Original Article

Drinking water, sanitation, hygiene, and health conditions in India: Findings from the national sample survey

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Abstract

Introduction: Uncertainty exists in the drinking water, sanitation, hygiene, and health conditions due to mosquitoes and flies across India. Therefore, this study aimed to assess the availability of drinking water, sanitation, hygiene, and health in India. **Methods:** We used secondary analysis data on 95,548 household members from the National Sample Survey, which included 113,822 homes and 555,351 persons across India between June 2017 and 2018. **Results:** About 36.4% of household members stated that tube wells or boreholes outside the property at a distance of less than 0.2 km were their main source of drinking water. More than 87% of respondents said that the water they drank was free of impurities, and 55.1% said that it had not been treated. About 45.7% of respondents stated that there were no bathrooms in the dwellings. More than 50% of the time, according to the respondents, garbage was not collected. A flea or mosquito problem was reported by about 97% of households. Around 97% of households reported fevers that were caused by a disease. **Conclusion:** In India, poor access to drinking water, sanitary facilities, good hygiene, and healthcare existed. The results will support the next visionary programs to increase living standards in the country.

Keywords: Environment, garbage, health, hygiene, sanitation, toilet facility, water

Introduction

One of the most significant measures of a nation's socio-economic progress is the quality of its population's housing.[1] Along with the need for shelter, various amenities in the micro-environment of housing, such as the type of dwelling unit, drinking water, sanitation, and hygiene, play a crucial role in the population's health and overall quality of life.[2,3] Thus, statistical data on housing conditions in qualitative and quantitative terms are required regularly to analyze the housing stock and develop hygienic housing policies and programs to improve quality of life.[4]

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Received: 30-08-2023 **Revised:** 03-01-2024
Accepted: 10-01-2024 **Published:** 22-04-2024

Access this article online

Quick Response Code:

Website: http://journals.lww.com/JFMPC

DOI: 10.4103/jfmpc.jfmpc_1435_23

Generally speaking, living conditions differ from one nation to another.[5] In tropical nations like India, where the middle class accounts for about 600 million of the population, the variation can be noticed.[6] This middle-class population's significant income inequality demonstrates India's wide geographic disparities.[7] Additionally, due to unsanitary water, food, and sanitation, tropical environments increase the risk of sickness, particularly when it comes to micro-biological contamination via flies and mosquitoes.[8,9] As a result, microbial food- or water-borne infections are among the most important public health problems in the modern period. Food poisoning, skin-wound infections, and disease outbreaks are only a few of the major health dangers posed by microbial contamination of water, food, food items, and other environmental factors.[10] In addition, microbial contamination contributes to the movement and spread of bacteria that are resistant to antibiotics.[11]

How to cite this article: Vennu V. Drinking water, sanitation, hygiene, and health conditions in India: Findings from the national sample survey. J Family Med Prim Care 2024;13:1535-43.

Therefore, it is crucial to assess the standard of living amenities in terms of the availability of drinking water, sanitation, cleanliness, housing, and health in India.[12] The previous report assessed the drinking water, sanitation, hygiene, and housing conditions in India.[13] A few recent studies assessed the practice of using unsafe drinking water and household sanitary practices in some parts of India.[14,15] However, it is uncertain what exists throughout India in terms of drinking water and its quality, cleanliness, hygiene, and health conditions, particularly as a result of mosquitoes and flies.[16] Thus, this study aimed to assess the availability of drinking water, sanitation, hygiene, and health in India. This study hypothesizes that poor sanitation, poor drinking water quality, and poor waste management frequently lead to health issues for the Indian populace. The results of this study will support the efforts of primary care or family physicians to raise awareness among their patients about the risks of infections or stomach issues associated with dirty drinking water, poor sanitation, improper waste disposal in the home, and unsanitary surroundings.

Materials and Methods

Study design and data source

A secondary analysis of data based on the National Sample Survey Organization's (NSSO) 76th round report on the "Key Indicators of Social Consumption in India: Health," was carried out, which included a national household-based survey performed in India between July and December 2018. In this round, a stratified multi-stage sample design was utilized to conduct a survey that included 113,822 households and 555,351 people throughout India.[17,18] The NSSO was designed to collect information on drinking water, sanitation, hygiene, and housing conditions for the household members' decent and healthful living. The NSSO used the interview method of data collection from a sample of randomly selected households and household members by trained field workers or investigators.

Data on the size of the home, the head's gender and age, the greatest degree of education attained by each male and female member of the household, the main industry and occupations, the head's religion, and the social group. Drinking water, sanitation, hygiene, and housing conditions were started to obtain information on the numerous components of living conditions necessary for household members to live properly and healthily. The household members' access to clean water, sanitation, hygiene, and shelter was assessed using a self-reported questionnaire. The following crucial drinking water information was gathered: (i) sources and availability, (ii) travel time to the source, and (iii) drinking water quality. Information was acquired regarding the sanitary facilities, such as (i) the type of latrine, (ii) the type of access to latrines, and (iii) the reasons why households having access to latrines are not using them. Some of the data about the house's micro-environment that were gathered have to do with (i) garbage disposal, (ii) drainage systems, (iii) the fly and mosquito issue, and (iv) specific illnesses experienced by members of the family in the previous 30 days.

Data analysis

The data were presented using descriptive statistics including mean, standard deviation, count, and percentages. The Chi-square test was used to determine whether categorical variables were significant. Post-hoc test or *t*-test was used for continuous variables significance. By using sampling weights provided by the NSSO, estimates were generated. Windows-compatible SAS 9.4 (SAS Corporation, NC, USA) was used for all the analyses.

Ethical statement

Ethical approval of the National Sample Survey was not obtained because the Government of India's national survey is freely accessible in the public domain for scholarly and policy research. The identities of the patients and their households are tagged, and there is no individual participant interaction in the survey. The guidelines outlined in the Declaration of Helsinki were followed when conducting this survey.

Results

Characteristics of participants

Table 1 presents the characteristics of the participants. There were equally as many men and women living in the 4.6-person

Table 1: Characteristics of the sample

	Mean±SD (Min-Max) OR *n* (%)
Household size*	4.6±2.4 (1-61)
House hold size-male*	2.4±1.4 (0-30)
House hold size-female*	2.3±1.4 (0-31)
Age of the head of the household**	
<18 years	1,370 (1.4)
≥18 years	94,143 (98.6)
Gender of the head of the household**	
Male	82,551 (86.4)
Female	12,997 (13.6)
Highest level of education of the household**	
Illiterate	27,000 (29.6)
Primary or less	36,086 (39.6)
Middle/higher secondary	92,263 (50.1)
Diploma/certificate course	2,850 (3.2)
Graduate	17,910 (19.6)
Postgraduate and above	6,239 (6.9)
Religion**	
Hinduism	73,781 (77.2)
Islam	12,749 (13.3)
Christianity	5,510 (5.8)
Sikhism	1,457 (1.5)
Buddhism	1,011 (1.1)
Others	1,036 (0.76)
Social group**	
Scheduled tribe	12,524 (13.1)
Scheduled caste	17,420 (18.2)
Other backward class	37,307 (39.1)
Others	28,297 (29.6)

*t-test or *post-hoc* test, $P<.0001$; **Chi-square test, $P<.0001$

average household. The majority of household heads were male (86.4%) and over the age of 18 (98.6%). Around 69.8% of the participants have only completed their primary school or less. The majority of participants were Hindus (77.2%) and belonged to the lower social levels (38.1%).

Drinking water facility sources and distance

The proportion of drinking water facility sources and distance in India is shown in Figure 1. The primary (36.4%) and secondary (35.5%) sources of drinking water were tube wells or boreholes. Another major source was water that was piped into the home (17.6%) as well as a standpipe or public tap (15.9%). The second most important extra source of drinking water (21%) was rainwater or surface water. Other than for drinking, piping inside the home was another significant source of water (18.1%). The major source of drinking water was located outside the premises at a distance of less than 0.2 km (35.3%).

Water quality, treatment method, and hygiene

In Figure 2, percentages for water quality, treatment method, and cleanliness are shown. More than 87% of the water used for drinking was defect-free, and 55.1% was not treated. Cloth filtration made up 16.2% of the secondary water treatment process, which was followed by boiling (12.2%). Alum chemical (0.5%) was used as the final ingredient in the water treatment process. Stainless steel made up the majority of water storage container materials (33.7%), with plastic coming in the second place (30.8%). In the water storage container, 0.9% of the participants used copper material. The most frequent method of taking out drinking water from a vessel was dipping it into take-out water (49.1%).

Bathroom and drainage facilities

Figure 3 displays the percentage of bathroom and drainage facilities. The majority of the homes had no bathrooms (45.7%). Households utilized bathrooms exclusively in the majority of cases (82.6%), primarily from facilities located outside of homes but still on the property (45.7%). Around 38% of households did not have drainage infrastructure.

Latrine facilities

Figure 4 shows the percentage of latrine facilities. The majority of participants (47.3%) only used the facilities for home purposes. Septic tanks made up most of the toilet facilities (52.8%). The most common excuse for not using a latrine was unclean or insufficient water (29.1%). However, most households did not have latrine facilities (37.7%).

Hygiene in garbage management

Figure 5 shows the percentage of hygiene in garbage management. More than 50% of the time, waste was not collected. Individual homes made up the majority of the garbage deposit sites (32%). However, daily removal of trash was the most common frequency (46%).

The problem of flies or mosquitoes in a household and efforts made by local bodies and a household

Figure 6 shows the percentage of households with a problem with flies or mosquitoes as well as the efforts made by both the

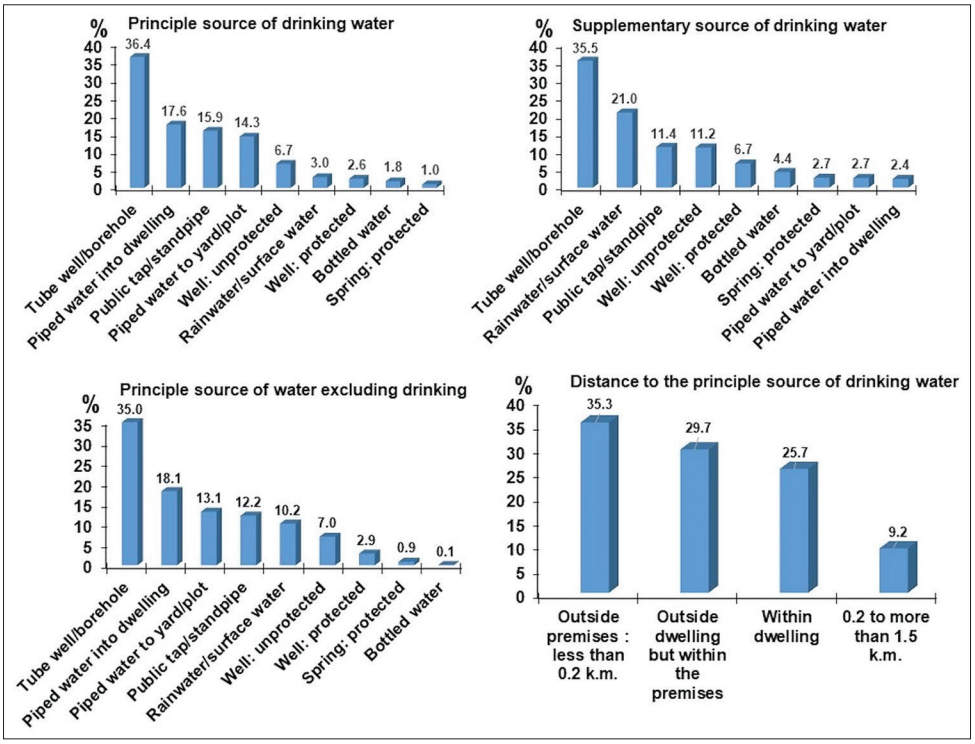

Figure 1: The percent of drinking water facility sources and distance in India. Chi-square test, $P < .0001$

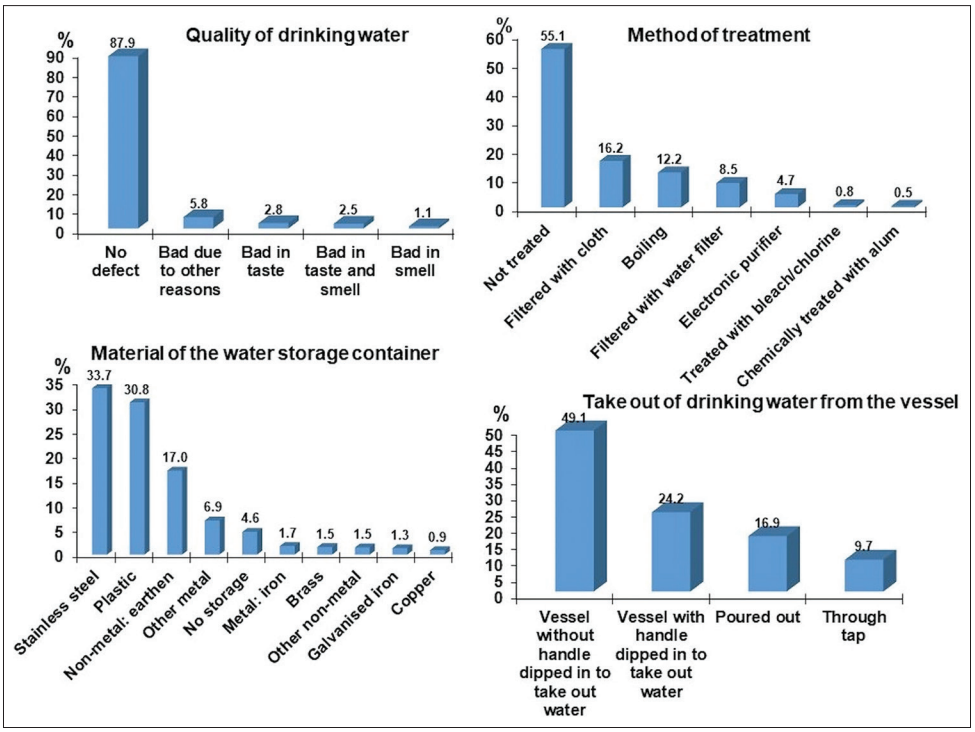

Figure 2: The percent of water quality, treatment method, and hygiene. Chi-square test, $P < .0001$

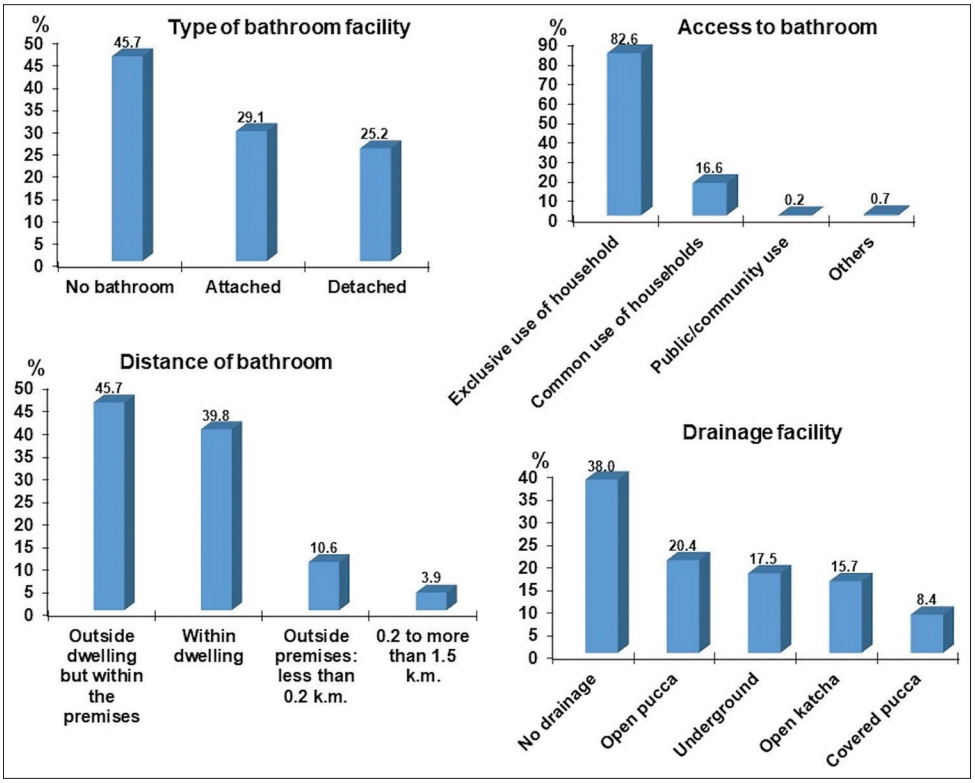

Figure 3: The percent of bathroom and drainage facilities. Chi-square test, $P < .0001$

government and the household. Approximately 97% of households reported having a problem with fleas or mosquitoes. However, 78% of a household and 70% of local authorities made no effort. Figure 7 illustrates the percentage of health issues that have been highlighted. Disease-related fevers were reported by the majority of households (35.5%), followed by stomach issues (19.4%).

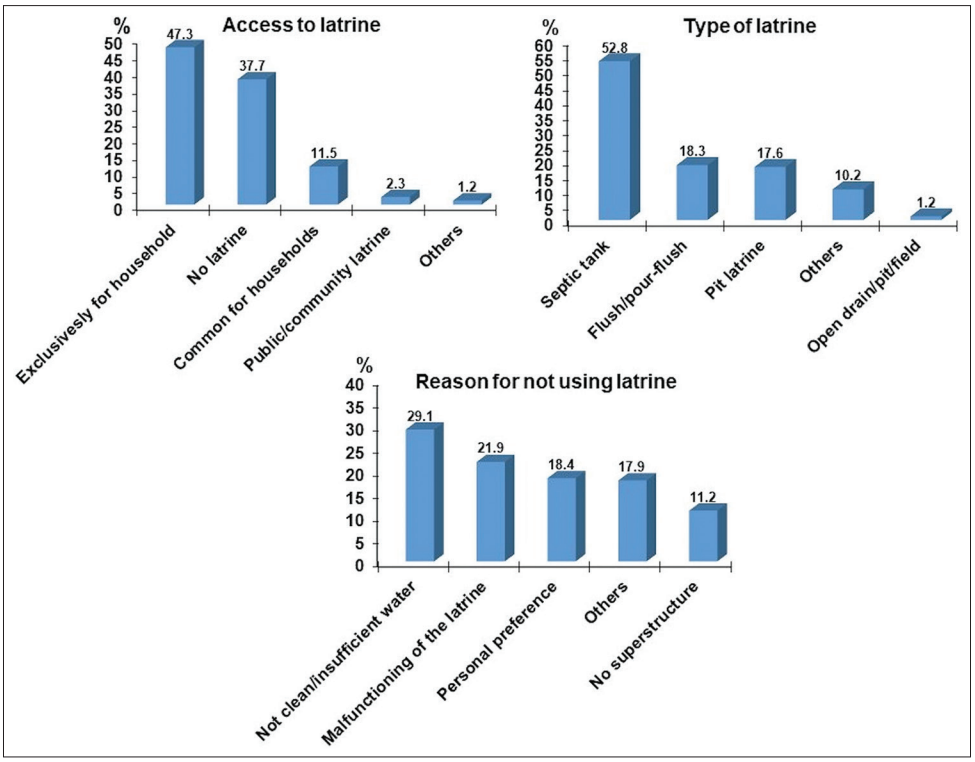

Figure 4: The percent of latrine facilities. Chi-square test, $P < .0001$

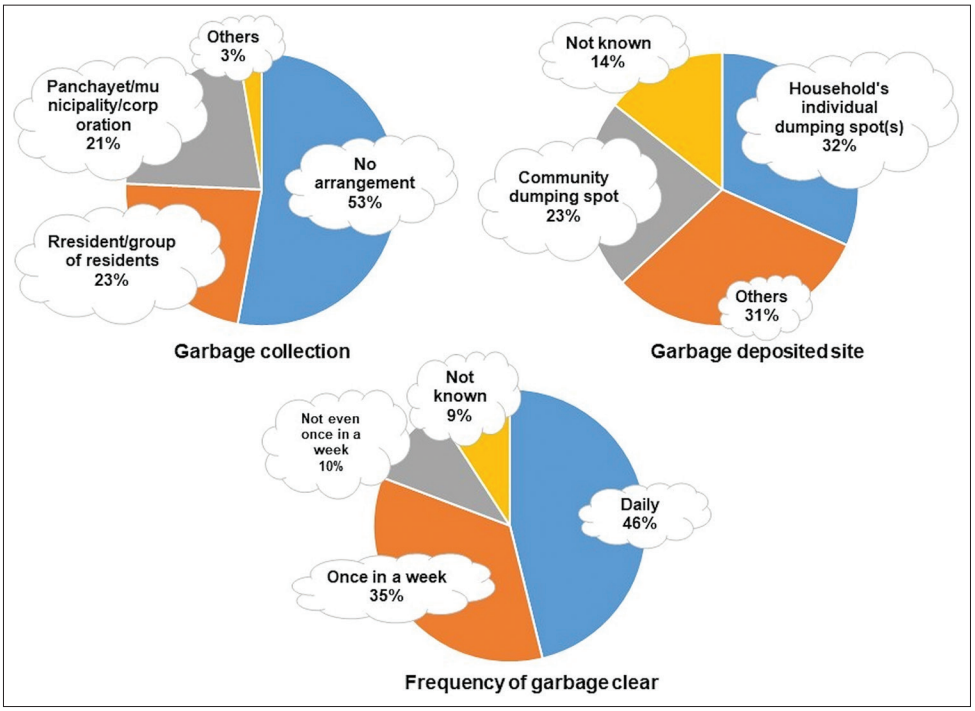

Figure 5: The percent of hygiene in garbage management. Chi-square test, $P < .0001$

Discussion

The present study assessed India's levels of access to drinking water, sanitation, hygiene, and health. The findings showed that tube wells or boreholes, which were situated outside the premises at a distance of less than 0.2 km, were the main sources of defect-free and untreated drinking water. Plastic was the second most common material used for water storage containers, followed by stainless steel. The most popular way to remove drinking water from a vessel was to dip it into take-out water. The majority of the homes lacked drainage infrastructure, toilet facilities, and bathrooms. There were no reports regarding

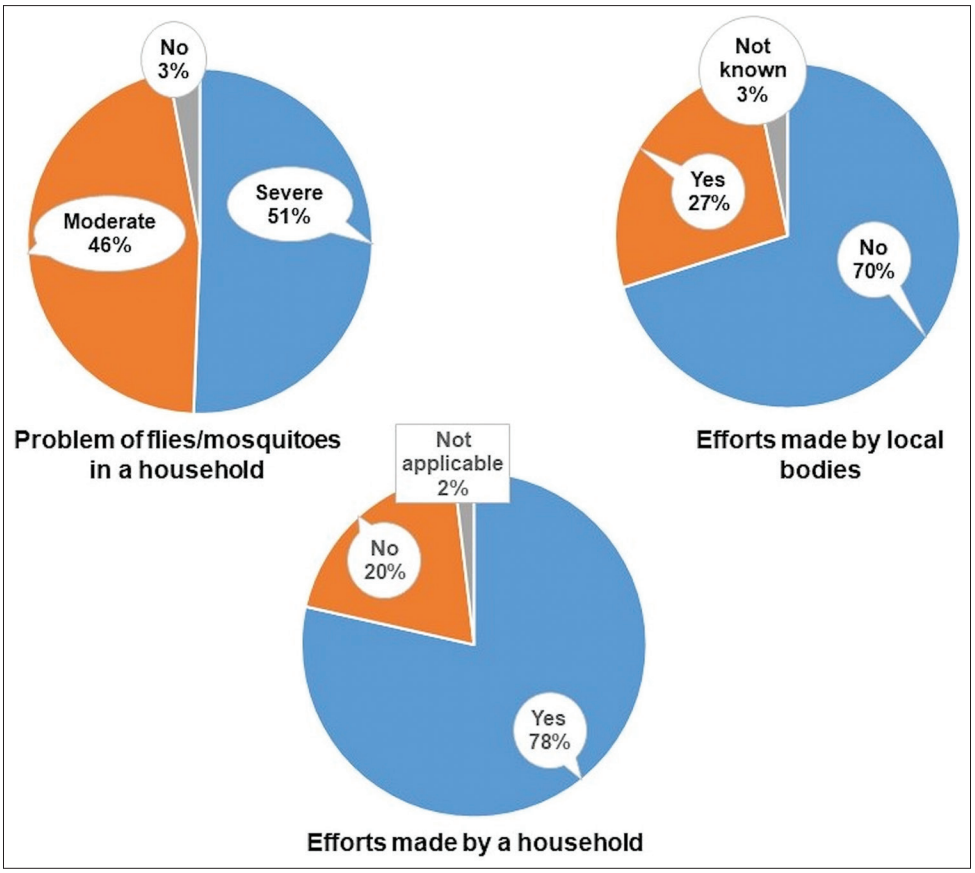

Figure 6: The percent of problem of files/mosquitoes in a household and efforts made by local bodies and a household. Chi-square test, $P < .0001$

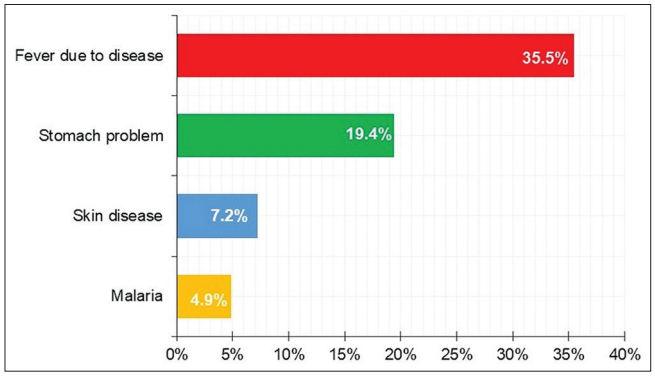

Figure 7: The percent of health problems. Chi-square test, $P < .0001$

garbage management. Most homes experienced mild to severe fly or mosquito infestation issues. The majority of households reported fever due to disease, followed by stomach problems.

The results of the current study are in line with those of the earlier report[13] and study.[19] According to a report,[13] a total of 48.6%, 87.6%, and 58.2% of rural families and 57.5%, 90.9%, and 80.7% of urban households, respectively, had exclusive access to the main source and enough drinking water within the household premises. In addition, 94.5% of rural households and 97.4% of urban households used "improved sources of drinking water," including bottled water, piped water into homes, piped water to yards or plots, piped water from neighbors, public taps or standpipes, tube wells, hand pumps, protected wells, public tanker trucks, private tanker trucks, and rainwater collection. Additionally, 75.0% of urban households and 50.3% of rural households had exclusive access to bathrooms. However, sanitation standards, garbage collection, and health issues, particularly due to mosquitoes and flies, have not been provided in this report.

According to a study,[19] the majority of participants stated that they store their water in plastic bottles or buckets and do not treat it before drinking it. According to another recent survey,[20] 25.2% of rural families lacked a toilet and 31.4% of households used tube wells or boreholes for water. On the other hand, the study's findings showed that 56.8% of people used public taps, 54.4% used water from tanker trucks, and 72.7% flushed or used the pour-flush method. The socio-economic condition and location of a population may be connected to these water, sanitation, and hygiene habits as an explanation.

According to the results of a recent study,[21] the majority of participants stated that supplying water was the main source of household needs. Furthermore, this study discovered that children living close to garbage piles are more likely to get diarrhea than children living far away from the waste pile. Also, it was noted that households that dispose of their garbage outside are more than three times as likely to experience diarrhea as those

who manage their waste inside by burning it. In addition, it was discovered that people who flush their children's waste down the toilet instead of throwing it in the trash or dumping it are more than twice as likely to get diarrhea. Given the socio-economic level of most Indian communities, one explanation for these findings could be the lack of knowledge about the advantages of efficient home waste management and frequent usage of footwear.

A recent study[15] found that 30% of homes had insufficient sanitary facilities, which meant at least one member of the household defecated outside. Menstrual absorbents were thrown out in the bush or field by about 64.6% of women, the river by 29.1%, and the trash can by 24.1% of women. This may be due to the fact that a mission or program from the Indian government is only partially successful in promoting healthy behavior. According to another study,[22] poor WASH practices were identified among the tribal people of Tamil Nadu, India. Fecal coliforms were found in the majority of the samples of home water. The absence of administrative support and the challenging economic climate may be to blame for these outcomes.

In addition to washing techniques, good food hygiene may help control disease-related fever. For instance, the results of a recent study[23] showed that the primary source of household drinking water that was treated before use was piped water. The outcome also showed that nearly all homes had hygienic restrooms. However, intake of unidentified ice creams and meals from street sellers on a more frequent basis than once-a-week basis was noticed in families, which supported enteric fever instances. The majority of Indians do not adhere to any water treatment practices and believe that the water they have access to is clean and does not need to be treated further, which may be the cause.[2] Consequently, it is important to inform people about drinking water purification techniques, cleanliness, and hand-washing habits.

Strengths and limitations

The extensive, nationally representative household survey is the study's key strength. The findings are applicable to all of India. It has limitations. The cause-and-effect link could not have been established because the study was cross-sectional based on secondary analysis of data. Second, it cannot be applied to other family members because only one representative from each household was chosen. Third, all the data were voluntarily provided by the participants. We did not look into their routines, which leaves room for self-reporting bias. Fourth, fever brought on by an illness or digestive issues may have a seasonal influence, which could skew data. Finally, due to a lack of resources, we were unable to evaluate the water quality for every family.

Implications

The findings of this study demonstrated the importance of raising public awareness about the impact of water, waste, and sanitation practices on health as well as about the numerous government initiatives designed to enhance water quality, sanitation, and hygiene habits for improved health. The Indian government should act to enhance the quality of drinking water and the sanitation infrastructure as well as to implement educational awareness policies in primary healthcare centers by bringing attention to the benefits of efficient household waste management and the significance of preventing stomach problems like diarrhea.[24] To further avoid fever from illness and stomach issues, area-specific planning and program resource allocation are required. Water supply, waste disposal, and hygiene are all aspects of hygiene management that need special consideration.[25] Furthermore, the causes of poor wash conditions and drinking water quality are likely to be avoided by appropriate administrative functioning and economic conditions. To improve living conditions and water quality, particularly for vulnerable groups, stakeholders must act quickly. In addition, among low-socio-economic populations, good food hygiene may help reduce disease-related fever. Finally, we require techniques for educating people about practices for treating drinking water as well as sanitation, hygiene, and health.

The results of this study highlight the significance of primary care physicians or family doctors educating their patients about the risks of infections or stomach problems related to unclean drinking water, inadequate sanitation, incorrect waste disposal in the home, and unhygienic surroundings, particularly from mosquitoes or flies. Because mosquito-borne diseases—namely, dengue, chikungunya, and malaria—pose a serious threat to public health, India is especially susceptible to these diseases due to its distinct socio-demographic mix.[26] The results also shed important light on the necessity of coordinated efforts to collaborate in the national fight against these diseases since inadequate primary healthcare infrastructure, unsanitary conditions, and poor drinking water all contribute to the spread of disease and mosquito breeding, which are serious public health concerns.[27]

Conclusions

The primary sources of drinking water were tube wells or boreholes, which were located outside the premises at a distance of less than 0.2 km. The second most popular material for water storage containers was plastic. The most common method for getting drinking water out of a container was to dip it in take-out water. The majority of the houses lacked bathrooms, toilets, and drainage systems. No reports on waste management were found. Infestations of flies or mosquitoes ranged from mild to severe in most residences. The most common home complaints were fever from a sickness, followed by stomach issues. Results show that by promoting knowledge of the advantages of good management of drinking water quality, hygienic practices, cleanliness, and waste management to prevent illness-related fever and stomach issues, the Indian government should take steps to enhance the quality of drinking water, the sanitation

system, and waste management, especially in regard to flies or mosquitoes.

Acknowledgments

The authors would like to extend their sincere appreciation to the Researchers Supporting Project Number (RSPD2024R1094), King Saud University, Riyadh, Saudi Arabia for funding this project.

Declaration of patient consent

Ethical approval of the National Sample Survey was not obtained because the government of India's national survey is freely accessible in the public domain for scholarly and policy research. The identities of the patients and their households are tagged, and there is no individual participant interaction in the survey.

Financial support and sponsorship

This research was funded by Researchers Supporting Project number (RSPD2024R1094), King Saud University, Riyadh, Saudi Arabia.

Conflicts of interest

There are no conflicts of interest.

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