

Promotion of sanitation and hygiene in a rural area of South India: A community-based study

Nagapraveen Veerapu¹, P. Subramaniyan², B. A. Praveenkumar², G. Arun²

¹Department of Community Medicine, Viswabharathi Medical College, Kurnool, ²Department of Community Medicine, PES Institute of Medical Sciences and Research, Kuppam, Andhra Pradesh, India

ABSTRACT

Introduction: Globally, billions of people do not have access to improved sanitation and many defecate in the open air. Poor hand washing practices and limited access to sanitation facilities perpetuate the transmission of disease-causing germs. The objectives of the study were to find out the level of knowledge, attitudes, and practices (KAPs) on sanitary latrine, footwear, and hand washing among rural people and to assess the improvement in KAP after health education intervention. **Materials and Methods:** A health education intervention study was conducted from November 2012 to January 2014 in a rural area of Kuppam, Andhra Pradesh, South India among the people aged 15 years and above. The individuals were selected by multistage random sampling and interviewed using a structured questionnaire. After a baseline KAP assessment, intervention activities were conducted twice. The intervention activities were group level talks and discussions, free soap distribution, and display of posters at anganwadi centers. Post-KAP was assessed twice, and the significance of difference was found by using McNemar's test. **Results:** After the intervention, there was a significant improvement in the overall KAPs among the subjects in post test-1 and post test-2 ($P_1 < 0.0001$, $P_2 < 0.0001$), respectively. **Conclusions:** Health education as an intervention has significantly increased KAP more than 30%. Hence, it is imperative that education interventions are needed to bring or sustain positive change.

Keywords: Attitudes and practices, disease, footwear, hand washing, health education, knowledge, sanitary latrine

Introduction

Out of a global estimate of 7 billion people in 2012, about 2.5 billion people do not have access to improved sanitation and 1 billion people defecate in the open air.^[1] In India, 53% of households or 600 million people defecate in open, out of which 69.3% belongs to rural areas and 18.6% belongs to urban areas.^[2] Field studies indicate that usage of the existing toilets in both rural and urban areas is very low.^[3]

Eighty-eight percent of diarrheal cases worldwide are linked to unsafe water and inadequate hygiene. Globally, every year diarrheal diseases account for about 1.8 million deaths.^[4] An estimated 2000 children under the age of 5 years die every day

from diarrheal diseases and out of this, 1800 deaths are due to unsafe water and poor sanitation.^[5]

Worldwide, soil-transmitted helminths infect more than 1 billion people a year due to a lack of adequate sanitation and the burden due to helminths infection was estimated at 39 million disability adjusted life years.^[6] In rural India, the hookworm infestation has been one of the major cause of iron deficiency anemia.^[7] Poor hand washing practices and limited access to sanitation facilities perpetuate the transmission of disease-causing germs. Around 32% of diarrheal diseases can be reduced by improving sanitary conditions. Health education interventions including hygiene education and promotion of hand washing with soap can lead to a reduction of diarrheal cases up to 45%. Schistosomiasis disease can be reduced up to 77% by improving sanitation, and trachoma morbidity can be reduced up to 27% by improving

Address for correspondence: Dr. Nagapraveen Veerapu, Department of Community Medicine, Viswabharathi Medical College, Kurnool, Andhra Pradesh, India.
E-mail: nagapraveen2k3@gmail.com

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access to safe water sources and improving hygiene.^[8] Hand washing with soap has been the most cost-effective way of preventing diarrhea and pneumonia, which are leading causes of child mortality.^[9]

India is to reduce the proportion of households having no access to sanitation to 38% by 2015. At the current rate of decline, India may achieve the proportion of households without any sanitation to 43% by 2015, missing the target by about five percentage points.^[10]

The goal of Nirmal Bharat Abhiyan was to end open air defecation and adopt safe, hygienic practices. Thus, a clean and healthy nation that thrives and contributes to the welfare of our people could be achieved.^[11] Community health mainly depends on sanitation and hygiene practices of the people. Health education improves the level of knowledge and change in the attitude of the people toward sanitation and helps the people to bring or to maintain a positive, healthy behavior.

In Andhra Pradesh, only a few intervention studies were conducted on this aspect. Therefore, we conducted a community-based interventional study on knowledge, attitudes, and practices (KAPs) regarding sanitary latrine, hand washing and usage of footwear among rural people of Kuppam, Andhra Pradesh, South India.

Materials and Methods

Study design, study area, and study population, study period

A community-based interventional study was conducted in the rural area of Kuppam, Andhra Pradesh, South India, among people aged 15 years and above. The study was conducted from November 2012 to January 2014.

Sample size

Prior to the study, a pilot study was conducted and it was found that there was at least 10% increase in the knowledge or attitude or practice after the intervention in the piloted sample. Based on this, the sample size was calculated at α (type one error) = 0.5% and power $(1-\beta) = 90\%$ and the sample size were 266 individuals. Assuming a loss of 10% during follow-up, it was decided to take a sample of 300 individuals.

Sampling technique

Study subjects were selected by multistage random sampling. All Gram Panchayats in Kuppam Mandal were listed. One Gram Panchayat was selected. There were five villages in Gram Panchayat. Out of five, three villages each having more than two hundred households was selected by simple random sampling. In each village, randomly households were selected until the number of households hundred was reached. Then, one person from the selected household aged 15 years and above was selected randomly and interviewed.

Data collection tool

A structured questionnaire was developed, translated into local language Telugu, and back into English. The questionnaire included four sections, namely sociodemographic characteristics of the study subjects, knowledge aspects, attitude aspects, and practice aspects regarding sanitary latrines, hand washing, and usage of footwear. The knowledge and practices were assessed by “Yes or No” questions. “Yes” indicates the presence of knowledge/positive practice. The attitude was assessed by sentences with three responses such as disagree, neutral, and agree. “Agree” indicates positive attitude. The questionnaire included a checklist for the presence of soap and to see whether latrine is sanitary or not. The reliability of the questionnaire was $r = 0.71$ (71%) by using test-retest. Approval for the study was obtained from the Institutional Ethics Committee.

Baseline survey (pretest)

A baseline survey was conducted to assess initial level of KAP using the questionnaire. The individuals were interviewed separately for 20–25 min. The survey was carried out during evening times (4–7 pm).

Intervention

The intervention activities were conducted twice in all of the selected villages. The second intervention was done, 1 month after completion of the first intervention. Each health education session was a group level interactive lecture for 30–45 min using flip charts containing pictures and health messages. Each group consisted of about 5–10 study subjects and other persons in the locality. The dynamics of disease transmission was explained and the importance of sanitation and hygiene was emphasized. Question and answer pattern was followed during and after the health education and doubts were clarified. After health education, pamphlets explaining the importance of sanitary latrine, footwear and hand washing were distributed, and posters were displayed at schools and anganwadi centers. Free detergent soap was distributed and importance of hand washing with soap was stressed during health education sessions. Community participation was increased by free distribution of soap.

Postintervention survey-1

After a gap of 1 month from the completion of the second health education intervention, a postintervention survey was conducted to assess the level of KAP using the same questionnaire.

Postintervention survey-2

After a gap of 4 months from the completion of the second health education intervention, another postintervention survey was conducted to assess the level of KAP using the same questionnaire.

Statistical analysis of data

The data were entered into MS Excel 2007 version and further analyzed using IBM SPSS version 21. The categorical data were represented using percentages (%), and continuous data were

represented using mean and standard deviation. The significance of difference was analyzed by using McNemar's test.

Results

Among the three hundred study subjects, most (53.3%) were females. The mean age of the study subjects was 37.03 ± 15.4. Most of the subjects were illiterates (64.7%), belonged to nuclear families (69.7%), and were in class 4 (55.3%) and class 5 (27%) socioeconomic status according to BG Prasad 2012 classification [Table 1].

Table 2 shows that the knowledge scores among the study subjects increased after the intervention. There was statistically significant increase in the overall knowledge score and also each aspect of knowledge score ($P_1 < 0.0001, P_2 < 0.0001$). The knowledge regarding naming the diseases was poor, both before and after the intervention. The awareness about government schemes for construction of sanitary latrine was increased from 55% (pretest) to 98.6% and 98.9% after intervention in post test-1 and post test-2, respectively.

Table 3 shows that the positive attitude scores among the subjects increased after the intervention. There was statistically significant increase in the overall attitude scores and also each aspect of attitude scores ($P_1 < 0.0001, P_2 < 0.0001$).

The perception of the need for having sanitary latrine was increased from 54.3% to 95% and 96% after intervention in post test-1 and post test-2, respectively. The attitude score toward buying footwear was increased from 38% to 87.7% and 91.6% after intervention.

Table 4 reveals that the practice scores increased after intervention among the study subjects. There was statistically significant increase in the overall practice scores and also in each aspect of practice scores ($P_1 < 0.0001, P_2 < 0.0001$). About 91.3% of the subjects were practicing open air defecation. After intervention 77.3% and 77.2% were practicing open air defecation. The practice of keeping latrine in a sanitary way was increased from 88.2% to 97.3% and 95.9% after intervention in post test-1 and post test-2, respectively.

The practices of hand washing with soap before/after some activities were studied. The score for practice before cooking food was increased from 29.7% to 63.2% and 81.3%. The score for the practice before food intake increased from 45% to 80.9% and 87.3%. The score for practice after toilet was increased from 54% to 94.7% and 95.3%. The score for practice after work was increased from 61.7% to 93.7% and 94.6%. The score for practice after cleaning child's bottom was increased from 78% to 93.2% and 97.3%. The score for the presence of soap at hand washing site in the subjects' households was increased from 32.7% to 77.3% and 69.8% in post test-1 and post test-2, respectively.

Discussion

In this study, the knowledge that "sanitary latrine protects from transmission of diseases/good for health" was increased

Table 1: Sociodemographic profile of the study subjects

Variable	n (%)
Gender	
Males	140 (46.7)
Females	160 (53.3)
Age groups (years)	
<55	48 (16)
≥55	252 (84)
Education	
Literates	106 (35.3)
Illiterates	194 (64.7)
Types of families	
Nuclear families	209 (69.7)
Extended families	91 (30.3)
Socioeconomic status	
Class 1	02 (0.7)
Class 2	17 (5.7)
Class 3	34 (11.3)
Class 4	166 (55.3)
Class 5	81 (27)
Total	300 (100)

Table 2: Knowledge about sanitary latrine, footwear, and hand washing with soap among the study subjects

Knowledge statement	Correct responses (yes), n (%)			
	Yes	Pre test (n=300)	Post test-1 (n ₁ =299)	Post test-2 (n ₂ =298)
Sanitary latrine protects from transmission of many diseases	Yes	101 (33.7)	245 (81.9)	269 (90.2)
Name any one disease that can be prevented by sanitary latrine (if the subject names, mark it as yes)	Yes	1 (0.3)	5 (1.7)	6 (2)
Aware of government schemes for construction of sanitary latrine	Yes	165 (55)	295 (98.6)	295 (98.9)
Significant difference			$P_1 < 0.0001$	$P_2 < 0.0001$
Footwear protects from transmission of some diseases	Yes	65 (21.7)	223 (74.6)	232 (77.9)
Name any one disease that can be prevented by wearing footwear (if the subject names, mark it as yes)	Yes	1 (0.3)	24 (8.0)	24 (8.1)
Significant difference			$P_1 < 0.0001$	$P_2 < 0.0001$
Hand washing with soap gives protection against many diseases	Yes	123 (41)	273 (91.3)	273 (91.6)
Name any one disease that can be prevented by hand wash with soap (if the subject names mark it as yes)	Yes	1 (0.3)	13 (4.4)	9 (3.0)
Significant difference			$P_1 < 0.0001$	$P_2 < 0.0001$
Total	Yes	457 (21.8)	1078 (51.5)	1108 (53.1)
Significant difference			$P_1 < 0.0001$	$P_2 < 0.0001$

Yes corresponds to correct responses. The number of wrong responses is not mentioned in the table. P_1 : Significance of difference between pre- and post-test-1; P_2 : Significance of difference between pre- and post-test-2

after intervention. In a cross-sectional study conducted in rural Madhya Pradesh,^[12] only 20% of the mothers were knowledge about diarrheal diseases were caused by consumption of

contaminated food and water. In a cross-sectional study in rural area of Maharashtra,^[13] people were afraid of getting diseases

Table 3: Attitude toward sanitary latrine, footwear, and hand washing among the study subjects

Attitude statement		Toward agree (good attitude), n (%)		
		Pre test (n=300)	Post test-1 (n=299)	Post test-2 (n=298)
You feel not expensive for construction of sanitary latrine	Ag*	76 (25.4)	171 (57.2)	179 (60)
You feel there is a need for sanitary latrine	Ag*	163 (54.3)	284 (95)	286 (96)
You feel opportunity for morning walk will not be missed, by sanitary latrine	Ag*	223 (74.4)	283 (94.6)	288 (96.7)
You are in favor of constructing sanitary latrine	Ag*	145 (48.3)	293 (98)	292 (98)
Significant difference			$P_1 < 0.0001$	$P_2 < 0.0001$
You feel not expensive to buy footwear	Ag*	114 (38)	262 (87.7)	273 (91.6)
You feel there is a need to wear footwear	Ag*	216 (72)	284 (95)	288 (96.6)
Significant difference			$P_1 < 0.0001$	$P_2 < 0.0001$
You feel not expensive to buy a soap for hand washing	Ag*	175 (58.3)	281 (94)	283 (95)
You feel there is a need to wash hands with soap (and water)	Ag*	187 (62.3)	287 (96)	284 (95.3)
You feel hand washing is not a time waste process	Ag*	282 (94)	295 (98.7)	292 (98)
Significant difference			$P_1 < 0.0001$	$P_2 < 0.0001$
Total	Ag*	1581 (58.6)	2440 (90.7)	2465 (91.9)
Significant difference			$P_1 < 0.0001$	$P_2 < 0.0001$

*Ag corresponds to agree. Number of neutral and disagreed responses have not been mentioned in the table. P_1 : Significance of difference between pre- and post-test-1; P_2 : Significance of difference between pre- and post-test-2

by consuming contaminated food and water by the fecal matter due to open air defecation (34.7%). In a study conducted in the rural area of Haryana,^[14] people falsely perceived that open air defecation did not spread diseases (18–25%). In this study, the attitude toward the need for sanitary latrine and the willingness to construct sanitary latrine increased after the intervention. In a study in Palestinian territory,^[15] the attitude of the school students toward using toilets was assessed; 44.1% of West Bank students and 42% of Gaza students refused to use school toilets and felt that the toilets were not clean. In this study, among the subjects having latrine in the households before the intervention, 88.2% of latrines were sanitary. After the intervention, 97.3% and 95.6% were sanitary in post test-1 and post test-2, respectively. The attitude toward agree “construction of sanitary latrine was not expensive” increased after intervention from 25.4% to 57.2% and 60% in post test-1 and post test-2, respectively. In a survey conducted in Thailand,^[16] two groups were compared, 93.3% of the group committee having a sanitary latrine and 8.69% of the group committee not having sanitary latrine agreed “constructing sanitary latrine was not an economic problem” for them.

Among the subjects, only 11.3% had sanitary latrine in the household. After the intervention, 24.4% and 24.8% were having latrines. Among those having latrines, 76.5% of the subjects were using it routinely. After the intervention, the percentage of routine usage was increased to 93.2% and 91.1% in post test-1 and post test-2, respectively. In a study conducted in Tamil Nadu,^[17] 41.5% in Main village and 23.2% in Harijan colony had toilets and the usages among those having toilets were 88.2% in Main village and 76.9% in Harijan colony. In this study, the practice of open air defecation was more than 60% after intervention, which was similar to various cross-sectional studies conducted in the rural area of India, Maharashtra^[13] (67%),

Table 4: Practices of latrine, usage of footwear, presence of soap at hand washing site, and hand washing with soap before food, after toilet, after work, before cooking food and after cleaning child’s bottom/feces among the study subjects

Practice statement		Correct practices (yes), n (%)		
		Pre test (n=34)	Post test-1 (n ₁ =73)	Post test-2 (n ₂ =74)
Latrine sanitary or not (check)	Yes	30 (88.2)	71 (97.3)	71 (95.6)
Latrine routinely used or not (ask)	Yes	26 (76.5)	68 (93.2)	68 (91.9)
Significant difference			$P_1 < 0.0001$	$P_2 < 0.0001$
		Pre test (n=300)	Post test-1 (n ₁ =299)	Post test-2 (n ₂ =298)
Using foot wear or not (ask)	Yes	242 (80.7)	282 (94.3)	283 (95)
Significant difference			$P_1 < 0.0001$	$P_2 < 0.0001$
Presence of soap at hand washing site (check)	Yes	98 (32.7)	231 (77.3)	208 (69.8)
Wash hands with soap before food (ask)		135 (45)	242 (80.9)	260 (87.3)
Wash hands with soap after toilet (ask)	Yes	162 (54)	283 (94.7)	284 (95.3)
Wash hands with soap after work (ask)	Yes	185 (61.7)	280 (93.7)	282 (94.6)
		Pre test (n=155)	Post test-1 (n ₁ =155)	Post test-2 (n ₂ =155)
Wash hands with soap before cooking food	Yes	46 (29.7)	98 (63.2)	126 (81.3)
		Pre test (n=73)	Post test-1 (n ₁ =73)	Post test-2 (n ₂ =73)
Wash hands with soap after cleaning child’s bottom/feces	Yes	57 (78)	68 (93.2)	71 (97.3)
Significant difference			$P_1 < 0.0001$	$P_2 < 0.0001$
Total	Yes	981 (54.6)	1623 (86.8)	1653 (88.6)
Significant difference			$P_1 < 0.0001$	$P_2 < 0.0001$

Yes corresponds to correct responses. The number of wrong responses is not mentioned in the table. The subjects who had constructed sanitary latrine were added in the post test. The study subjects who were not involved in preparing meals, cleaning child’s bottom, or feces were excluded from that activity. P_1 : Significance of difference between pre- and post-test-1; P_2 : Significance of difference between pre- and post-test-2

Madhya Pradesh^[12] (71% from Ichhawar block and 62% from Asha block), and Tamil Nadu^[17] (74.2%). In an awareness evaluation study conducted in Chandigarh,^[18] the usage of community latrines in urban slum area was assessed, and there was a significant increase in the awareness from the baseline, this study also showed a significant increase after the intervention.

The practice of going barefoot outside decreased after the intervention. During 1920's studies conducted in Porto Rico and Brazil showed that people having the habit of not wearing footwear and going on barefoot were highly infested with the worms.^[19]

In the present study, knowledge that hand washing with soap protects from transmission of diseases/good for health increased after intervention from 41% to 91.3% and 91.6% (post test-1, post test-2). A study conducted in the rural areas of Maharashtra,^[13] people (77.6%) had knowledge on the importance of hand washing. Another study conducted in the rural area of South India,^[20] 38.8% mothers had knowledge that hand washing could prevent diarrhea and 24.9% mothers had knowledge that hand washing could prevent acute respiratory infections. In an intervention conducted on hand washing in Eastern India,^[21] majorities of the people wrongly considered that child's feces was free of germs.

In a KAP study conducted in Anuradhapura Teaching Hospital,^[22] only 40% agreed they adhere to correct hand hygiene practices. In the present study, the need toward hand washing was assessed rather than adherence, and 62.3% subjects agreed that there is a need for hand washing with soap (and water). After the intervention, the need was increased to 96% and 95.3% (post test-1, post test-2).

In the present study, the practices of washing hands with soap (and water) before/after various activities, increased after the intervention. In a community-based cross-sectional study conducted in West Bengal,^[23] the subjects practicing washing their hands with soap and water were 71% after defecation, 13% before meals, 1% before cooking, and 5% after cleaning child's feces. In a cross-sectional study conducted in South India among the mothers having under five children,^[24] the mothers practicing hand washing with soap and water were 33.3% before food, 90% after defecation, 31.1% before cooking, and 87.8% after cleaning child's feces. In another study among the mothers,^[20] the practices were 73.1% after defecation, 76.9% before food, 20% before cooking, and 63.9% after cleaning child's feces.

In the present study, the presence of soap at hand washing site in the households was less than studies done in Thailand (94%) and in Ethiopia (82%), where free soap was distributed.^[25]

Conclusions

The present study showed that health educational interventions can significantly improve the overall KAPs of the study

population pertaining to sanitary latrine, usage of footwear, and hand washing by more than 30%. Health education made the people to realize their unfelt needs. There should be regular follow-up visits and repetition of health education to bring and sustain the positive healthy behavior in the community. This study is limited as post test-1 and post test-2 surveys were conducted with a gap of a few months because of time constraint and so there was not much difference between post test-1 and post test-2 results. The questionnaire needs to be further standardized.

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Conflicts of interest

There are no conflicts of interest.

References

1. WHO. Progress on drinking water and sanitation-2014 update. Switzerland: WHO Press; 2014. p. 80.
2. 53% Indian Households Defecate in Open: World Bank Says on World Toilet Day. The Times of India; 2013. Available from: <http://www.timesofindia.indiatimes.com/india/53-Indian-households-defecate-in-open-World-Bank-says-on-World-Toilet-Day/articleshow/26032829.cms>. [Last cited on 2014 Jan 28].
3. Aarti Kelkar K. The Sanitation Crisis in India - An Urgent Need to Look Beyond Toilet Provision. India Water Portal; 2012. Available from: <http://www.indiawaterportal.org/articles/sanitation-crisis-india-urgent-need-look-beyond-toilet-provision>. [Last cited on 2014 Jan 28].
4. Water Sanitation Health. WHO; 2014. Available from: http://www.who.int/water_sanitation_health/diseases/burden/en/. [Last cited on 2014 Jan 17].
5. Children Dying Daily Because of Unsafe Water Supplies and Poor Sanitation and Hygiene, UNICEF Says. New York: UNICEF; 2013. Available from: http://www.unicef.org/media/media_68359.html. [Last cited on 2014 Jan 29].
6. Ziegelbauer K, Speich B, Mäusezahl D, Bos R, Keiser J, Utzinger J. Effect of sanitation on soil-transmitted helminth infection: Systematic review and meta-analysis. PLoS Med 2012;9:e1001162.
7. Anand T, Rahi M, Sharma P, Ingle GK. Issues in prevention of iron deficiency anemia in India. Nutrition 2014;30:764-70.
8. Water, Sanitation and Hygiene Links to Health, WHO.

- Available from: http://www.who.int/water_sanitation_health/facts2004/en/. [Last updated in 2004 Nov; Last cited on 2014 Sep 28].
9. Hand Washing. Available from: http://www.unicef.org/wcaro/overview_4553.html. [Last cited on 2014 Sep 29].
 10. Millennium Developmental Goals India Country Report 2011. India: Government of India; 2011. p. 195.
 11. Nirmal Bharat Abhiyan; 2012. Available from: http://www.indiasanitationportal.org/sites/default/files/NBA%20Guidelines%20Final_3.pdf. [Last cited on 2014 Sep 29].
 12. Bhattacharya M, Joon V, Jaiswal V. Water handling and sanitation practices in rural community of Madhya Pradesh: A knowledge, attitude and practice study. *Indian J Prev Soc Med* 2011;42:93-7.
 13. Bharadwaj A, Avinash S, Prassana M, Abhishek S, Sanjeet P, Pankaj C. A community based cross sectional study on use of sanitary latrine in a rural setup in Maharashtra. *Indian Assoc Prev Soc Med* 2013;4:89-93. Available from: http://www.iapsmgc.org/index_pdf/120.pdf. [Last cited on 2014 Jan 10].
 14. Singh A, Arora AK. Knowledge, attitude and practices of villagers regarding sanitary latrines in North India. *Indian J Prev Soc Med* 2003;34:118-23.
 15. School Water Sanitation and Hygiene Knowledge, Attitudes and Practices Survey Report; 2012. p. 302.
 16. Doolyabhat M. Survey of Attitude and Knowledge about Latrine in Rural Thailand [Published graduate project on the internet]. Northridge: California State University; 1974. Available from: <http://www.scholarworks.csun.edu/bitstream/handle/10211.2/4713/DoolyabhatManus1974.pdf?sequence=1>. [Last cited on 2014 Jan 14].
 17. Banda K, Sarkar R, Gopal S, Govindarajan J, Harijan BB, Jeyakumar MB, *et al.* Water handling, sanitation and defecation practices in rural Southern India: A knowledge, attitudes and practices study. *Trans R Soc Trop Med Hyg* 2007;101:1124-30.
 18. Swami HM, Thakur JS, Gupta M, Bhatia SP. Improving environmental conditions of a slum in Chandigarh by an awareness campaign. *J Environ Sci Eng* 2004;46:252-6.
 19. The Rockefeller Foundation Annual Report; 1923 [Internet]. Available from: <https://www.rockefellerfoundation.org/app/uploads/Annual-Report-1923.pdf>. [Last Cited on 2015 Nov 25].
 20. Datta SS, Singh Z, Boratne AV, Senthilvel V, Bazroy J, Dimri D. Knowledge and practice of hand washing among mothers of under-five children in rural coastal South India. *Int J Med Public Health* 2011;1:33-7.
 21. Ray SK, Zaman FA, Laskar NB. Hand washing practices in two communities of two states of Eastern India: An intervention study. *Indian J Public Health* 2010;54:126-30.
 22. Kudavidnange BP, Gunasekara T, Hapuarachchi S. Knowledge, attitudes and practices on hand hygiene among ICU staff in Anuradhapura teaching hospital. *Anuradhapura Med J* 2011;1:29-40.
 23. Ray SK, Dobe M, Maji S, Chakrabarty D, Sinha Roy AK, Basu SS. A pilot survey on hand washing among some communities of West Bengal. *Indian J Public Health* 2006;50:225-30.
 24. Aithal KS, Judith MO, Vidya P, Shriyan P, Uday NY. Hand washing knowledge and practice among mothers of under-five children in coastal Karnataka, India - A cross-sectional study. *Int J Med Health Sci* 2014;3:266-71.
 25. Biran A, Schmidt WP, Zeleke L, Emukule H, Khay H, Parker J, *et al.* Hygiene and sanitation practices amongst residents of three long-term refugee camps in Thailand, Ethiopia and Kenya. *Trop Med Int Health* 2012;17:1133-41.