state of India.

GRAPHICAL ABSTRACT



1. INTRODUCTION

WASH is used as an abbreviation to encompass the three vital components of understanding the drinking water, sanitation and hygiene facilities which play vital roles for health, survival and development. The significance of these basic facilities can be understood from the fact that the sixth goal of the Sustainable Development Goals (SDGs) focuses on providing access to safe drinking water and sanitary conditions for everyone (Muniyapillai *et al.*, 2022). Moreover, the United Nations General Assembly and the Human Rights Council have declared fundamental human rights essential for survival (UN, 2010). The improved availability of these facilities is a key indicator reflecting the quality of human lives and contributes to a healthy life, ultimately benefiting the economy (Rahut *et al.*, 2022). A number of studies have suggested unavailability or poor WASH facilities are directly linked to communicable diseases (e.g., diarrhoea) (Freeman *et al.*, 2017; Soboksa *et al.*, 2020; Shrestha *et al.*, 2022) and have a significant contribution to global diseases burden (Prüss-Ustün *et al.*, 2019). More than 2 billion people across the globe do not have readily accessibility to water without contamination at home, over 263 million people spend more than 30 min fetching water (Sharma Waddington & Cairncross, 2021). At the same time, 3.6 billion people lack basic sanitation facilities and 2.3 billion people worldwide lack safe hygiene practices (Kayser *et al.*, 2019).

As of the 2017 estimate, approximately 892 million people globally engaged in open defecation, with the majority (524 million) located in India (WHO & UNICEF, 2010). The situation of wash facilities is a bit alarming in the Indian subcontinent, WHO statistics show that 782 deaths per 1,000 people in India are attributed to WASH, and it also accounts for 7.5% of all mortality (Bartram & Cairncross, 2010). Therefore, to enhance public health conditions and effectively control the outbreak of diseases like diarrhoea and other waterborne infections, it is crucial to develop household drinking water, sanitation conditions and hygiene behaviour.

These indicators are assessed by different agencies in different countries, in terms of India it is done under the National Health and Family Survey (NFHS) which remains the backbone of the data system to understand the prevailing situation in the country (Roy *et al*., 2023).

At the national level, several studies are available that depict the current situation of WASH facilities in India (Gurung *et al*., 2023; Roy *et al*., 2023). However, when it comes to the state of Sikkim, very few works have been conducted to examine the water and sanitation facilities in the region. Among the limited research carried out, none could be found that analyses WASH facilities based on data generated from NFHS-5. Thus, this research work remains the first of its kind in the state. It is noteworthy that Sikkim remains a top performer in the small state category in various socio-economic parameters, adding intrigue to this research on water and sanitation facilities.

1.1. Area of the study

Sikkim, nestled in the northeastern part of India, is a Himalayan state bordered by Nepal to the west, China to the north and east and Bhutan to the southeast (Figure 1). In the southern part of the state, it shares barely 80 km of the border with the Darjeeling district of West Bengal in India (Singha & Nayak, 2020). The state is geographically located between 27°04′46″ and 28°07′48″ north latitudes and 88°00′58″ and 88°55′25″ east longitudes. It spans approximately 114 km from north to south and 64 km from east to west, with a total geographical area of 7,096 sq km. The state comprises six districts and holds the distinction of having the lowest population in the

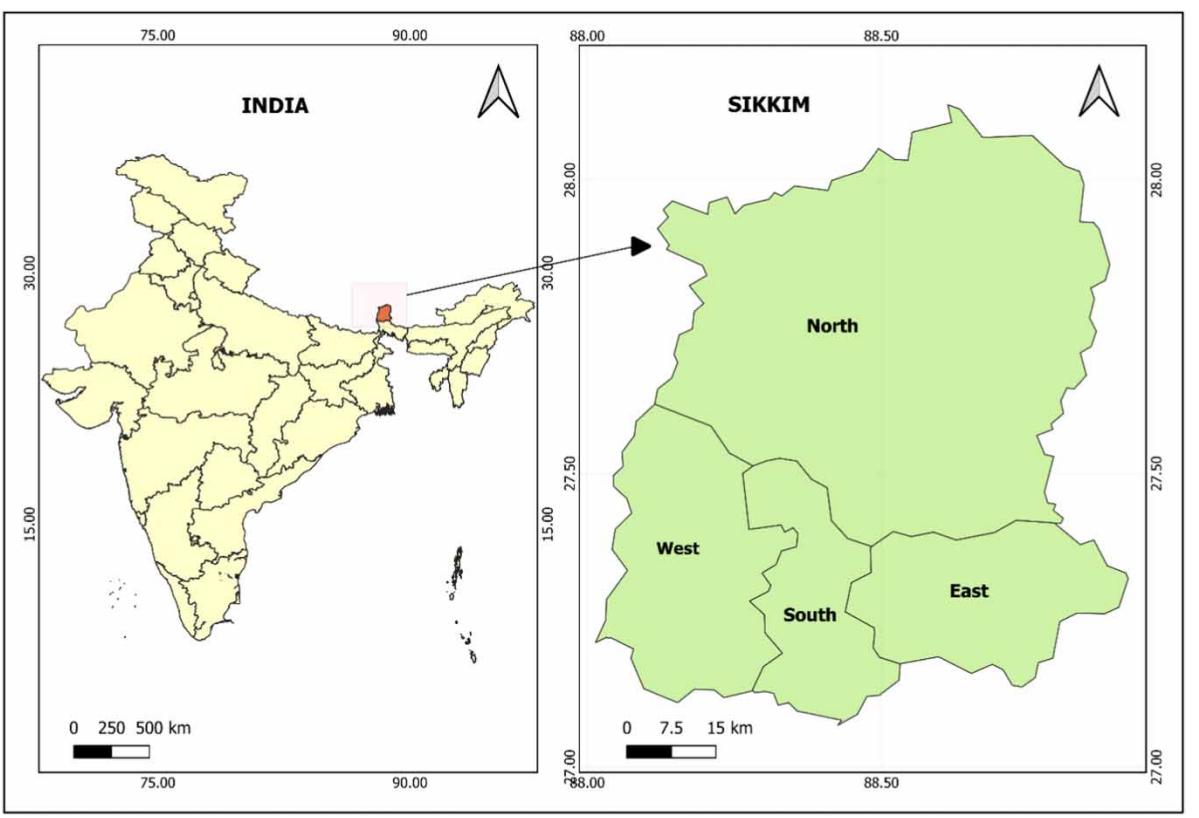


Fig. 1 | Location map of the study area.

country, with just 6.11 lakh residents. Despite its small population, a significant majority, 74.85%, resides in rural areas, amounting to around 4.57 lakh people. In contrast, urban areas account for only 25.15% of the population, with a mere 1.53 lakh residents (Census of India, 2011).

As previously highlighted, Sikkim consistently maintains its top-ranking position across various indicators. This assertion is substantiated by data from the 2011 census, revealing that Sikkim not only exceeded the national average in providing basic amenities but also outperformed all seven other states in the North Eastern Region (NER). In urban areas, 70% of households had access to tap water, and 92% were connected to drainage facilities, surpassing the national averages of 62 and 82%, respectively (Census of India, 2011). This underscores Sikkim's leading position in the NER. Moreover, the state demonstrated superior performance in providing households with bathroom and latrine facilities compared with the national average. Notably, in rural Sikkim, the state earned the Cleanest State Award in 2016 for its exceptional sanitation efforts, with 98.2% of households having access to sanitary latrines (PTI, 2016). Given this context, it would be intriguing to analyse the current state of WASH facilities in Sikkim through the lens of NFHS-5. This research stands as a pioneering effort, contributing to the limited existing literature in this domain.

2. METHODS

2.1. Data

The data analysed in this study was obtained from NFHS-5. The NFHS-5 is a nationwide large-scale and multi-round survey based on a representative sample of households across India conducted by the International Institute for Population Sciences (IIPS), Mumbai under the Ministry of Health and Family Welfare, Government of India. The NFHS provides vital data on health and family welfare and other issues related to them at both national and state levels. So far, five rounds of NFHS have been conducted. This study has used the most recent round of NFHS-5 (2019–2021) which has covered 636,699 households across 29 states of the country. This study uses data from only 3,516 sample households from Sikkim.

2.2. Measures

The present study has used two key dependent variables: 'source of drinking water' and 'type of toilet used'. The categorization of improved and unimproved sources of drinking water and sanitation follows the classification provided by the WHO-UNICEF Joint Monitoring Programme (JMP). For our study, improved drinking water sources included piped into dwelling, piped to yard/plot, public tap/standpipe, piped to neighbour, tube well or borehole, protected well, protected spring, rainwater, tanker truck, cart with small tank and bottled water. Unimproved sources included unprotected wells, unprotected springs, surface water and others. Sources of sanitation were also dichotomized into (1) improved sanitation and unimproved sanitation (0). Improved sanitation refers to flush (to piped sewer system, septic tank or pit latrine or don't know where), pit latrine with slab, ventilated improved pit and composting toilet. On the other hand, unimproved sanitation refers to flush to somewhere else, pit latrine (without slab/open pit), bucket toilet, hanging toilet/latrine, open defecation and others.

Several theoretically relevant socio-economic characteristics were included in the analysis, such as gender, education, wealth index, marital status, family size, caste category, family structure and agricultural land ownership. Place of residence (urban/rural) and districts were included to examine the regional effects.

2.3. Analytic approach

Analyses were based on weighted data to account for the complexity of the survey design. First, to describe the study population, descriptive statistics (cross-tabulation, frequencies and percentages, figures and tables) were

generated for all dependent and independent variables. Associations were analysed using the Pearson chi-squared test. Finally, a logistic regression model was used to assess the association between socio-demographic and economic variables and access to improved sanitation and drinking water. The results were presented as tables and summary statistics in odds ratios and *p*-values. The analysis was done using Stata 15 software.

3. RESULTS

The distribution of socio-demographic characteristics of the study population is presented in Table 1.

Around 98% of the households had access to improved sanitation and toilet facilities while around 94% of the households had access to improved water sources. The majority of the households are headed by males (around 82%). More than half of the population (i.e., around 60%) had attained secondary and higher education. Almost 57% of the population were residing in the urban areas. About 35% of the households belonged to middle-income category followed by richer (32%) and poorer (18%). Only 2.6% belonged to the poorest category. Almost three-quarters (73%) of the population were married. Almost all households had drinking water sources within 30 min. Around 67% of the households were nuclear families. Around half of the population belonged to Other Backward Classes (OBC) followed by Scheduled Tribe (ST).

3.1. Status of households' wash services in Sikkim

Household access to drinking water, sanitation facilities and shared sanitation are presented in Table 2.

North Sikkim (94.78%) had the highest access to improved drinking water, followed by East (94.48%) and South (94.42%), while the West district (91.68%) had the lowest access to improved drinking water. Again, North Sikkim (99.39%) had the highest access to improved sanitation facilities; however, the West district (93.19%) had the lowest access to improved sanitation facilities. In the state, a majority (around 63%) of the households in the East district had the water source within dwellings, followed by North (50.44%), West (39.53%) and South (33.40%). All households in the East district had access to improved drinking water within a distance of less than 30 minutes. This was followed by the South (99.83%), North (99.71%) and West (99.69%). Despite claims of 100% open defecation free, it was noted that West Sikkim (0.85%) had the highest prevalence of open defecation among the four districts, followed by North Sikkim (0.4%). However, the South and East districts (0.29% each) had the lowest prevalence of open defecation in the state.

North district (17.74%) had the highest proportion of shared sanitation facilities, followed by East (16.39%), South (10%) and West (4.84%). In all four districts, around 96% of the households had water at handwashing places. Additionally, the South district (96.79%) had the highest availability of soap or detergent at handwashing places. The majority of the diseases can be prevented by treating water before drinking. North district (95.97%) had the highest number of households treating water before drinking followed by South (97.70%) and East (90.15%). However, only 74.79% of households treated water before drinking. West district had the lowest facilities in terms of all WASH key indicators.

3.2. Socio-economic factors related to improved water and sanitation

The logistic regression results in Table 3 report the key determinants of a household having access to improved water and sanitation. The significant determinants of access to improved drinking water are caste category, household size, marital status, educational level, place of residence and the number of rooms.

First, female-headed households are 82% more likely to access improved water sources than male-headed households. This is plausible as in the Himalayan region, women have the traditional role of managing water (Shrestha *et al.*, 2019). Women could pay more attention to such issues than their male counterparts, especially when women are the household heads. Regarding sanitation, Sikkim has been declared an open defecation-free

Table 1 | Distribution of socio-demographic characteristics of the study population ($N = 3,516$).

Variables	Freq.	Percent
Toilet		
Unimproved toilet	66	1.89
Improved toilet	3,450	98.11
Water		
Unimproved water source	211	6.02
Improved water source	3,305	93.98
Gender		
Female	640	18.21
Male	2,876	81.79
Education		
No education	545	15.52
Primary	822	23.4
Secondary	1,557	44.29
Higher	591	16.8
Wealth quintile		
Poorest	92	2.62
Poorer	640	18.2
Middle	1,230	34.99
Richer	1,141	32.44
Richest	413	11.75
Place of residence		
Urban	1,487	42.29
Rural	2,029	57.71
Marital status		
Never married	476	13.54
Married	2,583	73.46
Widowed	335	9.53
Divorced	45	1.29
Not living together	77	2.18
Time taken to collect water		
Less than or equal to 30 min	3,509	99.89
More than 30 min	7	0.11
Family type		
Nuclear	2,354	66.96
Non-nuclear	1,162	33.04
Social category		
Scheduled caste	196	5.73

(*Continued.*)

Table 1 | Continued

Variables	Freq.	Percent
Scheduled tribe	1,229	35.97
Other backward class	1,749	51.17
None of them	244	7.14
District		
North district	176	4.99
West district	622	17.7
South district	828	23.55
East district	1,890	53.76

Source: NFHS-5 (2019–2021).

Table 2 | District-wise WASH status in Sikkim.

Parameters	North	West	South	East	Sikkim
Improved water source	94.78	91.68	94.42	94.48	93.84
Improved toilet	99.39	93.19	99.29	99.09	97.74
Drinking water in dwelling	50.44	39.53	33.4	62.95	46.58
Open defecation	0.4	0.85	0.29	0.29	0.4575
Water is available at handwashing place	96.1	96.31	96.57	96.82	96.45
Soap/detergent is available at handwashing place	95.17	80.79	96.79	91.64	91.0975
Less than/equal to 30 min for water collection	99.71	99.69	99.83	100	99.8075

Source: NFHS-5 (2019–2021).

state and toilets are available in all households, thus females may not have many issues with privacy and hygiene. Thus, gender did not significantly influence the odds ratio of access to improved sanitation.

Compared with small families, medium and large-sized families were 45 and 66% less likely to have access to improved drinking water. This finding is in line with Trivedy & Khatun (2024), Gurung *et al.* (2023) and Dongzagla (2022), who found that medium and large-sized households were less likely to use improved drinking water sources than small households. With an increase in family sizes, household income and wealth decrease, eventually leading to a decline in the household's ability to afford improved drinking water. Family size had no significant effect on access to improved sanitation.

The age of the household head has a positive effect on access to improved drinking water. This finding is in line with Dongzagla (2022) and Gurung *et al.* (2023). One explanation could be that older household heads are more concerned about their health and try to utilize services that improve their and their family's health and quality of life (Agbadi *et al.*, 2019). However, age had no effect on the household's access to sanitation.

We observed that the wealth quintile of households had a statistically significant impact on a household's chances of using improved sanitation facilities. Moving from a lower to a higher-income group increases the likelihood of using improved water and sanitation. As compared with the poorest households, poorer, middle, richer and richest households were 1.7 times, 1.7 times and 2.5 times more likely to have access to improved water. Similarly, poorer, middle, richer and richest households were 7.6 times, 4.4 times, 2.2 times and 7.4 times more likely

Table 3 | Logit analysis for access to improved drinking water and sanitation.

	Drinking water		Sanitation	
Variables	**OR**	**St. Err.**	**OR**	**St. Err.**
Family				
Medium	0.555***	0.113	1.529	0.432
Large	0.344***	0.131	2.826	2.038
Age				
35–54 years	0.976	0.273	0.935	0.41
Above 55 years	1.681*	0.508	2.125	1.11
Gender of the household (HH)				
Female	1.821*	0.576	0.713	0.347
Education				
Primary	1.174	0.305	1.861	1.016
Secondary	1.13	0.286	2.619	1.596
Higher	0.682	0.289	2.185	1.58
Wealth index				
Poorer	1.542	0.478	8.635***	4.741
Middle	2.706***	0.862	5.159***	2.545
Richer	2.72***	1.026	3.257**	1.59
Richest	3.502**	2.229	8.417***	6.341
Place of residence				
Rural	0.204***	0.097	0.98	0.589
Marital status				
Married	0.384**	0.185	0.096***	0.079
Divorced	0.232**	0.141	0.149**	0.133
Not living together	0.593	0.382	0.022***	0.022
Districts (Base: East)				
North district	1.828***	0.421	1.775	1.01
West district	1.608**	0.348	0.124***	0.044
South district	1.639**	0.372	1.544	0.817
Constant	46.691***	27.918	96.438***	98.779
N	3,515		3,515	
Log likelihood	−73.9025		−26.9974	
Pseudo R^2	0.1052		0.2074	
Prob > chi^2	0.001		0.001	

Source: NFHS-5 (2019–2021). Percentages are computed as rows.
*$p \leq 0.1$, **$p \leq 0.5$ and ***$p \leq 0.01$.

to access improved sanitation facilities. Higher-income households have better access to improved sanitation facilities (Amoak *et al*., 2023; Demsash *et al*., 2023; Trivedy & Khatun, 2024) as they can pay more for improved facilities, even when the local government does not provide it (Abubakar, 2019).

Urban households were around 80% more likely to access improved drinking water sources than rural households. This suggests urban households are spatially closer to facilities or services, whereas rural households are spatially dispersed. Installing a private facility is expensive in rural areas, whereas these are provided by local government or municipal bodies in urban areas. This depicts the urban–rural disparities in access to improved drinking water. This finding aligns with the literature suggesting that urban households have a better chance of having access to improved drinking water (Abubakar, 2019; Gurung *et al*., 2023). However, place of residence has no effect on access to improved sanitation in Sikkim.

The marital status of a household head was a statistically significant predictor of the household's access to improved drinking water and sanitation facilities. Households with married and divorced heads were 62 and 77% less likely to access improved drinking water facilities. Similarly, compared with households with unmarried heads, those with married and divorced heads were 90 and 85% less likely to have access to improved sanitation facilities. This result is consistent with those of Roy *et al*. (2023) and Dongzagla (2022) who found that households with unmarried heads are usually small-sized and thus can meet the cost of improved water and sanitation. On the other hand, it is plausible that households with married and divorced heads (generally having larger families) may have utilized their resources to provide for other family members leading to the sharing of household income and a further decline in its capability to afford improved drinking water and sanitation facilities.

Also, living in different districts of the state also slightly differentiates households according to their access to improved water and sanitation. Compared with the East district, households located in the North, West and South districts were 82, 60 and 63% more likely to access improved water. However, households in the West district were 87% less likely to access improved sanitation than in the East district.

The present study found that education has no significant influence on the drinking water source of the household while family size, age, gender, education and place of residence have no significant influence on the households' access to improved sanitation.

4. CONCLUSION

Using data from National Family Health Survey 5 (2019–2021), this study has identified the key determinants of access to improved drinking water and sanitation in Sikkim, India. The factors considered were gender, education, age, marital status, place of residence, wealth quintile and districts. For access to improved drinking water, gender, wealth, place of residence, marital status and district were statistically significant predictors. Urban female-headed households in higher wealth quintiles with unmarried household heads residing in the North district were more likely to have access to improved drinking water. Regarding improved sanitation access, all socio-economic and demographic variables, except gender and place of residence, showed a statistically significant association. Households in higher wealth quintiles with female heads who were unmarried and had at least primary education, living in joint families, belonging to scheduled castes, owning agricultural land and living in North district were more likely to have access to improved sanitation facilities.

The findings of the present study have important implications for WASH policies in Sikkim. We found that economically backward households located in rural areas are less likely to have access to safe drinking water and sanitation. Access to these facilities is a prerequisite for a healthy and disease-free life. Therefore, appropriate policies are necessary to improve the access of these sections of society. Despite several schemes, rural households have lower access to safe drinking water. This illustrates the existing disparity between urban and rural areas in terms of access. Rural areas in the state should be given high priority in providing improved sanitation facilities. Even in the congested and densely populated pockets of urban areas, safe drinking water and improved sanitation should be provided.

Economic status of the households was also found to be a significant predictor of access to these facilities. With rising incomes, households can shift to improved water and sanitation facilities. Therefore, improving the affordability of the poor sections calls for urgent attention in the region. Alternatively, steps may be taken to subsidize the cost of such facilities. Furthermore, awareness campaigns for educating the public about the harmful effects of unimproved sanitation and water may be conducted.

5. LIMITATIONS

The article is not free from limitations. Firstly, it relies on a nationally representative cross-sectional dataset. Therefore, a causal relationship cannot be implied. Also, as our study relies on a nationally representative dataset, it offers a broad perspective on the topic and yields general recommendations. Future studies may conduct field visits to specific locations and conduct focused group discussions (FGDs) to further support their findings.

ETHICS

The data used in the study is available in the public domain with no identifiable information on the survey participants; therefore, no ethics statement is required for this work.

DATA AVAILABILITY STATEMENT

All relevant data are available from an online repository or repositories: https://www.dhsprogram.com/data/dataset/India_Standard-DHS_2020.cfm?flag=0.

CONFLICT OF INTEREST

The authors declare there is no conflict.

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