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Original Article

Community Section

Analysis of Water, Sanitation and Hygiene in an Urban Community of Koppal, Karnataka, India: A Cross-sectional Study

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ABSTRACT

Introduction: Water, Sanitation and Hygienic (WaSH) practices are the major predictors of morbidity, mortality as well as nutritional status and are highly cost-effective. Their adequate implementation contributes to overall improvement of the population. Many communicable diseases can be effectively managed by improving the sanitation, hygiene and water usage practices. Globally, limited access to water and low level of sanitation and hygiene practices are responsible for 90% of diarrhoea-related mortality.

Aim: To estimate the proportion of population having access to safe water, adequate sanitation and practice of hand hygiene among people at Koppal, Karnataka, India and also to determine their association with occurrence of diarrhoeal episodes.

Materials and Methods: This community-based cross-sectional study was conducted in the field practice area of Urban Health Centre (UHC), Koppal, Karnataka, India, from March 2019 to July 2019. Simple random sampling technique was used for sample selection and a total of 410 households were included in the study. Data about source, availability, accessibility, treatment methods of water, availability of toilet, details about domestic hygiene, hand hygiene practices and also history of diarrhoeal episodes among members of the household were collected through interviews using pretested and semi-structured questionnaire. Statistical analysis was done using Epi info software version 3.5.4 {Centres for Disease Control and Prevention (CDC), Atlanta, Georgia, United States of America}. WaSH practices were presented as percentages and Chi-square test at 5% level of significance was applied to test the association between the occurrence of diarrhoeal episodes and the various environmental factors.

Results: The primary source of drinking water in majority (314, 76.58%) of households was piped corporation water and majority (309, 75.36%) of households had individual toilets. Majority (390, 95.12%) of the respondents practiced to wash hands after using toilet followed by 349 (85.12%) respondents admitted to wash hands before taking meals. Diarrhoeal episodes among household members, were found to be significantly associated with piles of solid waste around their households.

Conclusion: The present study finds that three out of four households had access to safe water and one out of three households treated water before drinking. More than nine among ten households had access to either individual or community toilet facilities. Similarly, nine out of ten participants admitted to wash their hands after using toilet and eight washed before taking meals. Solid waste piles around households were identified as risk factors for occurrence of diarrhoea both among adults and children.

Keywords: Diarrhoea, Domestic hygiene, Hand hygiene, Solid waste

INTRODUCTION

Access to safe water along with adequate sanitation and hygienic practices is essential for good health and are considered as the most basic needs for overall development [1]. Inadequate Water, Sanitation and Hygiene (WaSH) standards are associated with increased morbidity and mortality, particularly in low socio-economic countries [2]. Diarrhoeal diseases, nearly 90% of which have been attributed to suboptimal WaSH practices, is one of the largest causes of morbidity and mortality in low and middle-income countries, especially among young children [3].

Inadequate WaSH remain critical problems in many parts of the world. Over 2 billion people lack access to water that is readily available and free from contamination, more than one third of the world's population lacks basic sanitation such as facilities for the safe disposal of human waste and more than four fifths do not WaSH hands with soap after contact with excreta [4]. Most of the developing countries in the world including India also suffer from inadequate WaSH facilities [1]. National Family Health Survey (NFHS) -4 India reports that the households with an improved drinking water source and improved sanitation facility to be 89.9% and 48.4%, respectively [5]. In low-income and middle-income countries, annually 829,000 people die due to inadequate WaSH conditions and of these deaths, 432,000 are caused by poor sanitation alone [6]. Evidence indicates that inadequate WaSH practices can also impact growth in children negatively [2].

Appropriate WaSH practices/behaviours can reduce the burden of diarrhoeal diseases. Drinking safe water can prevent the spread of waterborne diseases; availability of plenty of clean water and soap enables and encourages people to WaSH their hands especially at critical times, thereby reducing the likelihood of disease transmission. Adequate sanitation can control flies and other arthropods that spread disease, and also prevents contamination of food or utensils [7]. WaSH has the potential to prevent atleast 9.1% of the global disease burden and 6.3% of all deaths. WaSH promotion can also greatly contribute to economic development [8]. Keeping this in mind, United Nations Sustainable Development Goal six envisages "Clean water and Sanitation for all" to be achieved by 2030 [9].

Till date the data on wash practices in India is scarce, that too in urban areas. Further, the present study is done in one of the most backward districts in Kalyan Karnataka region {Article 371 J-The Constitution (118th Amendment) Bill}.

With this background, the present study was undertaken and the objectives were to estimate the proportion of population having access to safe water and adequate sanitation in the study setting, to estimate the prevalence of hand hygienic practices among people in the study setting, and to determine the association

between various environmental factors and diarrhoeal episodes among people in households.

MATERIALS AND METHODS

This community-based cross-sectional study was conducted in the field practice area of Urban Health Centre (UHC), Koppal, Karnataka, India, from March 2019 to July 2019 among selected households in the study setting. Ethical clearance was obtained from the Institutional Ethics Committee (No.KIMS – Koppal/IEC/47/2018-19 Date 27.01.2019), Koppal Institute of Medical Sciences, Koppal.

Sample size calculation: Minimum sample size calculated was 400 with an absolute precision of 5% and significance level of 0.05, taking 48% prevalence of appropriate WaSH practices from a previous study done in Karnataka [9]. Simple random sampling technique was used for sample selection.

A list of households in the study setting was prepared using family folders maintained in the Department of Community Medicine and 410 households were selected by lottery method to be included as sampling units in the study.

Inclusion and Exclusion criteria: The unit of study was household and the study population consisted of all the households in the study setting. Households found locked at the time of visit were excluded from the study.

Questionnaire

A pretested and semi-structured WaSH questionnaire consisting of 26 questions, prepared by modification of the questionnaire provided by Global WaSH Cluster [10] was used for data collection, from one respondent each in selected households after taking an informed consent [Annexure-1]. The investigators who carried out the modifications in the questionnaire were qualified in the speciality of Community Medicine (MD) and had an experience of 10 years. It was formulated in English, but the data were collected by the medical undergraduate students through interviews, in the local language which is Kannada.

Data about source, availability, accessibility, treatment methods of water, taste of drinking water, availability of toilet, details about domestic hygiene, hand hygiene practices and also history of diarrhoeal episodes among members of the household were collected by the medical undergraduate students through interviews.

- Questions from 1-7 recorded the demographic details of the subjects.
- Questions 8,9,10,13 and 14 were same as original questionnaire with less options depending on local relevance.
- Questions 11 and 12 were added to get details about purification methods and taste of drinking water
- Questions from 15-18 were newly added to get details about accessibility and availability of water in the present study.
- Question 19 was derived from original questionnaire and modified to suit local context.
- Question 18-26 were newly added keeping in mind the purpose and objectives of the study after thorough review of literature.

STATISTICAL ANALYSIS

Statistical analysis was performed using the Epi info software version 3.5.4 {Centres for Disease Control and Prevention (CDC), Atlanta, Georgia, United States of America}. All the parameters related to WaSH conditions were presented as percentages and hand hygiene practices were presented in Bar graph. Diarrhoeal episodes both among children and adults were presented separately as percentages and their association with different variables was tested using Chi-square test at 5% level of significance and p-values derived.

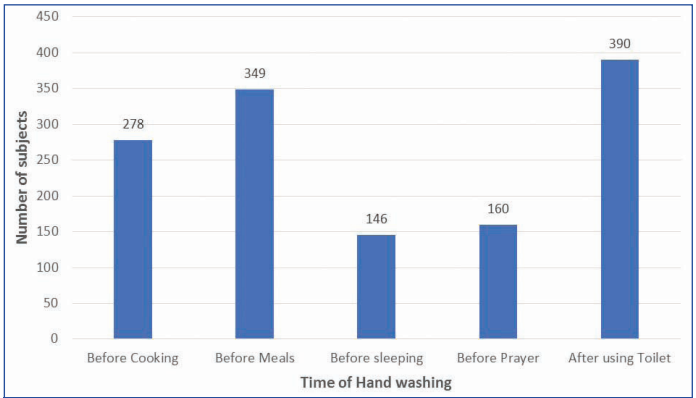
RESULTS

[Table/Fig-1] reveals household WaSH conditions in the present study. The primary source of drinking water in majority i.e. 314 (76.58%) of households was piped corporation water and among them, majority 143 (45.54%) received it for 2-3 days in a week. Only 147 (35.86%) of households in the present study treated water before drinking and nearly 105 (25.61%) of households had some form of purifier/filter. However, only 12 (2.93%) of respondents perceived taste of water as unacceptable in the present study. While majority i.e. 309 (75.36%) of households in the present study had Individual toilets, residents of 72 (17.56%) households used community toilets and the remaining household members practiced open air defaecation. Total 160 (39.02%) of households had stagnant/sewage water collections near house and 139 (33.90%) had solid waste piles. Solid waste was collected atleast once a week from majority i.e. 349 (85.12%) of the households as seen in the table.

Variables	Classification	Number of households (n, %)
Primary source of drinking water	Corporation connection	314 (76.58)
	Water tanker/Vendor	86 (20.97)
	Individual borewell	10 (2.45)
Frequency of water supply*	Less than once a week	2 (0.63)
	Once a week	98 (31.21)
	2-3 days a week	143 (45.54)
	4-7 days a week	71 (22.62)
Practice of treating water at home before use	Present	147 (35.86)
	Absent	263 (64.14)
Purification system at home	Present	105 (25.61)
	Absent	305 (74.39)
Perceived taste of water	Acceptable	398 (97.07)
	Unacceptable	12 (2.93)
Toilet facility	Individual	309 (75.36)
	Community	72 (17.56)
	None	29 (7.08)
Collection of stagnant water near house	Present	160 (39.02)
	Absent	250 (60.98)
Collection of solid waste piles near house	Present	139 (33.90)
	Absent	271 (66.10)
Frequency of collection of solid waste from household	>1 per week	349 (85.12)
	Once every 15 days	15 (3.65)
	Once a month	12 (2.92)
	None	34 (8.31)

[Table/Fig-1]: Distribution of households according to WaSH conditions (N=410). Parameters presented as percentages; *Only households receiving water from corporation are considered here

[Table/Fig-2] shows hand hygiene practices among members of the household. An enquiry was made about hand washing practices



[Table/Fig-2]: Distribution of households according to hand hygiene practices by the members (N=410).

among the respondents in the selected households and it was found that majority i.e. 390 (95.12%) of the respondents reported to wash hands after using toilet followed by 349 (85.12%) respondents admitting to WaSH hands before taking meals.

[Table/Fig-3] demonstrates distribution of diarrhoeal episodes among children (<5 years) in households during 4 weeks preceding the survey according to certain factors as mentioned below. Among 410 households, 172 had under five children and the occurrence of diarrhoeal episodes among them was found to be significantly associated (p-value <0.05) with piles of solid waste around their households as evident from the table.

Variables	Classification	Number of households	Diarrhoeal episodes		Test
			Present (n, %)	Absent (n, %)	
Availability of purifier/ filter	Present	39	7 (17.94)	32 (82.06)	χ^2=1.55 p=0.213
	Absent	133	14 (10.52)	119 (89.48)	
Stagnant water near house	Present	62	5 (8.07)	57 (91.93)	χ^2=1.553 p=0.212
	Absent	110	16 (14.55)	94 (85.45)	
Solid waste piles near house	Present	61	13 (21.32)	48 (78.68)	χ^2=7.306 p=0.006
	Absent	111	8 (7.21)	103 (92.79)	
Toilet facility	Individual	126	17 (13.50)	109 (86.50)	χ^2=0.743 p=0.689
	Community	36	3 (8.34)	33 (91.66)	
	None	10	1 (10)	9 (90)	

[Table/Fig-3]: Distribution of diarrhoeal episodes among children (<5 years) in households according to certain factors.
Chi-square test applied at 5% level of significance

[Table/Fig-4] demonstrates distribution of diarrhoeal episodes among adults in households during the previous 4 weeks of survey according to certain environmental factors and diarrhoeal episodes among adults in households were significantly associated (p-value <0.05) with piles of solid waste around their households in the present study.

Variables	Classification	Number of households	Diarrhoeal episodes		Test
			Present (n, %)	Absent (n, %)	
Availability of purifier/ filter	Present	105	9 (8.58)	96 (91.42)	χ^2=0.206 p=0.649
	Absent	305	22 (7.22)	283 (92.78)	
Stagnant water near house	Present	160	13 (8.13)	147 (91.87)	χ^2=0.119 p=0.729
	Absent	250	18 (7.20)	232 (92.80)	
Solid waste piles near house	Present	139	19 (13.67)	120 (86.33)	χ^2=6.274 p=0.012
	Absent	271	17 (6.27)	254 (93.73)	
Toilet facility	Individual	309	22 (7.12)	287 (92.88)	χ^2=3.806 p=0.149
	Community	72	7 (9.73)	65 (90.27)	
	None	29	5 (16.25)	24 (82.75)	

[Table/Fig-4]: Distribution of diarrhoeal episodes among households according to certain factors.
Chi-square test applied at 5% level of significance

DISCUSSION

The key to man's health lies largely in the surrounding environment. Much of the ill health in developing countries like India is due to poor WaSH practices. The present study was conducted in an urban community of Koppal city among 410 randomly selected households. The primary source of drinking water in majority i.e. 314 (76.58%) of households in the present study was piped Corporation water similar to the findings of other studies by Patel SK et al., using NSSO data in India, Gizaw Z and Addisu A, in Ethipia, Mittal A et al., in Tamil Nadu and Kaur S et al. in Punjab [1,8,11,12]. Only one third of households in the present study treated water before drinking and only one fourth had some form of purifier/filter. While only 7.6% in a study by Gizaw Z and Addisu A, in Northwest Ethiopia, none of the households treated water before use in a study by Ramya N et al., in Kolar district of Karnataka, only 21.6% in a study by Mittal A et al., in Tamil Nadu and only 31% of households in a study by Reddy BV et al., in Andhra Pradesh treated water, similar to the findings of present study [8,9,11,13]. Further, only 30.2% in a study by Mohd R and Malik I, in Bangalore and only 15% of households in urban slums of Delhi in a study by Joshi A et al., used filter for water purification [14,15]. On the contrary, a study done in a tribal community of Maharashtra by Jeyakumar A et al., identified well water as the main source of drinking water for majority of the households and more than two thirds of the participants treated water before use [16].

Majority i.e. 309 (75.4%) of households in the present study had individual toilets. These findings were in confirmation with Patel SK et al., where 90%, Ramya N et al., where 95%, Kaur S et al., where 85%, and Kuberan A et al., where 75% of households had Individual household toilet facilities [1,9,12,17]. However, in a number of studies like Anuj M et al., (70%), Reddy BV et al., (85.4%), Joshi A et al., (55%) and Chattopadhyay A et al., in Eastern India (82.1%), majority of the households relied on community toilets or practiced open air defaecation [11,13,15,18]. While one third of households had stagnant/sewage water collections in their premises, another one third had solid waste piles around them in the present study, in line with findings of few other studies [1,9]. However, a couple of studies found open drains in more than 80% of the households [15,16].

Majority i.e. 390 (95.12%) of the respondents reported to WaSH hands after using toilet in the present study followed by 349 (85.12%) of respondents admitting to WaSH hands before taking meals in line with findings of studies by Mittal A et al., and Kaur S et al., where majority of the participants admitted to wash hands after defaecation followed by washing hands before taking meals [11,12]. On the contrary, a study by Ntakirutimana T et al., in Rwanda, Reddy BV et al., in Andhra Pradesh and Mohd R and Malik I in Bangalore found majority to be washing hands before taking meals followed by washing after defaecation [7,13,14]. Occurrence of diarrhoeal episodes in the present survey among household members (both adult and children) during the previous four weeks of conducting survey, was found to be significantly associated with piles of solid waste around their households. Similarly, Jeyakumar A et al., in Maharashtra, Gali A et al., in Soloman islands and Thian S et al., in Senegal have found solid waste piles to be significantly associated with diarrhoea among children in confirmation with present study findings [16,19,20]. Solid waste piling around the households can be a reason for diarrhoea among children.

Limitation(s)

The present study findings were based on data collected through questionnaire and there were chances of information bias. Further, the study was conducted in the field practice area of only one urban health centre and during particular season of the year, which makes generalisability of the findings difficult. But the study still sheds some light on the current WaSH conditions/practices and its role in occurrence of diarrhoeal disease in the study setting for effective planning of interventions. And also paves the way for conducting further research in larger geographical settings overcoming the limitations of the present study.

CONCLUSION(S)

The WaSH conditions/practices in the present study are satisfactory, with substantial proportion of households having access to safe water and adequate sanitation facilities. There is still scope for improvement especially with respect to water treatment, use of sanitary toilets, proper disposal of solid as well as liquid waste and hand hygiene practices, which can be done by proper infrastructure improvement, economic schemes and behaviour change communication strategies. The present study also found significant

association between diarrhoeal episodes among members of household and indiscriminate solid waste piles in their premises, emphasising the need for its adequate and timely disposal.

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[ANNEXURE-1]

Study questionnaire

1. Name:
2. Age:
3. Sex: M/F
4. Religion: Hindu/Muslim/Christian/Others
5. Total no of family members:
6. No of under five children in the household:
7. Family income:
8. What is the primary source of drinking water: Municipal network/Water vendor/Water tanker/Individual bore well/others _____
9. Do you treat your water in any way to make it safer to drink? Yes/No
10. If yes, how _____
11. Do you have water purification system: Yes/No
12. How does your drinking water taste: Excellent/Good/Acceptable/Unacceptable
13. What is the primary source of water for domestic use in your household: Municipal network/Water tanker/Individual bore well/others _____
14. What is the water source for cooking: Domestic water/Drinking water/Both
15. How often does your household have running water from the network: Not connected/4-7 days per week/2-3 days per week/once a week/less than once a week/no supply
16. How long does your household have running water from the network at one time: Not connected/less than 4 hrs/5-12 hrs/more than 12 hrs per day/no supply
17. Is the water you are receiving enough to satisfy your needs? Yes/No
18. How much did you pay for drinking water last month?
19. What sort of toilet do you have? Individual/Community/No
20. Are you served by a wastewater network? Yes/No
21. Do you have stagnant or sewage water near your house: Yes/No
22. Do you have solid waste piles near your house? Yes/No
23. How frequently is the solid waste collected from outside your household: Collected once every week or more/collected every two weeks/collected every month/deal with ourselves
24. When do you usually wash your hands with soap? At prayer times/before meal/ after meal/before bed/before cooking/after using the toilet.
25. Has anyone in your household <5 years of age had unusual diarrheal symptoms (water/bloody diarrhea for a few days) in the past four weeks? Yes/No/Does not apply
26. Has anyone in your household >5 years of age had unusual diarrheal symptoms (water/bloody diarrhea for a few days) in the past four weeks? Yes/No/Does not apply