Zoonotic diseases and the plight of public health awareness: a study on human perception

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Abstract
Zoonotic diseases are one of the primary public health concerns. Both developing and developed nations have experienced the resurgence of infectious diseases with zoonotic potential, leading to significant economic and human losses. This raises the question of how well the public is informed about zoonotic illnesses in the state, where several outbreaks have occurred in recent years. This study attempts to understand the awareness level of individuals in Wayanad district, Kerala, and their relation with gender and education. A cross-sectional study was conducted among 122 individuals belonging to different sectors and ages selected using power analysis and a well-structured questionnaire was propagated among individuals. The collected data were analyzed using simple mathematical percentages and hypothesis testing using the Chi-square test. According to the research, the majority of the people are uninformed of zoonotic illnesses, particularly Kyasanur Forest Disease, Japanese Encephalitis, West Nile Fever, Rabies, Avian Influenza, and Swine Influenza, which have the lowest awareness. The news media, which comprises print, television, and the internet, is the main information source for most people about these illnesses. Similarly, the study found a significant association between overall awareness and educational level. The study put forward the existence of low awareness regarding many zoonoses in the study area. It advises that the government should be more involved in raising public awareness by collaborating with veterinarians and healthcare professionals.

Introduction
Zoonoses are one of the major public health concerns throughout the world (1). Zoonoses, or zoonotic diseases, are those diseases that can be naturally spread from animals to human beings or vice versa" (2, 3). Such diseases are of major concern because of the wide interaction between humans and animals and the pathogens that cause them, such as viruses, vectors, and bacteria (4). Meticulously examining the present situation of these diseases, it is stated that six out of the ten known infectious diseases affected in mortals are caused by animals; similarly, three of the four emerging infectious diseases are also caused by

animals (5). More than 60% of newly identified infectious agents that have affected individuals are caused by pathogens that originated from animals or animal products, of which 70% originated from wildlife (4, 6), indicating that zoonoses are solely responsible for 2.5 billion cases of illness and 2.7 billion deaths in the world (7). Furthermore, examining the incidence of these diseases, it can be inferred that these diseases are common in both developed and developing countries. Still, the situation of such an intense disease might be severe for developing countries due to the socio-economic conditions, political environment, and lack of epidemiological studies on these diseases (8).

Emphasizing the economic impact these diseases cause, shreds of evidence from different countries provide that zoonotic diseases cause a considerable impact on the economy (9-15). In the case of India, it could be understood that different zoonotic diseases are prevalent in the country. Over the past, the country has recorded an economic loss of Rs. 2400 lakhs due to brucellosis; death accounts for 120 lakh individuals due to the plague, 20 thousand individuals due to rabies, and considerable losses due to other zoonotic diseases (16). As elucidated above, this widespread phenomenon is due to the wide interaction between animals and humans daily, either as a source of revenue or otherwise, the abundance of vectors to transmit, and the large population, which creates a higher incidence of diseases.

Hence, in order to minimize the occurrence of these diseases and mitigate the associated losses, it is essential to first assess the level of awareness individuals have about these types of diseases (17-19). Hence, this study focuses on the awareness level among individuals other than farmers in Wayanad District, Kerala, where the state in the last few years has indicated a wide spread of zoonotic diseases such as Nipah virus in 2018, Kyasanur Forest Disease (KFD), avian flu, and other diseases.

Materials and methods

Study Type

A cross-sectional study was conducted in the district of Wayanad, Kerala, among different sections of individuals belonging to different socio-economic statuses.

Participants

The inclusion criteria of the study included adults (18 years of age and older) who have a smartphone and are permanent residents (living in the area for more than five years), were considered for the study, and provided informed consent to participate in the research. Participants from the healthcare sector, like doctors, nurses, and healthcare volunteers (ASHA workers), were excluded from the study.

Sampling

Power analysis was carried out to determine the sample size for a chi-square test from the total population of Wayanad district (20) using G*Power software (21, 22). With a medium effect size, 80% power (23), and an alpha value of 0.05, a sample of 122 individuals (Fig. 1) was chosen to draw a scientific conclusion from the study area. The entire study area was divided into three clusters (municipalities) based on the geographical area. Upon receiving consent from the participants who use smartphones, the questionnaire was distributed to them, and the distribution of participants is as follows: Sulthan Bathery (n = 52), Kalpetta (n = 46), and Mananthavady (n = 24).

Study Instrument

A well-structured questionnaire was formed to conduct the primary survey and circulated using Google Forms. The questionnaire was developed to understand the knowledge of individuals about ten zoonotic diseases [*Chikungunya, Kyasanur Forest Disease (KFD), Japanese Encephalitis (JE), West Nile Fever (WNF), Dengue, Rabies, Nipah, Coronavirus Disease, Avian and Swine Influenza*] that have been recorded in the study area (24-34) over the past decade. The questionnaire contains 49 questions. This includes five open-ended questions relating to general information about the participants, six yes/no questions on the nature of diseases, six single-select multiple-choice questions

relating to viruses causing the diseases, one yes/no question followed by a single-select question on the source of information received, and 30 multiple-choice questions on the mode of transmission and symptoms of diseases to check the awareness levels that were given to the individuals in both English and Malayalam (Regional Language).

Methodology

There are different methods to analyze health literacy (35), but there is no absolute concrete method to analyze the level of awareness; hence, the data collected through the primary survey was evaluated with a percentage, and scoring was given to each question, and that was used to understand the awareness about the diseases. Each correct answer was given with one mark and zero for wrong. The total possible score of awareness for each disease is as follows: Chikungunya, JE, WNF, dengue with nine scores each, KFD with ten scores, rabies with 11 scores, followed by Nipah, Coronavirus Disease, avian, and swine influenza with 12 scores each. Based on the total possible score, the overall awareness percentage was obtained by dividing the mark obtained by the respondent by the total possible score and multiplying by 100 (36). Hence, the percentages obtained were divided into four groups by the researcher: *very low awareness* (0 - 39.9%), *low awareness* (40 – 59.9%), *moderate awareness* (60 – 79.9 %) and *high awareness* (80% and more). Furthermore, hypothesis testing was conducted to understand whether there is any relation between the awareness level, gender, and education level of individuals using SPSS, version 26.

Results

The study reveals that out of the total sample size, 55% were female and the remaining 45% were male. The mean age of the participants was 39.72 ± 8.816 years, with a minimum age of 22 years and a maximum age of 55 years. Similarly, most of the respondents have a bachelor's degree (50%) followed by post-graduate education (24%), higher secondary education (15%), and remaining divided

into secondary education (7%), primary (3%) and doctoral degree (1%).

When looking at diseases separately, it is noticeable that 34% have a low degree of awareness, 27% have a moderate awareness, and 20% have very low awareness. The remaining 19% have a high level of awareness in the case of chikungunya, with a mean score of 5.02 ± 2.57. Likewise, in the case of dengue, 36% of people have a low degree of consciousness, followed by 27% with very low awareness, 23% with a moderate level of awareness, and 14% with high awareness, with a mean score of 4.43 ± 2.59. When it comes to Japanese Encephalitis (JE), 70% of people have very low awareness, followed by 15% with a low consciousness, 8% with a moderate level of awareness, and 7% with a high level of awareness, with a mean score of 2.80 ± 2.39. In the case of West Nile Fever (WNF), we can observe that the majority of people (71%) have extremely low awareness levels, followed by 12% with low awareness, 9% with moderate awareness, and 8% with a high degree of awareness, with a mean score of 2.62 ± 2.45.

In the context of Kyasanur Forest Disease, 53% of people have very low awareness, followed by 25% with low consciousness, 15% with a moderate level of knowledge, and 7% with high awareness, with a mean score of 3.30 ± 2.51. When it comes to rabies awareness, 43% have a very low degree of awareness, followed by 32% with low awareness, 13% with high awareness, and 12% with moderate awareness, with a mean score of 4.84 ± 2.98. When it comes to Nipah virus awareness, 28% have low awareness, followed by 27% having high awareness, 23% having moderate knowledge, and 22% have a very low awareness, with a mean score of 7.12 ± 3.32. Examining COVID awareness, the survey found that 32% of people have a very low degree of awareness, 30% have low awareness, 23% have a moderate level of awareness, and 15% have high awareness, with a mean score of 6.23 ± 2.80.

When it comes to influenza, we can observe that 72% of people have a very poor degree of awareness of avian influenza. Following that, 16% have a low degree of consciousness, 8% have a high level of awareness, and 4% have moderate knowledge with a mean score of 3.30 ± 3.37. In the context of swine flu, 71% have a very low degree of awareness, followed by 15% with a low consciousness and 7% have both a high and moderate level of knowledge with a mean score of 3.62 ± 3.20. The overall awareness score of

respondents is 43.28 ± 22.04 regarding zoonotic diseases.

It is clearly understood from Table 1 that 51.6% of people received information regarding diseases from news media like print, broadcast media, and the internet, while 20.5% received information from government advertisements in the public interest, and 19.7% from books, journal articles. Interestingly, in the sample, only 8.2% gathered information from health workers.

Table 1. Represents the Source of information for receiving information.

Source	No. of Individuals	Age (%)
Advertisements given on public interest by the government	25	20.5 %
Books, Journals, Articles, etc	24	19.7 %
From Health Workers	10	8.2%
News Media like Print, Broadcast media, and the Internet	63	51.6 %

Source: Data collected and complied by the researcher.

Table 2. Represents the overall awareness concerning gender.

		High Awareness	Moderate Awareness	Low Awareness	Very low Awareness	Total
Gender	Female	4	3	20	26	53
	Male	5	5	26	33	69
Total		9	8	46	59	122

Source: Data Collected and Complied by the researcher.

Table 3. Represents the Chi-square test result for gender and overall awareness regarding zoonotic disease.

	Value	df	Asymptotic Significance (two-sided)
Chi-square	0.128	3	0.988
Likelihood Ratio	0.130	3	0.988

Source: Data Collected, Complied and Analyzed using SPSS

Examining the relationship between gender and overall awareness, it could see that the sample violated the assumption of a 20% value less than 5, hence the likelihood ratio was used to derive the p-value, which reveals that the calculated p-value (0.988) is greater than the significance level (α-value) of 0.05 (Tables 2 and 3). Hence, we failed to reject the null hypothesis (H_0). Thus, it can be inferred that there is no significant relation between gender and the overall level of awareness regarding zoonotic diseases, i.e., the overall awareness is not related to the gender of an individual.

Similarly, in case of education level and overall awareness (Tables 4 and 5) also violated the assumption of a 20% value less than 5, hence the likelihood ratio was used to derive the p-value. We can see that the calculated p-value (0.001) is lower than the significance level (α-value = 0.05). Indicating that the sample rejects the null hypothesis, indicates a relationship between education level and overall level of awareness. Cramer's V value is considered to understand the degree of association. From the Cramer's V value of 0.355 at degrees of freedom *(df)* of 3, it is inferred that there is a large association between both

variables, i.e., the overall awareness about zoonotic diseases is highly influenced by the educational qualification of the individual.

Table 4. Represents the overall awareness with education level

		High Awareness	Moderate Awareness	Low Awareness	Very low Awareness	Total
Level of Education	Primary to Higher Secondary level	1	1	5	25	32
	More than Higher Secondary level	8	7	41	34	90
Total		9	8	46	59	122

Source: Data Collected and Complied by the researcher.

Table 5. Represents the Chi-square test result for Education and Overall awareness level.

	Value	df	Asymptotic Significance (two-sided)
Chi-square	15.398	3	0.002
Likelihood Ratio	16.060	3	0.001

Source: Data Collected, Complied and Analyzed using SPSS

Discussion

Few studies, such as the one conducted in the Singur region of West Bengal, found that 12.8% of farmers were aware of the potential for disease transmission from animals to humans. The study also reveals that for diseases like brucellosis (3.8%), tuberculosis (3.6%), and avian flu (6.6%) farmers know the zoonotic potential of these diseases; further, a higher percent of farmers (48%) were aware of rabies in the region (37). Likewise, the study conducted in Pondicherry emphasized that only 16.4% of farmers knew about the diseases transmitted from animals to humans (38). While another study conducted in Punjab stated that 40.8% of farmers have moderate awareness, 30.8% have high awareness, and 28.4% have the least awareness about rabies, brucellosis, TB, anthrax, and avian flu (39). Similarly, one more study conducted among butchers in the state of Punjab showed that only a few (11%) individuals knew about zoonotic disease, and 27% knew that these kinds of diseases can lead to the death of animals (40). While similar studies in India (like the above-mentioned) concentrated on the level of awareness regarding livestock farmers and allied individuals in different regions, some studies outside India showcased the level of awareness among different sectors like students, healthcare, and other sectors (41, 42). Looking into gender-based awareness, a study conducted in Pune, India, indicated the existence of poor knowledge regarding these diseases among females (43). Similarly, another study conducted in south-west Delhi, India revealed poor knowledge about these diseases among females (44). The current pandemic and endemic situation shown us that these diseases impact not only affect the individuals working closely with animals, but also affect the wider population. All these studies revealed that individuals belonging to different genders and educational backgrounds have limited awareness regarding zoonotic disease. The study further adds that there is no significant relation between gender and education level and level of awareness, indicating that having a higher level of education implies a higher understanding of these diseases and vice versa; likewise, this is the case with gender and awareness about zoonotic diseases.

So far, few studies have been conducted in India relating to awareness about zoonotic diseases. However, in the state of Kerala, we can see a lack of studies related to public awareness about such

diseases. Hence, the study tried to include participants from the public sector, private sector, healthcare sector, educators, and students. The study also makes progress in incorporating different zoonotic diseases and understanding each one. When we look into whether individuals have adequate awareness related to different zoonotic diseases that have occurred in Kerala, we can see that the majority of the diseases, like Kyasanur Forest Disease, Japanese Encephalitis, West Nile Fever, Rabies, Avian Influenza, and Swine Influenza, the individuals have inadequate awareness, but they have adequate knowledge regarding Nipah virus disease. In the case of Chikungunya, dengue, and COVID, people have a neutral perception of these diseases. When considering the source of information, it is understood that 52% receive information from new media like print, broadcast, and the internet, while only a limited number of individuals (8%) receive information from health workers.

Conclusion

The study provides us with the information that most of the individuals in the district have a very limited understanding of the nature of the diseases, viruses, and vectors causing them, the symptoms, and the mode of transmission of different zoonotic diseases. This lack of awareness might be due to two-fold reasons. The first one might be due to the indifferent attitude of most individuals towards the health protocols and measures put forward by the government, and the second may be because of the lack of involvement of health workers in creating awareness. This can be substantiated by a small %age of individuals receiving information about these diseases from health workers. Hence, a strict and proper way of providing information needs to be implemented through the government with the help of NGOs and SHGs so that people living in remote areas, especially tribals, can receive information regarding such life-threatening diseases. Similarly, a proper interaction between healthcare workers and veterinarians should be incorporated so that any wide-spread outbreak of

diseases of zoonotic potential can be effectively tackled by them, as well as to carry out extensive research to provide information. Furthermore, during the second wave of COVID-19, the study was conducted over a short period, which prevented one-on-one personal interaction with respondents. Thus, the study paves the way for further study on the same topic by incorporating more individuals.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 2013 Helsinki Declaration and its later amendments or comparable ethical standards.

Conflict of Interest

There is no conflict of interest.

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