



# **Assessment of Knowledge and Practices on Effective Hand Hygiene among Rural and Urban Population of South India: A Web Based Cross Sectional Survey**

**S. M. G. Ishrar<sup>a\*#</sup>, C. Nagavalli<sup>a@</sup>, V. Vikas Reddy<sup>a@</sup> and G. Navya<sup>a@</sup>**

<sup>a</sup> *Department of Pharmacy Practice, Raghavendra Institute of Pharmaceutical Education and Research (RIPER) – Autonomous, Ananthapur, Andhra Pradesh, 515721, India.*

## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

**Aims:** The study aims to assess the level of awareness regarding Hand hygiene among the population in urban and rural areas of South India.

**Study Design:** A web based cross sectional survey.

**Place and Duration of Study:** An online study was conducted among public of South India for a period of 6 months.

**Methodology:** The data was collected through online mode by providing google link to fill questionnaire form through various social media platforms. The questionnaire consists of demographic details, knowledge and practice related questions. SPSS was used to interpret data and chi-square test, independent T test, backward multiple regression analysis was done.

**Results:** From the collected data a total of 1178 responses were collected (urban:726, rural:452). From independent T test the knowledge mean score of HH was: 10.07±2.136 for urban population and 9.79±2.138 for rural population. By this urban population has more knowledge than rural

<sup>#</sup>Assistant professor;

<sup>@</sup>Pharm. D interns;

<sup>\*</sup>Corresponding author: E-mail: [ishrarpharma@gmail.com](mailto:ishrarpharma@gmail.com);

population. From backward multiple regression analysis of Knowledge score, the findings shown that the urban male residents with 2 members household residing in Tamilnadu have preferably more knowledge than others when compared with demographic details. From the independent T test the HH practice mean score was  $11.25 \pm 1.991$  for urban residents and  $10.77 \pm 2.280$  for rural residents. From the Backward multiple regression analysis of Practice score, the findings shown that most parsimonious combination of region (rural, urban), age group (10-30 years, 30-60 years and >60 years), gender (female, male), state and UT (Andhra Pradesh, Karnataka, Tamilnadu, Kerala, Telangana, Andaman and nicobar, Puducherry, Lakshadweep), household (2, 3, 4, >4 members), education level (10 and below 10, intermediate, UG, PG, Ph. D) in predicting the practice score.

**Conclusion:** The study results concluded that urban residents have preferably more knowledge than rural residents. Creative campaigns and awareness programs should be conducted to attain persistent improvement in HH practices.

*Keywords: Hand hygiene; infections; public; knowledge; practice and South India.*

## ABBREVIATIONS

HH : Hand Hygiene  
WHO : World Health Organization  
CDC : Centers for Disease Control and Prevention  
UNICEF : United Nations Children's Fund  
SPSS : Statistical Package for the Social Sciences

## 1. INTRODUCTION

Hygiene is practiced for ages and is considered the central element in cultural and religious customs. The relation between hand hygiene and health was first made less than two centuries ago [1]. In the mid-19th century, two pioneers, Ignaz Semmelweis and Florence Nightingale delivered the importance of handwashing [2]. Food-borne outbreaks of diseases caused by *Campylobacter* and health-related infections in the 1980s made the United states CDC actively encourage HH [3].

HH is an important, cost-effective, preventive and practical measure to reduce the incidence of infections in clinical and community settings; it is a well-recognized tool for disease prevention [4,5]. As per WHO and UNICEF joint monitoring program report on hygiene interventions, 542 million people in India live without a basic handwashing facility and around 41% of schools have no hygiene services, affecting 900 million children. In the world, two out of five people and half of the schools do not have handwashing facilities with soap and water on-premises.

In 2017, 78 countries had comparable data available on the accessibility of basic handwashing facilities and disclose the actual

levels of handwashing with soap are generally low [6]. 40% of the world's population does not have a place in their residence to wash hands with water and soap. Three-quarters of those who lack access to water and soap live in the world's poorest countries and are amongst the most vulnerable: children and families living in informal settlements, migrants, and refugee camps. 43% of clinical settings do not have hand hygiene facilities at points of care where patients are treated. With limited or no hand hygiene facilities and improvement programs, health care workers' compliance with hand hygiene best practices can be as low as 8%. This puts teachers, doctors, nurses, and patients- all of the us-at risk [7]. 13 million deaths are estimated across the globe annually and infectious diseases proceed to be a health challenge and economic burden between 1980 and 1992 due to poor hand hygiene promotion and education, deaths caused by infectious diseases is increased of 22% [8].

Some organisms are not found on the skin of humans most consistently and are considered as transient flora which is located on the superior layer of the skin and can be contacted during direct contact with clients, patients, residents, health care providers, and in the environment. Transient bacteria may also be easily passed onto others or to objects in the environment and causes health-associated infections. Such flora can be removed by mechanical friction of washing with soap and water or removed by using an antiseptic hand rub. Hand washing is a widely established practice to control the cross-transmission of infections. The Centre for disease control and prevention and the association for professionals in infection control and epidemiology in the United States has

identified that successful handwashing practice is useful to prevent the spread of infections. Knowledge of hand washing supports the public to stay safe and healthy. Handwashing education helps to decrease the rate of people who gets sick with diarrhea by 31%, diarrheal illness in people with weakened immune systems by 58%, respiratory infections by 16-21% and absenteeism in school children due to gastrointestinal infections by 29-57% [9,10].

### 1.1 Statement of the Problem

Assessment of knowledge and practices on effective hand hygiene among rural and urban population of South India: A web based cross sectional survey.

### 1.2 Objectives of the Study

- To develop a self-administered questionnaire form on HH.
- To assess the knowledge among rural and urban residents.
- To observe the practices of HH among the general public

## 2. MATERIALS AND METHODS

The design used in this study was a web based cross sectional survey.

### 2.1 Study Site and Duration

The study was carried out by using an online questionnaire form from the residents of South India and was planned and carried out for a period of 6 months.

### 2.2 Variables

#### 2.2.1 Independent variables

The independent variables in this study are:

- a) Rural participants
- b) Urban participants

#### 2.2.2 Dependent variables

In this study the dependent variables are:

- a) Knowledge score
- b) Practice

#### 2.2.3 Demographic variables

In this study the socio demographic variables include age, gender, states and union territories, household and education level.

## 2.3 Sampling Criteria

### 2.3.1 Inclusion criteria

Individuals residing in rural and urban areas of South India.

Individuals above 10 years of age.

Individuals willing to participate in the study.

### 2.3.2 Exclusion criteria

People who are unable to understand the questionnaire.

Responses without appropriate information were excluded.

Individuals who do not have accessibility to the internet.

## 2.4 Sample Size Determination and Sampling Technique

The required sample size is calculated by using the sample size formula for infinite population, variables included are Z score (Z) of 1.96 at 95% confidence interval, estimated proportion (p) of 0.5, and margin of error (e) of 3%.

$$\begin{aligned} \text{Sample size} &= Z^2 [p (1-p)] / e^2 \\ &= (1.96)^2 [0.5(1-0.5)] / (0.03)^2 \\ &= 1067 \end{aligned}$$

A total of 1067 is obtained from the formula, by considering non response rate, 10% of sample is added therefore the sample size was 1174.

A total of 1191 responses were obtained from web based survey, after eliminating missing errors and incompletely filled data, a total of 1178 responses were taken for the data analysis and snowball sampling technique was used in the survey.

## 2.5 Study Procedure

Respondents aged  $\geq 10$  years old, residents of South India were recruited via snowball sampling method, google forms were used to facilitate data collection, and it is an online survey tool that can ease the distribution of questionnaire via e-mail, WhatsApp, Facebook, telegram, Instagram etc. It analyzes and exports the results after responses have been collected, it also guides the respondents to complete all questions after

responses have been collected, it also guides the respondents to complete all questions before exiting, thereby minimizing the frequency of missing questions before exiting, thereby minimizing the frequency of missing questions.

## 2.6 Description of the Tool

A self-administered questionnaire on Hand hygiene was developed by an extensive literature review on key issues related to hand washing and hand drying and critical times of Hand washing.

- Section-A includes electronic consent.
- Section-B includes 7 questions related to demographic details.
- Section-C includes 15 questions related to knowledge on hand hygiene.
- Section-D includes 15 questions related to practice on hand hygiene.

Participants were asked to select an answer for the multiple choice questions. Score of 1 was given for each correct answer for a knowledge question and 0 for a wrong answer. The score ranged from 0 to 15 with highest score indicating considerable knowledge on hand hygiene. The score ranged 0 to 15 even for practice questions with highest score indicating good practice on Hand hygiene.

## 2.7 Content Validity

The amount to which an element in a measuring technique is relevant and indicative of the construct that will be measured is the content of validity. The developed questionnaire was sent to 6 academicians in the field of public health and the tool was adjusted based on their suggestions and the final tool was prepared.

## 2.8 Pilot Study

After getting approval from the Institutional review board, a pilot study with the sample size of 30 was conducted in online platform, the responses were collected from the participants which were determined to be practicable therefore no changes were made thus the tool was finalized.

## 2.9 Data Analysis

Descriptive statistics for socio-demographic details, Knowledge level on hand hygiene and hand hygiene practices were presented, the data

was retrieved from google forms and interpreted in the Microsoft excel. Chi square test was used to determine the association between the categorical variables by using Graph Pad Prism version 9.0.0.121, Graph Pad Software LLC. Independent t test was used to compare the region differences in knowledge and practice scores on hand hygiene. Backward multiple regression was conducted to identify the most parsimonious combination of region and other extraneous variables in predicting knowledge and practice scores by using IBM SPSS statistics 26 version 26.0.0.0.

## 3. RESULTS

### 3.1 Data Interpretation

A total of 1191 responses were collected by using Google forms, among them the data which was incomplete and inappropriate was excluded, therefore 1178 responses were included for the analysis.

#### 3.1.1 Section 1: Socio demographic characteristics of the respondents

In this section the demographics of the respondents were divided based on their region, age groups, gender, state and UT, house hold, and education level.

#### 3.1.2 Section 2: Knowledge level towards Hand hygiene among the rural and urban population

The knowledge score among rural and urban population is differentiated by using independent T test. From this it was found that urban population have considerably good knowledge than rural population on hand hygiene.

The above table indicates that the urban respondents have better knowledge towards HH than rural respondents. ( $10.07 \pm 2.136$  vs  $9.79 \pm 2.138$ ).

### 3.2 Multiple Regression Analysis

Backward multiple regression was conducted to identify the most parsimonious combination of region (rural, urban), age group (10-30 years, 30-60 years and >60 years), gender (female, male), state and UT (Andhra Pradesh, Karnataka, Tamilnadu, Kerala, Telangana, Andaman and nicobar, Puducherry, Lakshadweep), household (2, 3, 4, >4 members), education level (10 and

below 10, intermediate, UG, PG, Ph. D) in predicting the knowledge score. The assumptions of linearity, data multi co linearity, homoscedasticity and distribution of residuals and the options of influential cases were checked and met, after conducting backward regression, the model that included males, urban, Tamilnadu, 2 members (house hold) was the most parsimonious combination [F (4,1173) =26.139,  $P < .001$  (0.000127), adjusted  $R^2 = 0.016$ ]. The final model suggested that urban had a significant higher knowledge score by 0.279 than rural after adjusting for males, Tamilnadu, 2 members (house hold).

**3.2.1 Section: 3 Practice towards Hand hygiene among the rural and urban population**

From the Independent t-test it was found that urban residents are preferably practicing more hand hygiene practices than rural population.

The table indicates that the urban respondents are practicing Hand hygiene in a better way than rural respondents (10.77±2.280 vs 11.25±1.991).

**Table 1. Socio demographic characteristics of the respondents**

Characteristics	Total (%)	Rural (%)	Urban (%)	p-value
Variables				
Age groups				0.031
10-30	1017 (86.33)	399 (88.27)	618 (85.12)	
31-60	154 (13.07)	48 (10.61)	106 (14.60)	
>60	7 (0.59)	5 (1.106)	2 (0.27)	
Gender				0.115
Female	509 (43.20)	182 (40.26)	327 (45.04)	
Male	669 (56.79)	270 (59.73)	399 (54.95)	
States and UT				<0.0001
Andhra Pradesh	899 (76.31)	386 (85.39)	513 (70.66)	
Karnataka	103 (8.74)	19 (4.20)	84 (11.57)	
Tamilnadu	42 (3.56)	9 (1.99)	33 (4.54)	
Kerala	47 (3.98)	26 (5.75)	21 (2.89)	
Telangana	80 (6.79)	10 (2.21)	70 (9.64)	
Lakshadweep	2 (0.16)	0 (0)	2 (0.27)	
Puducherry	4 (0.33)	1 (0.22)	3 (0.41)	
Andaman and nicobar	1 (0.08)	0 (0)	1 (0.137)	
Household				0.744
2	137 (11.62)	55 (12.16)	82 (4.40)	
3	142 (12.05)	49 (10.84)	93 (12.80)	
4	583 (49.49)	228 (50.44)	355 (48.89)	
>4	316 (26.82)	120 (26.54)	196 (26.99)	
Education level				<0.0001
10 <sup>th</sup> & below 10 <sup>th</sup>	102 (8.65)	63 (13.93)	39 (5.37)	
Intermediate	127 (10.78)	61 (13.49)	66 (9.09)	
UG	665 (56.45)	239 (52.87)	426 (58.67)	
PG	263 (22.32)	85 (18.80)	178 (24.51)	
PhD	21 (1.78)	4 (0.88)	17 (2.34)	

**Table 2. Independent t-test for Hand hygiene knowledge**

Region	N	Mean	Std. deviation	Std. error Mean
Rural	452	9.79	2.138	.101
Urban	726	10.07	2.136	.079

**Table 3. Possible predictors on knowledge towards Hand hygiene using regression analysis (final model)**

Variables entered	Unstandardized coefficients Beta std error		t	Sig.	Adjusted R <sup>2</sup>	F value(df)(sig.)
(Constant)	9.500	.202	47.044	.00	.016	F(4,1173)=26.139, P<.001
Males	.273	.126	2.170	.23		
Urban	.279	.128	2.188	.20		
Tamilnadu	-.612	.335	-1.828	.06		
Household(2)	-.646	.194	-3.323	.001		

*Dependent variable: Total correct in knowledge towards Hand Hygiene*

**Table 4. Independent t-test for Hand hygiene practice**

Region	N	Mean	Std. deviation	Std. error Mean
Rural	452	10.77	2.280	.107
Urban	726	11.25	1.991	.074

**Table 5. Possible predictors on practice towards Hand hygiene using regression analysis (final model)**

Variables entered	Unstandardized coefficients Beta std error		t	Sig.	Adjusted R <sup>2</sup>	F value(df)(sig.)
(Constant)	10.968	.111	98.367	.00	.032	F(5,1172)=37.928, P<.001
Household(2)	-5.75	.191	-3.006	.003		
Urban	.388	.127	3.061	.002		
Household(3)	.339	.189	1.798	.07		
10th & below 10 <sup>th</sup>	-.610	.220	-2.771	.006		
Intermediate	-.607	.198	-3.064	.002		

*Dependent variable: Total correct in practice towards Hand hygiene*

### 3.3 Multiple Regression Analysis

Backward multiple regression was conducted to identify the most parsimonious combination of region (rural, urban), age group (10-30 years, 30-60 years and >60 years), gender (female, male), state and UT (Andhra Pradesh, Karnataka, Tamilnadu, Kerala, Telangana, Andaman and nicobar, Puducherry, Lakshadweep), household (2, 3, 4, >4 members), education level (10 and below 10, intermediate, UG, PG, Ph. D) in predicting the practice score. The assumptions of linearity, data multi co linearity, homoscedasticity and distribution of residuals and the options of influential cases were checked and met, after conducting backward regression, the model that included household(2), urban, household(3), 10 and below 10, intermediate was the most parsimonious combination [F(5,1172)=37.928,  $P<.001$ , adjusted  $R^2 = 0.032$ ]. The final model suggested that urban had a significant higher practice score than rural population.

### 4. DISCUSSION

The majority of the studies on hand hygiene were majorly conducted in Health care workers, Hospital staff, and specific groups, but in our study respondents were not restricted to a single group and focused on the general public of South India regarding their knowledge and practices on Hand hygiene and also a majority of studies concentrated more on handwashing procedures but in the current study we focused on handwashing as well as hand drying techniques.

In this study, the results showed that the urban respondents have good knowledge of hand hygiene than the rural population (Mean 10.07 and 9.79 out of 15 respectively). The knowledge score was relatively low for some items in the questionnaire related to hand washing, hand rubbing, increased bacterial count after using a warm air dryer, and Paper towels have good ability to remove bacteria from hands. From the results of multiple regression, it was shown that there was an association between the demographic variables and the male respondents in a household of 2 members residing in urban regions of Tamilnadu had relatively better knowledge on hand hygiene behavior when compared with other demographic variables in the survey.

The multiple regression results of the present cross-sectional survey showed that male respondents have more knowledge on HH than

females but it was not similar to the previous study performed by Suen et al. [11] in Hong Kong, China 2019 where the female participants have more knowledge than males the reason might be the difference in female respondents in both the studies and also there was a difference in a particular item in the questionnaire i.e., handwashing with soap is high in suen et al. study than current cross sectional survey the reason may be the way of questioning or the participants might have more knowledge regarding handwashing than the respondents in the current survey.

In the questionnaire of the present survey, there were certain items related to Handwashing practices like before and after caring for a sick person, after blowing nose, coughing and sneezing, these particular findings are relatively high in the present survey when compared with the study conducted by Ashwini et al.[12] in Davangere rural population in November 2019. As the present survey was done at the COVID-19 Pandemic where there was a wide range of HH promotional activities through various channels this might be the reason for increased awareness on HH in public.

A study conducted by Water Aid India in 2017 where the rural population from the states of Bihar, Chhattisgarh, Rajasthan, Odisha were interviewed about handwashing practices at critical times [13]. The findings of the study were similar to our survey except for some HH practices like before, during, and after preparing food, which was found to be high in our survey, the reason might be the present survey is web-based and only literates are responded to the questionnaire where the study conducted by water aid India is an interview-based study where illiterates also participated in the study. Likewise, a study performed by Pandve HT et al [14]. study on handwashing practices in the rural community of Pune, India in 2015. The findings of the study are agreed with our study by this it was found to be evident that hand hygiene practices are to be promoted in the rural communities.

S K Ray et al [15]. performed a study on handwashing practices in urban and rural communities in and around Kolkata, West Bengal 2009. The findings of the study were not similar to our study for some practices like before, during, and after preparing food, after using toilets, and also Hand drying practices were low in the S K Ray et al. study where it was found high in the current survey. From this, it was found

that Hand drying practices are also to be promoted in the public.

## 5. CONCLUSION

The study results shown that urban residents have preferably more knowledge than rural residents. Misconceptions related to the concepts that are associated with Hand Hygiene were noted amongst the public. The findings of this study can provide information to region specific health promotion activities. Creative campaigns and awareness programs should be conducted to attain persistent improvement in Hand hygiene practices.

## 6. LIMITATIONS AND RECOMMENDATIONS OF THE STUDY

The current study has some limitations primarily because the language English is used alone to collect the responses, as it is an online survey many of the general population which includes illiterates can't have access to participate in our study. In this study, snowball technique was used and it may not represent entire population and respondents may give biased information as hand hygiene is a socially desirable and morally laden behavior. So, it is recommended to conduct future studies in a logical way where the respondent's knowledge and practices on hand hygiene can be assessed more accurately. A wide range surveys have to be conducted to know the factors that may cause variation in hand hygiene practices among underdeveloped, developing and developed countries.

## CONSENT

Before data collection, informed consent was obtained from the participants.

## ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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