

## Research Paper

# Assessment of personal hygiene and sanitation using a composite index among adolescent girls and their households in urban slums of Pune, Maharashtra

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### ABSTRACT

The assessment of hygiene and sanitation in urban slums is essential to identify adolescent health needs. A tool that comprised of three domains and 13 variables including drinking water index (DWI), personal hygiene index (PHI) and household hygiene index (HHI) was developed and tested among 60 households. Observations were repeated after 6 weeks. Cronbach's alpha was used to test the reliability and Inter Class Correlation Coefficient was used to assess repeatability of the questionnaire. The tool was used to assess the personal hygiene of adolescent girls ( $n = 565$ ) and their household sanitation in nine slums of Pune city. Excellent reliability ( $\alpha = 0.9$ ) was obtained for four variables, two observations obtained good ( $\alpha = 0.8$ ), two scored acceptable ( $\alpha = 0.7$ ) and one scored questionable ( $\alpha < 0.6$ ) reliability. No variance was observed among four variables. DWI and PHI scores were average (between 2 and 3). About 40% of the households scored the least (between zero to one) in HHI. History of malaria was reported among 3%, one year prior to the study period and 30% minor infections were reported. The composite index developed was valid to assess hygiene and sanitation of this population. Measures to improve household hygiene would contribute to integrated approaches in improving adolescent health.

**Key words** | adolescent health, personal hygiene, sanitation, urban slums

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### INTRODUCTION

The World Health Organization (WHO UNICEF 2015a, 2015b) reports that worldwide about 700 million people do not have access to safe drinking water and other improved water sources. About 2.4 billion people lack access to adequate sanitation. According to the World Bank (1993), promotion of better hygienic practices is the third most productive method of preventing infectious diseases. It has been projected that providing adequate water and sanitation to the deprived communities would prevent the global disease burden by 9.1% (Global Water, Sanitation and Hygiene (WASH) 2016).

In India, there has been a disproportionate growth of the slum population due to urbanization. Large disparities in health indicators have been reported among the slum and non-slum population (Agarwal 2011). Among those vulnerable,

the migrants who settle in slums are deprived of basic needs such as water and sanitation that subsequently affect health.

Adolescent girls in these resource poor settings are susceptible to infections and therefore are of public health concern. Frequent infections may affect their health and micronutrient status. The USAID reports that about 10–15% of maternal deaths are due to infections associated with unhygienic conditions and practices (USAID 2015). Therefore, interventions in maternal and child health aim to provide clean and safe conditions.

In the Sustainable Development Goals (SDGs), Target 6.1 aims at achieving universal access to safe drinking water ([www.un.org/sustainabledevelopment/sustainable-development-goals/](http://www.un.org/sustainabledevelopment/sustainable-development-goals/)). Target 6.2 aims to achieve improved

sanitation and hygiene to meet the needs of vulnerable women and children. Globally, data on hygiene and sanitation are available from low- and middle-income countries. Among these, Asia is least represented (Griggs *et al.* 2013). Hygiene and sanitation are frequently studied among children under five. However, with reference to adolescent health it is less explored. The executive summary of *The Lancet, Maternal and Child Nutrition Series (2013)* series have identified nutrition sensitive interventions such as providing water and sanitation to address underlying basic causes of undernutrition. Improving access to water and sanitation is important for an integrated approach to improve adolescent health. This study therefore aims to describe the prevailing condition of hygiene and sanitation and the morbidity status of adolescent girls in the slums of Pune, Maharashtra.

## METHODS

### Development of a tool to assess hygiene and sanitation

In order to measure hygienic practices, structured observation along with spot testing was used. The items for the tool were selected and modified for this study setting, similar to one used by Webb *et al.* (2006). The tool used in the present study comprised of three domains that included drinking water index (DWI), personal hygiene index (PHI) and household hygiene index (HHI). Of the three, DWI comprised of five observations and PHI as well as HHI had four observations each. The entire tool comprised of 13 observations. Each observation was scored 0 or 1, a positive observation was given a score of one. The indices were calculated as a simple sum of the items. Table 1 shows the indices created for assessing hygiene and sanitation.

The source of water, storage of water, drinking method and boiling of water, that was elicited through a structured questionnaire and a spot check of storage containers together, formed the DWI. Good hand hygiene has been identified as the most effective method of controlling infections. Therefore, practices related to hand hygiene and practice of wearing footwear in the neighborhood were studied among adolescents to assess personal hygiene. These observations formed the PHI. Observations on

**Table 1** | Indices for assessing personal and domestic hygiene

Domains	Variable	Possible score
DWI	1. Source of water 2. Storage vessels 3. Drinking method 4. Boiling water 5. Water storage practices (covered/uncovered)	5
PHI	1. Before food with water 2. Before food with water and soap 3. After visiting toilet with soap 4. Wearing footwear	4
Domestic Household Hygiene Index (DHI)	1. Partially/fully open drain 2. Garbage disposal 3. Sewage disposal 4. Presence of stagnant water	4

drainage, and presence or absence of stagnant water, sewage and garbage disposal formed the HHI.

### Pretesting of tool and reliability assessment

The tool was pretested among 60 households by two observations after an interval of 6 weeks. Reliability of the tool was assessed using Cronbach's alpha. Intraclass correlation coefficient (ICC) was used to assess the validity or repeatability of the tool.

### Selection of slums

Nine slums were selected at random for the study. Of these, seven were selected from five wards in Pune Municipal Corporation (PMC) and two were selected from two different wards in Pimpri-Chinchwad Municipal Corporation (PCMC).

### Selection of adolescent girls

Adolescent girls 16–18 years of age, 565 in number, were recruited for the study. Sanitation was studied in these selected households.

## Survey of sanitation in the community and personal hygiene among adolescent girls

The developed and pretested tool was used to survey the household hygiene in nine slums and the personal hygiene of adolescent girls distributed in these slums. Details of chronic and acute infections, its duration and history of chronic illness were recorded. Perceived worm infection and history of deworming intervention was recorded using a structured questionnaire.

Written informed consent was obtained from participants. Ethical clearance was obtained from the Inter-System Biomedica Ethics Committee (ISBEC), Mumbai, India.

## RESULTS

### Population characteristics

As the study was carried out in slums of Pune city, greater than 75% of the families belonged to the lower socio-economic status according to classification by the Kuppuswamy scale 2014 (Gururaj 2014). More than 50% of fathers of the adolescent girls worked as semiskilled or contractual laborers. About 40% of the fathers had received education up to primary school level whereas 40% of the mothers received education up to middle school.

### Reliability of the tool

The mean and standard deviation (SD) of variables used in the tool for assessment of sanitation and hygiene are provided in Table 2. Table 3 gives the correlation as per Cronbach's alpha analysis. Cronbach's alpha for first and second observations gave the following results. No variance was observed in four variables including: practice of boiling water; washing hands with soap after visiting toilet and garbage disposal. An alpha value of 0.9, corresponding to excellent reliability, was obtained for storage of water, drinking method, open or closed drainage and sewage disposal. Two observations including hand washing with soap before food and the presence or absence of stagnant water, scored  $\alpha = 0.8$ , reflecting good reliability. Indicators such as a covered container for water storage and washing

**Table 2** | Mean and SD of the variables studied in the first and second observation

Variable (N = 60)	Mean $\pm$ SD	
	1st observation	2nd observation
Source of water	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00
Storage of water	0.68 $\pm$ 0.46	0.68 $\pm$ 0.46
Drinking method	0.60 $\pm$ 0.49	0.58 $\pm$ 0.49
Boiling water	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00
Covered container	0.85 $\pm$ 0.36	0.87 $\pm$ 0.34
Washing hands before food	0.92 $\pm$ 0.27	0.90 $\pm$ 0.30
Washing hands before food with soap	0.85 $\pm$ 0.36	0.85 $\pm$ 0.36
After visiting toilet with soap	0.00 $\pm$ 0.00	0.0 $\pm$ 0.00
Footwear in the neighborhood	0.12 $\pm$ 0.32	0.22 $\pm$ 0.41
Drainage	0.83 $\pm$ 0.37	0.80 $\pm$ 0.40
Garbage disposal	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00
Sewage disposal	0.82 $\pm$ 0.39	0.78 $\pm$ 0.41
Stagnant water	0.75 $\pm$ 0.43	0.68 $\pm$ 0.46

hands with water (but without soap) before food scored  $\alpha = 0.6$ , which reflects acceptable reliability, and wearing footwear in the neighborhood scored  $\alpha = 0.59$ , which reflects questionable reliability. Those domains with reliability scores  $< 0.7$  were those behaviors, i.e. hand washing before food and wearing footwear in the neighbourhood, which changed during the second observation. This may be due to the awareness to follow better practices, or the presence of the researcher. Domains with low acceptability are common to tools that are intended to make quick assessments compared to those that are intended to make precise measurements (Eisinga *et al.* 2013).

Practices related to storage and use of drinking water among the population studied is presented in Table 4. All the slums selected had corporation water supply for drinking purposes. Steel vessels were used for water storage by nearly three-quarters of the population. The stored water was covered in 84% of the households visited. However, in nearly 10% of the households visited, the stored drinking water was not covered either fully or partially. Almost 75% of the households followed a method where the hands came in contact with the water during removal for drinking, others used ladles and taps, 11.2 and 13.8% respectively.

**Table 3** | Reliability of observations as analyzed by Cronbach's alpha

	Scale mean if item is deleted		Scale variance if item is deleted		Corrected item-Total correlation		Cronbach's alpha
	1st observation	2nd observation	1st observation	2nd observation	1st observation	1st observation	
Source of water	No variance						
Storage of water	0.68	0.22	0.68	0.22	0.92	0.92	0.96
Drinking method	0.58	0.60	0.24	0.24	0.96	0.96	0.98
Boiling water	No variance						
Covered container	0.87	0.85	0.11	0.13	0.52	0.52	0.68
Washing hands before food (yes)	0.90	0.92	0.09	0.07	0.50	0.50	0.66
Washing hands before food with soap	0.85	0.85	0.13	0.13	0.73	0.73	0.85
Washing hands with soap after visiting toilet	No variance						
Footwear in the neighborhood	0.22	0.12	0.17	0.10	0.43	0.43	0.59
Drainage closed	0.80	0.83	0.16	0.14	0.89	0.89	0.94
Garbage disposal	No variance						
Sewage disposal	0.78	0.82	0.17	0.15	0.90	0.90	0.94
Stagnant water	0.68	0.75	0.22	0.19	0.68	0.68	0.81

Variables on personal hygiene recorded among adolescent girls are described in Table 5. Nearly 90% of the adolescent girls washed their hands with only water before

food. However, more than 90% washed their hands with soap and water after visiting the toilet. Use of footwear to protect the feet from contaminated soil is a preventive measure for helminthes infections. In this study, about 20% did not use footwear in the neighborhood.

**Table 4** | Practices related to storage and use of drinking water

	N (565)	%
Source of drinking water		
Corporation source/pump	565	100
Metro tanks	0	0
Tap water	0	0
Well	0	0
Storage/cleanliness of container		
Copper vessels	1	0.2
Steel vessels	417	73.9
Earthen pot	3	0.5
Combination	144	25.4
Aluminium	0	0
Covered container	474	84
Drinking method		
Ladle	63	11.2
Tap	78	13.8
Steel glass	42	7.5
Boiling water	2	0.35

There is improper planning for disposal of waste and water drainage in urban slums. Water logging further increases the risk of vector borne infections. Table 6 shows the percentage of closed and open drains in the slums. Although the drains in the vicinity of the house were covered either fully (73%) or partially (17%), nearly 10% of the households were located near open drains. All the slums had a garbage bin as observed and the garbage was cleared every day, as reported. However, in all the

**Table 5** | Practices related to hand hygiene

	N (565)	%
Washing hands before food		
Soap and water	55	9.7
Only water	510	90.3
Washing hands after visiting toilet		
Soap and water	524	92.7
Only water	41	7.3

**Table 6** | Cleanliness in the vicinity of the house

	N	%
<b>Garbage disposal</b>		
Presence of garbage bin	565	100
Daily removal of garbage	528	93%
Garbage outside the bin	565	100
<b>Drainage</b>		
Partially closed	95	16.5
Fully open	59	10.4
Fully closed	413	73.1
<b>Sewage</b>		
In the vicinity	59	10.4

selected slums, the garbage overflowed or the garbage was found outside the bin. About 30% of households had stagnant water in the vicinity even during non-monsoon season, as observed by spot-checking.

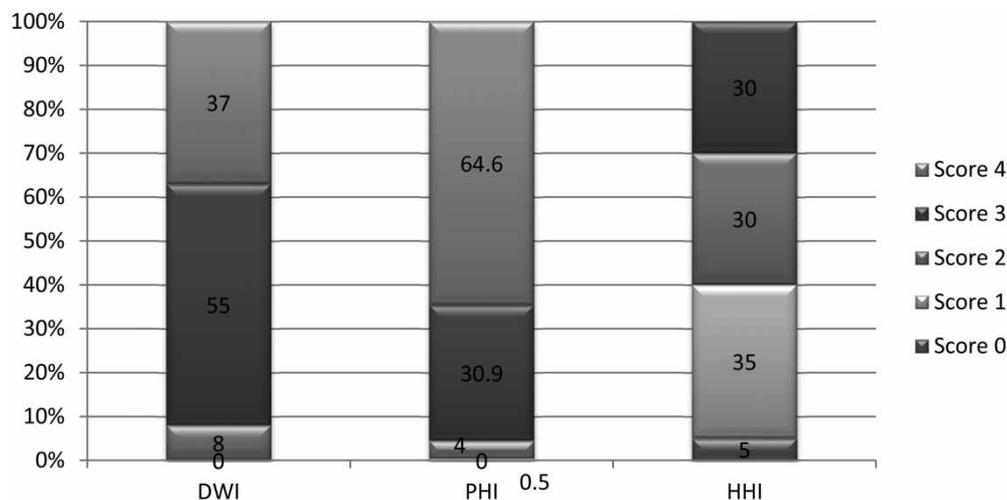
The distribution of observations related to hygiene and sanitation and their corresponding specific indices are presented in [Figure 1](#). More than 50% of the households scored three out of five in the DWI and none of the households scored zero or five out of five. This reflects an average supply of water and storage practices among the households. The scores of PHI also did not show zero. More than 60% scored a highest score of four and about 30% scored three out of four. As per the HHI, scores of three and four were

obtained by 30% each. About 35% scored one and 5% scored zero.

[Table 7](#) shows the description of self-reported morbidities among the adolescent girls. Assessment of self-reported morbidities among the adolescents revealed that 3% of the participants suffered from malaria during the one year prior to the study period. Nearly 8% reported an incidence of malaria among family members. Tuberculosis was reported among family members by 2% of participants.

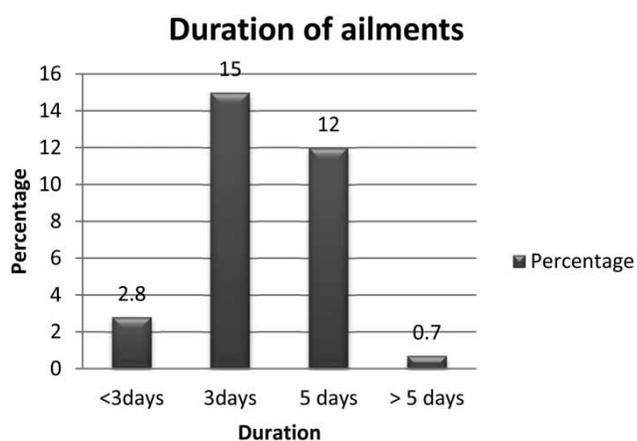
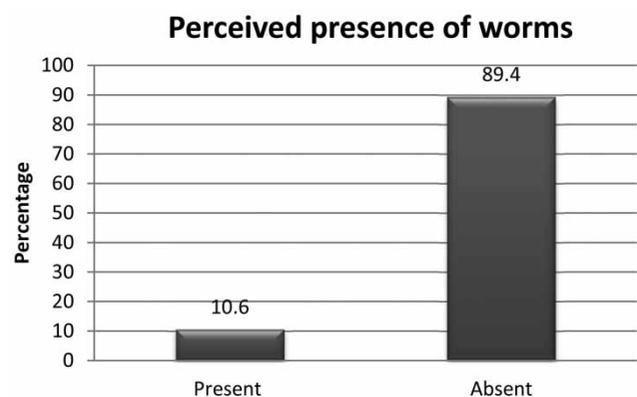
About 31% suffered from minor ailments. Morbidity symptoms in the order of prevalence were: fever 23%; followed by acute respiratory infections, 4%; gastrointestinal problems, 2% and others, such as minor injuries, pain etc. were 2%. Among those who had minor ailments, 12% suffered for a duration of 5 days. [Figure 2](#) shows the duration of ailments and their distribution. Of the 31% with ailments, only 14% were treated and the remaining 17% did not seek treatment.

Intestinal parasitism is a serious public health issue in developing countries as it is an indirect cause of various health related issues. Of these, helminthes infections have more serious effects such as blood loss, leading to anemia. [Figure 3](#) shows the percentage of adolescent girls who reported to have worm infestation. Although results showed that 11% had experienced the presence of worms, 99.5% of the participants, including those who were perceived to have worms, were not dewormed during the one year prior to the study period.

**Figure 1** | Distribution of scores for specific hygiene indices.

**Table 7** | Self-reported morbidities among the participants

Ailments	N	%
No ailments	392	69.4
Total participants who suffered minor ailments	173	30.6
Fever	129	22.8
Cough/cold	23	4.1
Gastro-intestinal problems	12	2.1
Others	9	1.6

**Figure 2** | Duration of ailments among participants.**Figure 3** | Percentage of adolescent girls who perceived presence of worms.

## DISCUSSION

A tool was constructed to assess sanitation and hygiene in the community. During pretest of the tool, the presence of the researcher changed and improved behavior, especially during the second observation. It has been reported in

earlier work (Bartlett *et al.* 1992; Merchant & Udipi 1997; Amar-klemesu *et al.* 2000) that hygiene practices observed through spot checks are likely to vary on different days and hence pose a limitation in assessment. In such situations, composite indices that employ multiple indicators are more dependable than the use of one specific indicator. They are known to have better repeatability and are used for risk assessment for diseases (Griggs *et al.* 2013). This work addresses the limitation of a single measure for hygiene and sanitation. By using a composite index this tool provides a relative picture of hygiene and sanitation at the community level. The observations used in the tool ranged from good to acceptable alpha values for seven out of 13 variables and three did not show any variance. However, the tool needs to be additionally tested with different health workers for repeatability. The slums selected for the study had an adequate supply of water. Although steel vessels were majorly used, a variety of storage utensils and a combination of these were used for storing water. Water was boiled only in those households that had children less than two years of age. Another observation in the practices was that the storage containers of water were partly covered or fully open in one-tenth of the households. Such observations were seen in households where water was stored in buckets or wide neck containers and covered with bamboo mats. In some households the storage vessels had covers with sizes that were inappropriate. It has been well established that drinking water infections related to poor hygiene, sanitation and safe water contribute significantly to infections (WHO 2001). Earlier reports have suggested that better hygienic benefits are obtained from clean storage vessels with narrow necks (Nath *et al.* 2006). Awareness on hygienic storage practices would probably improve hygienic water storage practices.

In this study, washing hands with only water before food was observed among the participants. A similar study carried out in Lucknow (Sachan *et al.* 2012) among adolescent girls showed that girls with poor personal hygiene had 80% of the listed morbidities. However, intervention among school-going children in Delhi did improve their knowledge and hand washing practices (Garg *et al.* 2013). To inculcate hygiene behavior, interventions should be initiated in early school-going years. Also, the provision of soap and water in hand wash areas would ensure hygiene practices.

In this study, not wearing footwear in the neighborhood was also a commonly observed practice among the adolescent girls. Studies have reported hookworm prevalence rates ranging from 10 to 20% in relatively dry unsanitary conditions, and up to 80% in rural unsanitary conditions in wet tropics (Stephenson *et al.* 1989). Prevalence rates of infection are high in populations who do not use footwear (Stoltzfus *et al.* 1997). Although data are scarce for providing footwear through public health interventions and prevention of helminthes infection, it should be advocated. For those below poverty such simple interventions would improve healthy practices. In this study, the reasons for not wearing footwear were sometimes associated with the loss of family members and associated religious beliefs. These sensitive issues have to be dealt with using culturally appropriate measures.

With poor garbage disposal practices and overcrowding in the slums, the risk of infection is high. Therefore, there is an immense responsibility to improve personal hygienic practices among adolescent girls in urban slums. More bins need to be installed and removal of garbage twice a day would avoid the overflowing of garbage bins.

Hygiene and sanitation in the context of adolescent morbidities is of significance as undernutrition adversely affects immune status. Nutritional deficiencies such as iron deficiency, highly prevalent in developing countries among adolescent girls, reduce the capacity of leukocytes to fight against the microorganisms. In such conditions, lymphocytes have decreased ability to replicate with mitogen stimulation. Furthermore, a decrease in 'L' and 'B' lymphocytes involved in cell mediated immunity has been observed (Chandra 1983; WHO 2001; Ahluwalia *et al.* 2004). In this study nearly 30% of adolescents reported to have had infections during the study period. Of these a major percentage did not seek intervention. Poor hygiene and sanitation combined with delayed or neglected health seeking behavior increase the risk of repeated infections and poor health.

Almost 99% of the participants in this study were not dewormed and this further increases the risk of anemia. Worm infestation has been identified as a major causative factor for anemia among adolescents (Sampathkumar & Rajaratnam 1997). Work carried out in Pondicherry, India, showed that one-third of the participants who were anemic had a history of passing worms in stools (Saratha

*et al.* 2010). Similar work carried out by Kumar *et al.* (2003) showed 71% stool parasite positivity as compared to 50% in a tribal population in Madhya Pradesh (Chakma *et al.* 2000). Helminthes infection may not be restricted to hilly or tribal regions alone. Living conditions in resource poor settings combined with poor hygiene and sanitation predisposes the adolescents to worm infection. Improved hand hygiene before taking food needs to be emphasized through health education. The results also suggest the importance of creating awareness and periodic deworming to prevent re-infection.

## CONCLUSIONS

In conclusion, the modified and tested tool is simple and efficient to assess hygiene and sanitation in a community setting. Amongst the three domains, the HHI scored poorly with nearly 40% scoring between zero and one. There is therefore a fundamental need to provide improved sewage and garbage disposal for those living in the slums. It is of utmost importance to educate the people living in these areas about water storage and the importance of hand washing with soap before food. There is a need to improve the awareness of adolescent girls on personal hygiene, foot care and environmental cleanliness with maternal health perspective. Tested interventions that have proven to be effective need to be implemented to improve hygienic behavior. In addition they need to be encouraged to avail the periodic deworming interventions provided through government programmes. Such interventions may improve the physical environment, promote hygienic behavior and indirectly contribute to improved health.

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