International Journal of Public Health Science (IJPHS)
Vol. 14, No. 2, June 2025, pp. 634~642
ISSN: 2252-8806, DOI: 10.11591/ijphs.v14i2.23836

Knowledge, attitude, and practice among the Indian population regarding COVID-19 using LASI-DAD COVID-19 data

Ala Saritha, Rohit Jangra, Lekha Bhat, Neena Elezebeth Philip
Department of Epidemiology and Public Health, Central University of Tamil Nadu, Thiruvarur, India

Article Info

Article history:

Received Aug 25, 2023
Revised Jul 30, 2024
Accepted Nov 4, 2024

Keywords:

COVID-19
India
Knowledge, attitude, and practice
LASI-DAD
Socioeconomic effects

ABSTRACT

During the COVID-19 pandemic, India was one of the worst-hit countries in terms of the number of cases and deaths. Knowledge, attitude, and practice play an important role in reducing disease transmission. This study uses a nationally represented large data set to understand the knowledge, attitude, and practice (KAP) of COVID-19 among the Indian population. This cross-sectional study utilized Diagnostic Assessment of Dementia for the Longitudinal Aging Study in India (LASI-DAD) COVID-19 data which provides information on respondents' demographics, socioeconomic effects, health status, behavior, perceptions, and attitudes toward COVID-19. Descriptive statistics, correlation, and regression were performed to find the results. Out of 3,797 respondents, 1,929 (50.8%) accounted for males and 1,868 (49.2%) for females; rural respondents were 40.3% and urban were 59.7%. The findings show that the respondent's knowledge about COVID-19 was improved from rounds 1 to 4 and 7, but attitude from round 2 to round 8 and behavior from round 1 to round 9 were poor. In multivariate analysis, males (AOR=1.855; CI=1.129-3.048; p=0.015) and people residing in urban areas (AOR=1.698; CI=1.050-2.745; p=0.031) had a good level of knowledge towards COVID-19 when compared to their females, and rural counterparts. Despite a good level of knowledge about COVID-19 among the Indian population, attitudes and practices towards COVID-19 were poor. There is a need to establish and implement effective policies and interventions to improve people's behavior towards COVID-19 and similar pandemics that the world might encounter in the future.

Corresponding Author:

Neena Elezebeth Philip
Department of Epidemiology and Public Health, Central University of Tamil Nadu
Thiruvarur, Tamil Nadu, India
Email: neenaphilip87@gmail.com

1. INTRODUCTION

COVID-19 has become a significant global public health burden due to increased morbidity and mortality worldwide. The disease affected the communities despite the differences in gender, age, ethnicity, race, nationality, and other factors [1]. Globally, the fear of the disease, lack of proper understanding of the virus, lack of preparedness, and lack of transparency confused citizens regarding the effective practices, treatment, and vaccination, and created socioeconomic disturbances [2], [3]. Particularly in low-and middle-income countries, the challenges posed by COVID-19 were dreadful [3], [4]. According to the World Health Organization, as of July 26, 2023, globally, 768,560,727 cases of COVID-19 and 6,952,522 deaths are reported. Most of the cases were registered in European countries [5]. In response to the emergence of COVID-19 and the increase in the number of cases, a wide range of preventive measures, such as using sanitizer or washing hands with soap, wearing a mask, self-isolation, quarantine, travel restrictions, lockdown, and

vaccination, have been implemented worldwide to mitigate and contain the pandemic [6]. However, despite all these measures, the COVID-19 pandemic has affected all aspects of people's lives, such as psychological well-being, economic stability, and people's behavior, in all socioeconomic groups worldwide [7].

In the Indian context, COVID-19 posed a significant challenge due to the socioeconomic, cultural, and religious values of India differing from Western and European countries, and also weak health systems coupled with a large number of low-income populations [2], [8]. Within a few months of reporting the first case in the country, India became the worst affected country in terms of both the number of cases and deaths. The country's prevention strategies initially included a nationwide lockdown, which was later followed by mass media campaigns, contact tracing through Arogya Sethu App, and mass vaccinations. The policy actions implemented to control the spread of disease, such as social distancing, lockdown, self-isolation, and quarantine, seriously impacted the country's economy [9]. India made significant efforts to develop preventive strategies in which the population's general knowledge, attitude, and practice play an important role in reducing disease transmission. As a country with limited health infrastructure and resources, preventive strategies are crucial for this middle-income country [3], [10].

According to the (WHO) world health organization, a total of 44,995,332 confirmed cases of COVID-19, with 531,915 deaths, were reported from January 2020 to July 2023 in India [5]. One of the main causes for the increase in the incidence of cases was unforeseen havoc created by COVID-19, lack of proper knowledge, limited healthcare facilities, and people's attitude towards the sudden pandemic [2], [3], [6]. Many studies have been reported to evaluate the knowledge, attitude, and practices of the Indian population towards COVID-19. Studies on students, health care workers, and marginalized and impoverished communities in India show that despite the proper knowledge towards COVID-19, there were many misconceptions, and the spread of inaccurate information through social media about the transmission of disease hampering the coping behavior and attitude towards COVID-19 among the population [11]–[13]. Despite all these preventive measures/guidelines given by the WHO and other government agencies, the success or failure of all these measures largely depend upon public behavior [3], [14].

The Longitudinal Aging Study in India (LASI) is the largest national health and retirement study in the world. It provides data on the health, social, and economic aspects of aging in India. It helps to assess the developments and changes in the older adult's life and also provides information on interventions' effects on aging. The LASI DAD COVID-19 module provides detailed information on respondents' demographics, socioeconomic effects, health status, behavior, perceptions, and attitudes toward COVID-19 [15].

This study used data from a large-scale cross-sectional survey on COVID-19 LASI-DAD to provide input to knowledge, attitude, and practice levels among the Indian population. The study also assesses the correlation between knowledge, attitude, and practice during COVID-19. While existing literature offers valuable insights into various aspects of COVID-19 knowledge, attitude, and practice (KAP), our study bridges the gaps by employing nationally representative sample-based data to comprehensively analyze demographic and geographical strata. Thus, to the best of our knowledge, this is the first study that explores the COVID-19 KAP interplay with diverse demographic groups using a nationally representative large-scale data set. The study of knowledge, attitudes, and practices related to COVID-19 remains relevant in addressing future challenges. Furthermore, it will help us to understand the behavioral patterns and preparedness of the population for future outbreaks and contribute to a more adaptive healthcare system to address the long-term consequences of the pandemic.

2. METHOD

2.1. Study design

The cross-sectional study was conducted to assess KAP among the general population of India in May 2020. It was done by conducting nine rounds of baseline interviews during the lockdown period, which included COVID-19-related questions, access to health care, economic impacts, and mental health through phone surveys. It is a secondary data analysis derived from the LASI-DAD study.

2.2. Sample design

According to the LASI-DAD COVID-19 module, households previously identified and surveyed as a part of the larger LASI-DAD study were randomly sampled, 2,704 LASI-DAD households with valid phone numbers were selected, 1,766 households participated in the survey [16]. The survey targeted randomly selected adult males and females from each household through a phone survey. The study population consisted of adults aged 16 years and above who were residing in India. The sample was drawn from all states and union territories of India. A total of 3,797 people between the age of 16-102 years have participated in the phone survey. Of 3,797, 1,929 (50.8%) were males, and 1,868 (49.2%) were females.

2.3. Material and data collection

This study utilized LASI data on COVID-19, which is a secondary data set derived from the LASI-DAD survey, which was collected by the Indian Institute of Population Sciences (IIPS). It utilizes a multi-stage, stratified sampling approach aimed at achieving national representativeness and demographic diversity, conducting nine rounds of interviews over the course of one year. Re-interviews were conducted with the same respondents every two months starting from May 2020 [16].

Throughout several rounds of interviews conducted between May 2020 and April 2021, a variety of questions were asked to gather information related to COVID-19. In round 1 (May 2020), questions were asked relating to knowledge of COVID-19 symptoms, avoidance behavior, migration, food security, access to healthcare, economic impacts, discrimination, mental health, coping behavior, and attitude towards lockdown. Round 2 (July to August) included questions about economic impacts, coping behavior, and discrimination experiences specifically for respondents who were not asked about them in round 1. Round 3 (September to October 2020) included questions about the respondents' risk perception and attitude towards gender. Additionally, respondents were asked questions from the patient health questionnaire (PHQ9) related to their general health. In round 4 (November 2020 to January 2021), new questions were added about vaccinations, social isolation, social contact, dementia, knowledge, migration, discrimination information, word recall, delayed recall, coping behavior, PHQ9, general health, and attitude towards lockdown. Round 5 (January to February 2021) included questions about caregiving, functional health, depression, and anxiety. Round 6 (March to April 2021) included questions about vaccinations (different from Round 4), migration, testing and treatment of coronavirus, and general health and mental health. In round 7, questions about dementia, depression, anxiety, word recall, and delayed recall tasks were repeated from previous rounds (2, 4, and 5). Round 8 included questions about substance abuse, use, and animal naming tasks. Questions relating to functional health and informal caregiving were repeated, and respondents were asked about their risk perception and gender attitude. Finally, in round 9, questions were asked about the second dose of the COVID-19 vaccine, social behavior in the preceding two months, and diagnosis and treatment of COVID-19 at the household level. The vaccination module, risk perception module, depression, and anxiety module were repeated, in addition to the core set of questions asked in every round.

2.4. Data management and permission to use data

The instruments used for data collection are available in LASI-DAD (public domain) in PDF format for public use. The data collected and stored is available in LASI-DAD as a Stata .dta file, facilitating its use for advanced statistical analysis. This combination of accessible instruments and easily downloadable data allows researchers worldwide to conduct in-depth comparative analysis. All the personal identifiers of the samples were removed by IIPS to ensure the confidentiality and privacy of the LASI-DAD survey participants.

2.5. Eligibility criteria

People aged 16 to 102 years old participated in this survey, making it a diverse representation of age groups. Since the COVID-19 module was conducted during the pandemic, interviews were administered via telephone. Therefore, participants who had access to a telephone to complete the survey were included. This method ensured continued data collection while adhering to public health guidelines.

2.6. Variable definition

Dependent variables: knowledge, attitude, and practice are the three outcome variables assessed in this study. Knowledge, attitude, and practice variables are given scores to determine the levels of KAP among participants. Independent variables: demographic variables like age, gender, educational qualification, and area type. were included. The age variable was divided into five categories: 16-30, 31-45, 46-60, 61-75, 76-102 years. Education was categorized as never attended school, less than primary school, primary school, secondary school, higher secondary school, diploma and certificate, graduate degree, post-graduate degree, and professional course/degree.

2.7. Data analysis

Data analysis was performed using appropriate statistical software. The frequencies of the variable's knowledge, attitudes, and practices toward COVID-19 were calculated using descriptive statistics. The bivariate association between sociodemographic characteristics and knowledge, attitudes, and practices toward COVID-19 was calculated by using the Chi-square test and logistic regression.

2.8. Ethical clearance

LASI-DAD COVID-19 data obtained informed consent from the participants prior to the data collection and approved by the Institutional Review Board at the University of Southern California and the All-India Institute of Medical Sciences. There was no need for separate ethical clearance from the institute. The data is available in the public domain.

3. RESULTS

A total of 3,797 respondents participated in the survey. The sample was composed of (1,929) 50.8% males and (1,868) 49.2% females. The age group of the respondents varied from 16 to 102 years; most of the respondents (1,327), 34.9% belonged to the 61-75 age group. Among 3,797, 59.7% (2,268) reside in rural areas, and 40.3 % (1,529) reside in urban areas. Furthermore, 21.8 % of the sample (829) never attended school, and the majority of the respondents, 17.5% (665), attended secondary school (standard 10-11) as shown in Table 1.

Table 1. Socio-demographic profile of the sample

Variable	Frequency (n=3,797)	Percentage (%)
Age (Years)		
16-30	630	16.6
31-45	951	25.0
46-60	549	14.5
61-75	1,327	34.9
76-102	340	9.0
Gender		
Male	1,929	50.8
Female	1,868	49.2
Area type		
Rural	2,268	59.7
Urban	1,529	40.3
Educational qualification		
Never attended school	829	21.8
Less than primary school (standard 1-4)	340	9.0
Primary school (standard 5-7)	509	13.4
Middle school (standard 8-9)	427	11.2
Secondary school (standard 10-11)	665	17.5
Higher Secondary (standard 12)	368	9.7
Diploma and Certificate	20	0.5
Graduate degree (BA, BS)	496	13.1
Post-graduate degree (MA, MS, PhD)	130	3.4
Professional course/Degree (MBBS, MD, MBA)	13	0.3
Total	3,797	100.0

3.1. Knowledge, attitude, and practices toward COVID-19

The findings of the study indicate that the respondent's knowledge about COVID-19 significantly improved from rounds 1 to 4 and 7. Most are aware of the symptoms of COVID-19, such as fever (89.4%) and cough (84.8%). Moreover, most of the participants practiced preventive and protective behavior during the COVID-19, such as wearing facemasks (89.5%), washing hands (97.5%), and staying at home (80.5%) in the past seven days of the interview. During the interview, people may have gained knowledge about COVID-19 via different platforms and are cautious about reducing the risk of getting COVID-19 by following preventive and control measures.

The findings show that attitudes towards COVID-19 were reduced from round 2 to round 8. Even though most respondents know what to do if they get COVID-19 symptoms, only a few mentioned consulting a doctor, taking medications, or staying at home. The scoring was given to knowledge, attitude, and practice variables to determine the levels of KAP among participants by assigning numerical scores to the labels (1-Yes, 2-No) and summing up the scores assigned to each participant's responses across the KAP. Furthermore, we categorized it into good and bad by taking the mean value as a cutoff. The mean knowledge, attitude, and practice scores for participants were 5.6929 (range 2-14), 5.9685 (range 2-11), and 3.5215 (range 2-9) respectively.

After removing any missing data from the knowledge, practice, and attitude variables, we discovered two types of data sets with varying respondent numbers. We then conducted cross-tab and Chi-square tests to determine the association between these variables and also to test their significance. The age groups of the respondents 76-90 years and 91-102 years were combined to 76-102 years, and educational level was recoded into five categories as mentioned in the table because there are fewer respondents in some groups/categories.

Table 2 shows the bivariate analysis of factors associated with knowledge and practice among a sample size of 2,507 individuals, reveals significant associations across several variables. Gender demonstrates a notable disparity in practice, with 92.7% of males and 96.5% of females exhibiting poor practice, whereas 7.3% of males and 3.5% of females display good practice, indicating a statistically significant difference ($p<0.001$). Age, however, does not show a significant correlation with either knowledge ($p=0.229$) or practice ($p=0.357$). The type of living area is significantly associated with both knowledge and practice; 89.5% in rural areas have poor knowledge compared to 83.9% in urban areas, while good knowledge is exhibited by 10.5% in rural and 16.1% in urban areas ($p<0.001$). This trend is also observed in practice, where 93.4% in rural areas demonstrate poor practice, in contrast to 96.0% in urban areas, and stark contrast in good practice with only 6% in rural areas versus 4% in urban areas ($p=0.004$). The educational level shows a significant correlation

with knowledge, with the highest percentage of poor knowledge among those who never attended school at 93.1%, and progressively better knowledge up to post-graduate/professional degree holders (27.9%) (p<0.001), though this does not significantly correlate with practice. These findings underscore the importance of gender, type of living area, and educational level as determinants of knowledge and practice in the studied population.

Table 2. Bivariate analysis of factors associated with knowledge/practice

Variables (n=2,507)		Knowledge		p-value	Practice		p-value
		Poor	Good		Poor	Good	
Gender	Male	1,134 (86.0%)	185 (14.0%)	0.062	1,223 (92.7%)	96 (7.3%)	<0.001*
	Female	1,051 (88.5%)	137 (11.5%)		1,146 (96.5%)	42 (3.5%)	
Age	16-30	357 (86.4%)	56 (13.6%)		392 (94.9%)	21 (5.1%)	
	31-45	577 (85.1%)	101 (14.9%)	0.229	649 (95.7%)	29 (4.3%)	0.357
	46-60	337 (86.9%)	51 (13.1%)		363 (93.6%)	25 (6.4%)	
	61-75	748 (88.8%)	94 (11.2%)		793 (94.2%)	49 (5.8%)	
	76-102	166 (89.2%)	20 (10.8%)		172 (92.5%)	14 (7.5%)	
Type of living area	Rural	1,296 (89.5%)	152 (10.5%)		1,352 (93.4%)	96 (6.6%)	
	Urban	889 (83.9%)	170 (16.1%)	<0.001*	1,017 (96.0%)	42 (4.0%)	0.004*
Educational level	Never attended school	404 (93.1%)	30 (6.9%)		414 (95.4%)	20 (4.6%)	
	Primary school (1-9)	743 (89.7%)	85 (10.3%)		781 (94.3%)	47 (5.7%)	
	Secondary school (10-12)	625 (83.3%)	125 (16.7%)	<0.001*	710 (94.7%)	40 (5.3%)	0.806
	Graduate/Diploma degrees	338 (86.4%)	53 (13.6%)		368 (94.1%)	23 (5.9%)	
	Postgraduate/professional degrees	75 (72.1%)	29 (27.9%)		96 (92.3%)	8 (7.7%)	

*Significance at p<0.05

Table 3 shows the bivariate analysis of factors associated with attitude in round 2 among a sample size of 721 individuals, revealing that there are no significant associations between attitude (poor or good) and gender (p=0.898), age group (p=0.762) or type of living area (rural or urban) (p=0.966). For gender, 93.6% of males and 93.4% of females exhibited a poor attitude. Across age groups, those aged 31-45 years had the highest proportion with a poor attitude (95.1%), followed by 46-60 years (93.6%), 61-102 years (93.2%), and 16-30 years (91.2%). The urban area had a slightly lower percentage with a poor attitude (93.4%) than the rural area (93.5%). However, educational level showed a significant association with attitude (p=0.045). Of those who never attended school 88.8% had a poor attitude. In contrast, primary school (1-9), secondary school (10-12), and graduate/diploma degrees had 95.4%, 95.2%, and 90.6% with a poor attitude, respectively, suggesting a potential trend of higher education being linked to a more positive attitude.

After excluding missing values, a multivariate logistic regression was performed to identify the factors associated with knowledge, attitude, and practice toward COVID-19 in 721 samples. The results of the logistic regression show in Table 4 a statistically significant association between factors associated with knowledge of COVID-19. After controlling covariates in the model, males (AOR=1.855; CI=1.129-3.048; p=0.015) had a good level of knowledge of COVID-19 when compared to their females, and urban residents (AOR=1.698; CI=1.050-2.745; p=0.031) when compared to the rural areas. On the other hand, there was no association between age and educational level with knowledge of COVID-19. However, logistic regression results between age, gender, type of living area, and educational level with attitude toward COVID-19 showed no significant association between the variables. Multivariate analysis of factors associated with practice towards COVID-19 revealed that the type of living area-urban (AOR=0.304, CI=0.139-0.664, p=0.003) has a significant association with practice towards COVID-19. Age, gender, and educational level with practice towards COVID-19 had no significant association. Spearman's rank-order correlation was used to determine the relationship between knowledge, attitude, and practice scores. There was a very weak positive correlation between knowledge and practice scores, which was statistically significant (r_s=0.106, p=0.004), as shown in Table 5.

Table 3. Bivariate analysis of factors associated with attitude

Variables (n=721)	Poor N=674 (100%)	Good N=47 (100%)	p-value	Variables (n=721)	Poor N=674 (100%)	Good N=47 (100%)	p-value
Gender				Type of living area			
Male	365 (93.6%)	25 (6.4%)	0.898	Rural	332 (93.5%)	23 (6.5%)	
Female	309 (93.4%)	22 (6.6%)		Urban	342 (93.4%)	24 (6.6%)	0.966
Age				Educational level			
16-30	104 (91.2%)	10 (8.8%)		Never attended school	79 (88.8%)	10 (11.2%)	
31-45	176 (95.1%)	9 (4.9%)		Primary school (1-9)	230 (95.4%)	11 (4.6%)	
46-60	103 (93.6%)	7 (6.4%)	0.762	Secondary school (10-12)	220 (95.2%)	11 (4.8%)	0.045*
61-102	291 (93.2%)	21 (6.7%)		Graduate/Diploma degrees	145 (90.6%)	15 (9.4%)	

*Significance at p<0.05

Table 4. Multivariate analysis of factors associated with knowledge, attitude, and practice

Variables	Knowledge			Attitude			Practice		
	AOR	95% CI	p-value	AOR	95% CI	p-value	AOR	95% CI	p-value
Age	0.996	0.982-1.010	-	1.001	0.983-1.019	-	1.012	0.991-1.034	-
Gender									
Female	ref	ref	-	ref	ref	-	ref	ref	-
Male	1.855	1.129-3.048	0.015*	0.977	0.532-1.795		1.315	0.640-2.701	
Type of living area									
Rural	ref	ref	-	ref	ref	-	ref	ref	-
Urban	1.698	1.050-2.745	0.031*	1.040	0.571-1.895		0.304	0.139-0.664	0.003*
Educational level									
Never attended school	ref	ref	-	ref	ref	-	ref	ref	
Primary school (1-9)	0.750	0.326-1.726	-	0.378	0.153-0.932	0.035*	0.649	0.203-2.071	-
Secondary (10-12)	1.166	0.519-2.618		0.397	0.158-0.996	0.049	1.047	0.339-3.238	
Graduate/Post graduate/Professional/Diploma degrees	1.014	0.420-2.448		0.825	0.329-2.067		1.712	0.524-5.591	

*Significance=p<0.05

Table 5. Spearman's correlation between knowledge score, attitude score, and practice score

N=721			Knowledge score	Attitude score	Practice score
Spearman' rho	Knowledge score	Correlation coefficient	1.000	0.046	0.106**
		p-value	-	0.214	0.004
	Attitude score	Correlation coefficient	0.046	1.000	0.041
		p-value	0.214	-	0.275
	Practice score	Correlation coefficient	0.106**	0.041	1.000
		p-value	0.004	0.275	-

**Correlation is significant at the 0.01 level (2-tailed)

4. DISCUSSION

The study found that half of the respondents (50.8%) were male, and a majority of them (59.7%) were living in rural areas, while only 40.3% were from urban areas. The largest age group of the participants fell between 61-75 years (34.9%). The study revealed that the respondents had good knowledge about COVID-19, with most being aware of the symptoms, such as fever and cough. Additionally, a majority of the participants practiced preventive behaviors like wearing facemasks, washing hands, and staying at home during the seven days prior to the interview. Although most respondents knew what to do if they experienced COVID-19 symptoms, only a few mentioned they would consult a doctor, take medication, or stay at home. Although the majority of the participants had over 80% knowledge, their attitude and behavior decreased gradually. The study found a significant association between the knowledge of gender and the area type of the respondents. Moreover, there was a significant association between practice and the type of living area of the respondents and a significant association between knowledge and attitude toward COVID-19 with educational level. The study also showed a weak positive correlation between knowledge and practice toward COVID-19.

This study's univariate analysis shows that respondents with good knowledge reported good attitudes and practices toward COVID-19, this may be attributed to an increase in awareness of COVID-19 among the respondents. Our findings align with the existing literature which shows a good level of knowledge, good attitude, and appropriate practice toward COVID-19 [17]–[21]. The study done in Palestine [20] shows that higher awareness of COVID-19 disease was significantly associated with a lower probability of having negative attitudes about the handling of the pandemic by the government and practicing potentially harmful behaviors. A review [22] also showed a positive trend in the population's knowledge, attitude, and practices towards COVID-19 two months after the onset of the pandemic. The positive impact on KAP was seen after the government and health stakeholders implemented preventive measures.

The study results showed that people from the age group 61-75 years were found to be more aware of the disease compared to other age groups, as supported by other studies [23]–[25] and males demonstrated more awareness towards COVID-19 than females, unlike other studies [23], [26], [27]. The study indicates a significant difference between the knowledge levels of males and females. However, this is contradicted by another study [28]. According to some studies [8], [14], [20], [29] awareness about the disease was high among females and older adults because older age groups are vulnerable to the risk of getting the disease with less immunity and females are anxious about disease transmission and most of the women stayed at home. The study results show a positive association between the practice of the respondents toward COVID-19 with

people residing in urban areas, as supported by some studies [13], [18], [30] that practice scores are positively associated with people residing in cities compared to the people residing in villages.

The study concludes that knowledge about COVID-19 does not necessarily induce preventive and protective practices among respondents, even though knowledge is the foundation of behavior. As mentioned in the study [24], the key which induces behavior is the individual's actions. So, it is essential for people to change their attitude to reduce disease transmission by following preventive behaviors against COVID-19. It is also essential for the government and relevant authorities to take quick action to provide awareness and knowledge to the people on how to behave appropriately during the pandemic. Finally, the study findings may be helpful in informing policymakers and healthcare professionals on the interventions, health education, awareness programs, policies, and propaganda that influence people to change their behavior and enhance their willingness to take preventive actions in the future.

The LASI-DAD COVID-19 module data set has many missing values due to a lack of complete information. Despite these limitations, best efforts have been made to reduce the potential biases during the analysis of the variables. Furthermore, the absence of similar previous studies on the data set made it difficult to compare our findings but this study provides a unique opportunity to establish baseline data for future research on the impact of COVID-19 on aging populations. Future studies could address these gaps and provide comparative insights.

5. CONCLUSION

The study findings show that despite a good level of knowledge about COVID-19 among the Indian population, attitudes, and practices towards COVID-19 were poor. There is a significant difference between the knowledge and practice with the type of living area (urban) and between attitude and the educational qualification of the participants. The attitude and practice were becoming poor gradually from round 1 to round 9. Thus, there was a significant gap in the attitude and practices towards COVID-19. Therefore, the study suggests strengthening health education, awareness, policies, programs, and interventions by the government to influence the behavior of individuals positively. There is a need for improvement in individuals' actions and community participation to improve the behavior of the whole population. Furthermore, there is a need to implement mass education and awareness programs to influence people to practice preventive measures.

From the findings, it is evident that female, rural people, and those with low education were at a disadvantage regarding KAP of COVID. Another striking finding is that the knowledge gained did not automatically lead to a better attitude and practice in preventing the disease. WHO and scholars predict further zoonosis and similar pandemics in the future. It is challenging to forecast the next pandemic pathogen threat; however, making realistic assumptions, assessing prior efforts, and planning strategies to respond to disease outbreaks and pandemics may help the health system combat future pandemics in a more time-cost efficient manner. Finally, this study recommends that the government and public health organizations should establish and implement effective policies and programs like mass media awareness and education that are accurate, accessible, and relevant, that do not overlook people in emergencies, and improve people's knowledge, positive attitude, and practices towards COVID-19. Besides, limited studies were found to compare the findings; further research may be necessary to explain the research problem.

In this context, the interplay of psychological factors and social networks should be carefully considered when designing mass media campaigns to promote positive knowledge, attitudes, and practices (KAP). In South Asian countries, cultural beliefs and myths significantly shape community behavior towards disease. Therefore, interventions must target entire social networks within communities, rather than individuals. Government efforts should not only focus on knowledge-building but also empower citizens to take preventive actions and report cases without fear or stigma. A long-term, community-based approach will foster widespread behavior change, particularly in rural populations, through continuous training and awareness campaigns integrated into daily life. This can help build a shared culture of health, enabling future generations to better combat pathogens and communicable diseases.

REFERENCES

[1] A. A. Gebru *et al.*, "Global burden of COVID-19: Situational analyis and review," *Human Antibodies*, vol. 29, no. 2, pp. 139–148, 2021, doi: 10.3233/HAB-200420.

[2] R. Keni, A. Alexander, P. G. Nayak, J. Mudgal, and K. Nandakumar, "COVID-19: emergence, spread, possible treatments, and global burden," *Front Public Health*, vol. 8, 2020, [Online]. Available: https://www.frontiersin.org/articles/10.3389/fpubh.2020.00216.

[3] K. Murali *et al.*, "Knowledge, attitude, and practices related to COVID-19 among poor and marginalized communities in central India: A cross-sectional study," *PLoS One*, vol. 17, no. 4, p. e0264639, Apr. 2022, doi: 10.1371/journal.pone.0264639.

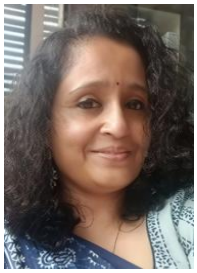
[4] M. Elhadi *et al.*, "Knowledge, attitude, and acceptance of healthcare workers and the public regarding the COVID-19 vaccine: a cross-sectional study," *BMC Public Health*, vol. 21, no. 1, p. 955, Dec. 2021, doi: 10.1186/s12889-021-10987-3.

[5] WHO, "COVID-19 cases | WHO COVID-19 dashboard." Accessed: Sep. 28, 2024. [Online]. Available: https://data.who.int/dashboards/covid19/cases
[6] M. Yıldırım and A. Güler, "COVID-19 severity, self-efficacy, knowledge, preventive behaviors, and mental health in Turkey," *Death Studies*, vol. 46, no. 4, pp. 979–986, 2022, doi: 10.1080/07481187.2020.1793434.
[7] M. H. Temsah *et al.*, "Knowledge, attitudes and practices of healthcare workers during the early COVID-19 pandemic in a main, academic tertiary care centre in Saudi Arabia," *Epidemiology Infection*, vol. 148, p. e203, 2020, doi: 10.1017/S0950268820001958.
[8] M. S. Fawzy and S. A. AlSadrah, "COVID-19 and Saudi Arabia: awareness, attitude, and practice," *Journal Multidisciplinary Healthcare*, vol. 15, pp. 1595–1618, 2022, doi: 10.2147/JMDH.S373007.
[9] A. Joshi, A. H. Mewani, S. Arora, and A. Grover, "India's COVID-19 Burdens, 2020," *Fronties Public Health*, vol. 9, 2021, doi: 10.3389/fpubh.2021.608810.
[10] B. S. Tomar *et al.*, "Indian community's knowledge, attitude & practice towards COVID-19," *Public and Global Health*, 2020, doi: 10.1101/2020.05.05.20092122
[11] A. V. Kartheek, Kh. Gara, and D. Vanamali, "Knowledge, attitude and practices towards COVID-19 among Indian residents during the pandemic: A cross-sectional online survey," *Journal of Dr. NTR University of Health Sciences*, vol. 9, no. 2, p. 107, 2020, doi: 10.4103/JDRNTRUHS.JDRNTRUHS_75_20.
[12] T. K. Suvvari, L. V. S. Kutikuppala, and A. N. S. Kiran, "Knowledge, Attitude, and Practices toward the COVID-19 Pandemic among the Indian General Population: A Cross-Sectional Survey," *Indian Journal of Respiratory Care*, vol. 10, no. 1, pp. 88–92, Jan. 2021, doi: 10.4103/ijrc.ijrc_73_20.
[13] P. K. Singh, A. Anvikar, and A. Sinha, "COVID-19 related knowledge, attitudes, and practices in Indian Population: An online national cross-sectional survey," *PLoS One*, vol. 17, no. 3, p. e0264752, Mar. 2022, doi: 10.1371/journal.pone.0264752.
[14] M. K. Al-Hanawi *et al.*, "Knowledge, attitude and practice toward COVID-19 among the public in the Kingdom of Saudi Arabia: a cross-sectional study," *Front Public Health*, vol. 8, May 2020, doi: 10.3389/fpubh.2020.00217.
[15] D. E. Bloom, T. V Sekher, and J. Lee, "Longitudinal Aging Study in India (LASI): new data resources for addressing aging in India," *Nature Aging*, vol. 1, no. 12, pp. 1070–1072, 2021, doi: 10.1038/s43587-021-00155-y.
[16] J. Banerjee *et al.*, "Cohort Profile: real-time insights of COVID-19 in India (RTI COVID-India)," *BMC Public Health*, vol. 23, no. 1, p. 292, 2023, doi: 10.1186/s12889-023-15084-1.
[17] B. G. Yazew, H. K. Abate, and C. K. Mekonnen, "Knowledge, attitude and practice towards COVID-19 in Ethiopia: A systematic review; 2020," *Patient Prefer Adherence*, vol. Volume 15, pp. 337–348, Feb. 2021, doi: 10.2147/PPA.S288186.
[18] A. S. Bazaid, A. Aldarhami, N. K. Binsaleh, S. Sherwani, and O. W. Althomali, "Knowledge and practice of personal protective measures during the COVID-19 pandemic: A cross-sectional study in Saudi Arabia," *PLoS One*, vol. 15, no. 12, p. e0243695, Dec. 2020, doi: 10.1371/journal.pone.0243695.
[19] S. Rugarabamu, M. Ibrahim, Ai. Byanaku, H. Ngasongwa, "Knowledge, attitudes, and practices (KAP) towards COVID-19: an online cross-sectional survey of Tanzanian Residents," *Journal of Community Medicine and Public Health Reports*, Jun. 2022, doi: 10.38207/JCMPHR/2022/JUN03040247.
[20] N. Qutob and F. Awartani, "Knowledge, attitudes and practices (KAP) towards COVID-19 among Palestinians during the COVID-19 outbreak: A cross-sectional survey," *PLoS One*, vol. 16, no. 1, p. e0244925, Jan. 2021, doi: 10.1371/journal.pone.0244925.
[21] T. Yangzom, T. Cheki, N. Koirala, and D. Rai, "Knowledge, attitude and practices towards COVID-19 preventive measures among adults in Bhutan: a cross-sectional study," *PLoS One*, vol. 17, no. 12, p. e0278535, Dec. 2022, doi: 10.1371/journal.pone.0278535.
[22] U. I. Nwagbara *et al.*, "Knowledge, attitude, perception, and preventative practices towards COVID-19 in sub-Saharan Africa: a scoping review," *PLoS One*, vol. 16, no. 4, p. e0249853, Apr. 2021, doi: 10.1371/journal.pone.0249853.
[23] S. Paudel, P. Shrestha, I. Karmacharya, and O. Krishna Pathak, "Knowledge, attitude, and practices (KAP) towards COVID-19 among Nepalese residents during the COVID-19 outbreak: an online cross-sectional study," Jun. 2020, PREPRINT available at *Res Sq*, doi: 10.21203/rs.3.rs-31044/v1.
[24] Y.-F. Luo, L.-C. Chen, S.-C. Yang, and S. Hong, "Knowledge, attitude, and practice (KAP) toward COVID-19 pandemic among the public in Taiwan: a cross-sectional study," *International Journal Environmental Resarch Public Health*, vol. 19, no. 5, p. 2784, Feb. 2022, doi: 10.3390/ijerph19052784.
[25] M. Kiros, S. B. Gebru, and B. Tewelde, "Knowledge, attitude, practice and associated factors towards COVID-19 and its prevention measures among residents of Mekelle City, Tigray Region, Northern Ethiopia: a community-based cross-sectional study," *Journal Public Health (Bangkok)*, Jan. 2023, doi: 10.1007/s10389-023-01826-3.
[26] Y. Sarria-Guzmán, C. Fusaro, J. E. Bernal, C. Mosso-González, F. E. González-Jiménez, and N. Serrano-Silva, "Knowledge, attitude and practices (KAP) towards COVID-19 pandemic in America: A preliminary systematic review," *The Journal of Infection in Developing Countries*, vol. 15, no. 01, pp. 9–21, Jan. 2021, doi: 10.3855/jidc.14388.
[27] M. Muslih, H. D. Susanti, Y. A. Rias, and M.-H. Chung, "Knowledge, attitude, and practice of Indonesian Residents toward COVID-19: a cross-sectional survey," *International Journal Environmental Resarch Public Health*, vol. 18, no. 9, p. 4473, Apr. 2021.
[28] R. Venkataraman, U. Yadav, Y. Shrestha, S. Narayanaswamy, and S. H. P. Basavaraju, "Knowledge and attitudes toward the COVID-19 vaccine among India's general rural population," *Vacunas*, vol. 24, no. 2, pp. 128–134, Apr. 2023, doi: 10.1016/j.vacun.2022.11.002.
[29] L. Ning *et al.*, "The impacts of knowledge, risk perception, emotion and information on citizens' protective behaviors during the outbreak of COVID-19: a cross-sectional study in China," *BMC Public Health*, vol. 20, no. 1, p. 1751, Dec. 2020.
[30] S. Getawa, M. Aynalem, B. Bayleyegn, and T. Adane, "Knowledge, attitude and practice towards COVID-19 among secondary school students in Gondar town, Northwest Ethiopia," *PLoS One*, vol. 17, no. 5, p. e0268084, May 2022, doi: 10.1371/journal.pone.0268084.

BIOGRAPHIES OF AUTHORS

Ala Saritha is an Epidemiology/Public Health Student from the Department of Epidemiology and Public Health, Central University of Tamil Nadu, Thiruvarur, Tamil Nadu, India. Her research interests lie in infectious diseases and Randomized control trials. She can be contacted at email: alasaritha22@gmail.com.

Rohit Jangra is a Junior research Fellow at the Postgraduate Institute of Medical Education and Research, Chandigarh, India. His research interest lies in health economics and econometrics, evidence synthesis, and geospatial epidemiology. He can be contacted at email: rohit2000jangrarj@gmail.com.



Lekha Bhat is an Assistant professor at the Department of Epidemiology and Public Health, Central University of Tamil Nadu, Thiruvarur, Tamil Nadu, India. Her research interest areas are informal sector and health, adolescent health, social epidemiological approach in public health, and qualitative methods. She can be contacted at email: lekhabhatd@gmail.com.

Neena Elezebeth Philip is an Assistant professor at the Department of Epidemiology and Public Health, Central University of Tamil Nadu, Thiruvarur, Tamil Nadu, India. Her research interests lie in gender and intersectionality in health, healthcare economics, health systems, and health policy. She can be contacted at email: neenaphilip87@gmail.com.