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Article

Societal awareness regarding viral Hepatitis in developed and developing countries

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SUMMARY

Acute viral hepatitis is a condition in which healthy liver tissue gets inflamed, whereas chronic viral hepatitis can reach the point of cirrhosis and sometimes end-stage liver cancer. The disease, in its chronic form, causes detrimental amounts of scar tissue that stifle the liver's functionality and leads to organ failure. Many cases of viral hepatitis are easily preventable if caught early; however, a lack of public awareness regarding often leads to diagnoses near the final stages of disease when it is most lethal. Thus, we wanted to understand to what extent an individual's sex, age, education and country of residence (India or Singapore) impacts disease identification. We sent out a survey and quiz to residents in India (*n* = 239) and Singapore (*n* = 130) with questions that test their knowledge and awareness of the disease. We hypothesized that older and more educated individuals would score higher because they are more experienced, but that the Indian population will not be as knowledgeable as the Singaporean population because they do not have as many resources, such as socioeconomic access to schools and accessibility to healthcare, available to them. Additionally, we predicted that there would not be any notable differences between make and females. The results revealed that the accuracy for all groups we looked at was primarily below 50%, demonstrating a severe knowledge gap. Therefore, we concluded that if more medical professionals discussed viral hepatitis during hospital visits and in schools, patients can avoid the end stages of the disease in notable cases.

INTRODUCTION

Discovered in 1965 by Dr. Baruch Blumberg, viral hepatitis infections are responsible for two-thirds of liver cancer-related deaths (1, 2). Chronic viral hepatitis results from viral transmission through infected blood, unprotected sex, and from mother to child during birth (1). The disease causes an inflammatory condition in the liver, which eventually replaces all healthy tissue with scar tissue and, in extreme cases, may progress to liver cancer (1). There are five main types of strains of the virus: A, B, C, D, and E, that differ in severity, mode of transmission, and prevalence (1).

Hepatitis A (HAV) and Hepatitis E (HEV) are the viral agents that cause acute infection resulting in liver inflammation but are usually cured within the first six months of infection (1). Since contaminated food, water, and stool cause HAV and HEV, rather than infected blood, they are more prevalent in developing countries where families live in unhygienic environments with poor plumbing systems (1). For instance, in the past 30 years, numerous outbreaks of HAV have occurred in different locations in India due to contaminated water pipelines that are poorly maintained, resulting in a cluster of cases (3). Often, people in developing countries cannot identify the disease due to common symptoms, such as fever, fatigue, loss of appetite, and nausea, and mistake it for an average viral infection, resulting in millions of avoidable deaths if they had access to the appropriate vaccinations, medication and surgery options (1, 3). Additionally, many are vulnerable to acute viral hepatitis because they are unvaccinated, and instead must resort to basic, more economical and homemade remedies and rituals to treat themselves, such as ginger tea, garlic and coriander seeds (4).

Hepatitis B (HBV), Hepatitis C (HCV), and Hepatitis D (HDV) are viral agents that cause a chronic infection much more lethal than HAV and HEV (5). Researchers estimate that in 2019, 296 million patients suffered from HBV, and 58 million patients suffered from HCV. HDV makes up less than 10% of liver-related diseases in India and is not as prominent as HBV and HCV (5, 6). When the virus first enters the body through contact with infected bodily fluids, it may remain dormant for around 25–30 years before an individual begins experiencing severe symptoms, including abdominal pain, dark urine, light-colored stools, joint pain, and jaundice (1, 7). If not accurately identified, the disease can progress to cirrhosis, a condition where scar tissue replaces the liver's healthy tissue and hinders its ability to function (8). In severe cases, cirrhosis can develop into liver cancer and cause organ failure (8). Currently, doctors must resort to a liver transplant to treat cirrhosis, which is challenging to perform especially in developing countries (7, 9). Medical professionals claim that 14.4% of cases of HBV require a liver transplant, and 34–40% of all liver transplant cases are due to HCV because it is the only effective method of treating end-stage liver disease (7). Nevertheless, successful organ transplants are challenging in some countries because they do not have functional transplant programs (7, 10, 11). Moreover, developing countries with inefficient transplant programs do not receive enough organ donations to serve as a readily available option for many families (11).

According to the Centers for Disease Control, viral hepatitis infection rates are steadily increasing (5). As of 2019, 357 million people live with a hepatitis infection globally, and the mortality rate has increased by more than 20% since 2000 (5, 12). However, with increased awareness of the disease and improved vaccination programs, many severe cases of viral

hepatitis can be prevented.

The Indian government, recognizing the epidemic, founded an HBV vaccination program in 2002 to promote protection against the virus across the country (3). However, 55% of infants ranging from 12–55 months were still unvaccinated in 2015 (3). Similarly, Singapore implemented an immunization program in 1987 to vaccinate infants and school-aged students against HBV (13). Although the program was fairly successful, with the number of HBV cases of patients above the age of 15 plummeting from 243 in 1987 to 83 in 2005, around 3.6% of Singaporeans are still carriers of HBV but remain unaware of this fact until their liver is severely damaged (13). According to Singapore's National Registry of Diseases Office, liver cancer is the fourth leading cause of death for men in Singapore, and 60–70% of these cases originate from HBV (14).

Given the lack of resources and proper education regarding viral hepatitis globally, it is vital to question the extent to which an individual's sex, age, education, and country of residence impact their ability to identify this disease. The difference in resource accessibility and affordability of vaccines is also significant between both countries. In India, only around 3% of districts have a HBV vaccination coverage rate of more than 90% because of the lack of access to medical resources, whereas the vaccination rate of infants has been higher than 97% since 1987 (13, 15).

Our study aims to compare the extent of knowledge regarding viral hepatitis in India (a developing nation) and Singapore (a developed nation) amongst people of different ages, sexes, and education levels using a survey and quiz. We hypothesized that older and more highly educated residents would score higher because they are more likely to have been exposed to knowledge about hepatitis, but the Indian population will not be as knowledgeable as the Singaporean population because they do not have as many resources. Additionally, we predicted that there would be a non-significant difference between males and females. By analyzing the data from the point of view of each factor, we discovered that education plays a significant role in an individual's knowledge of viral hepatitis. Lastly, we concluded how much residents of India and Singapore know about viral hepatitis and suggest solutions to minimize liver-related deaths. Initiating programs to spread awareness about the disease and importance of vaccinations amongst parents are highly recommended.

RESULTS

This correlational study followed a quantitative approach to determine the extent of knowledge and attitudes surrounding viral hepatitis in India and Singapore. Using social media, a survey and quiz was sent out to residents in India (*n* = 239) and Singapore (*n* = 130) to assess their knowledge of viral hepatitis and attitudes towards the disease **(Table 1)**. We have included a detailed description of the sociodemographic characteristics of the participants who completed the survey and quiz **(Table 1)**. The most prominent age group in the sample from India was 45–55 years old (*n* = 104) and 36–55 years old from Singapore (*n* = 45) **(Table 1)**. There were more males present in the sample from India (*n* = 146) and more females from Singapore (*n* = 80) **(Table 1)**. Additionally, most of the sample from both India (*n* = 125) and Singapore

Sample Characteristics	India		Singapore	
	n	%	n	%
Age Group				
14-18	4	1	6	2
19-25	9	2	2	0.5
26-35	29	8	12	3
36-45	40	11	45	12
46-55	104	28	43	12
56-65	31	8	20	5
66+	20	5	2	0.5
Sex*				
Male	146	40	50	14
Female	93	25	80	22
Prefer Not to Say	0	0	0	0
Education*				
Less than High	0	0	2	0.5
School	6	2	28	8
High School	103	28	35	9
Bachelor's Degree	125	34	61	17
Master's Degree	5	1	4	1
Doctorate Degree				
Country of Residency	**n**		**%**	
India	239		65	
Singapore	130		35	

Table 1. Demographic Characteristics of Study Population.
% = percentage of entire sample
* = sum of percentage is 101 because of rounding

(*n* = 61) had a Master's Degree **(Table 1)**. Once we obtained the responses, we used statistical analysis to determine the significance of the data in terms of how knowledgeable the participants are about viral hepatitis (denoted as "accuracy" throughout).

The 14–18 year old cohort had the lowest accuracy of 33%, whereas the 19–25 year old age group had an accuracy of 43% while answering questions regarding viral hepatitis **(Figure 1)**. People in the 26–35, 36–45, and 46–55 age cohort all had 48% accuracy, and people in the 56–65 year old groups had a little more knowledge with 50% accuracy **(Figure 1)**. Finally, the accuracy of everyone above 66 years of age averaged at about 51%. The trend depicted that as age increased, the knowledge regarding viral hepatitis increased as well **(Figure 1)**. Additionally, men in the study were found to have 43% accuracy whereas the women had 46% accuracy **(Figure 2)**.

When calculating the accuracy of the respondents while answering questions regarding the disease itself, adolescents with a less than high school education had only a 13% accuracy rate, but those who graduated high school averaged 45% accuracy **(Figure 3)**. Furthermore, adults with a bachelor's degree had a 48% accuracy rate, and adults with a master's degree had a 49% accuracy rate **(Figure 3)**. Finally, those with a doctoral degree gave the most accurate answers with a 67% accuracy rate. This trend showed that as participant's level of education increased, their average accuracy, and thus their general knowledge of viral hepatitis, increased as well **(Figure 3)**. Overall, all Singapore residents averaged at a 47% accuracy rate and all India residents averaged at a 49% accuracy rate **(Figure 4)**.

When asked if they had heard about viral hepatitis prior to participating in this study, 65% of Singaporeans responded 'Yes' (*n* = 84), 28% responded 'No' (*n* = 37) and 7% responded 'Not Sure' (*n* = 9) **(Figure 5)**. Additionally, 72% of Indians responded 'Yes' (*n* = 170), 25% responded 'No' (*n* = 59) and 3% responded 'Not Sure' (*n* = *8*) **(Figure 5)**. Additionally, when asked if viral hepatitis is discussed often in their household or school, 5% of Singaporeans responded 'Yes' (*n* = 7), 94% responded 'No' (*n* = 122) and 1% responded 'Not Sure' (*n* = 1) **(Figure 6)**. Additionally, 16% of Indians responded 'Yes' (*n* = 38), 81% responded 'No' (*n* = 193) and 3% responded 'Not Sure' (*n* = 7) **(Figure 6)**.

The next question asked if the participants were vaccinated against viral hepatitis. 38% of Singaporeans responded 'Yes' (*n* = 51), 34% responded 'No' (*n* = 45) and 28% responded 'Not Sure' (*n* = 37) **(Figure 7)**. Additionally, 37% of Indians responded 'Yes' (*n* = 88), 47% responded 'No' (*n* = 111) and 16% responded 'Not Sure' (*n* = 38) **(Figure 7)**. Lastly, the participants were asked if they were willing to get vaccinated if they weren't already. 64% of Singaporeans responded 'Yes' (*n* = 56), 3% responded 'No' (*n* = 3) and 33% responded 'Not Sure' (*n* = 29) **(Figure 8)**. Additionally, 61% of Indians responded 'Yes' (*n* = 107), 15% responded 'No' (*n* = 26) and 24% responded 'Not Sure' (*n* = 41) **(Figure 8)**.

The ANOVA statistical analysis revealed that only the level of education (p = 4.856 E-5) of an individual influences their knowledge regarding viral hepatitis because it has a p-value lower than 0.05. The age group (p = 0.6312), gender (p = 0.7492) and country of residency (p = 0.8775) are non-significant in determining an individual's knowledge because they have p-values higher than 0.05.

DISCUSSION

Our study shows that knowledge regarding viral hepatitis is very limited amongst all age groups in residents of Singapore and India. Although all age groups demonstrated a gap in knowledge, the data depicts an increasing trend in the knowledge about viral hepatitis as age increases. The older cohorts were more accurate with their answers for questions about the fatality, cause, and description of viral hepatitis perhaps because they are more likely to have experienced the disease themselves or know someone who has experienced the disease.

Despite the trend, the statistical analysis produced a non-significant p-value of 0.6312 indicating that there is no significant relationship between the age of an individual and their knowledge of viral hepatitis. Thus, educating all individuals, regardless of their age, about the dangers of contact with infected blood, lack of personal hygiene, and unprotected sexual engagement will warn them about viral hepatitis and allow for an even distribution of awareness.

Despite previous studies that show men are six times more likely to suffer from chronic HBV than women due to their weaker immune system response against the virus strain, we found that women are 3% more knowledgeable about viral

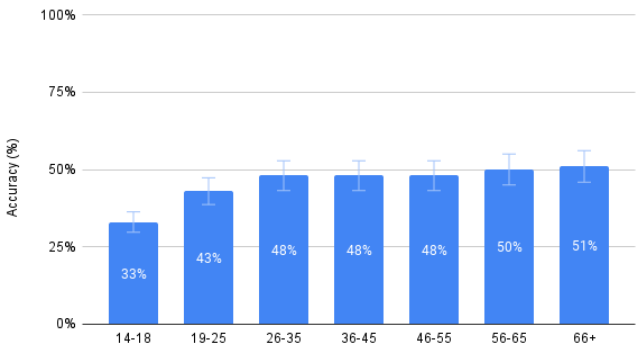

Figure 1: Average accuracy for each age group. Percentage of correct answers for Section A of the survey and quiz by participants in each age group. The percentage correct for each age group was calculated by finding the mean of the participants' individual scores.

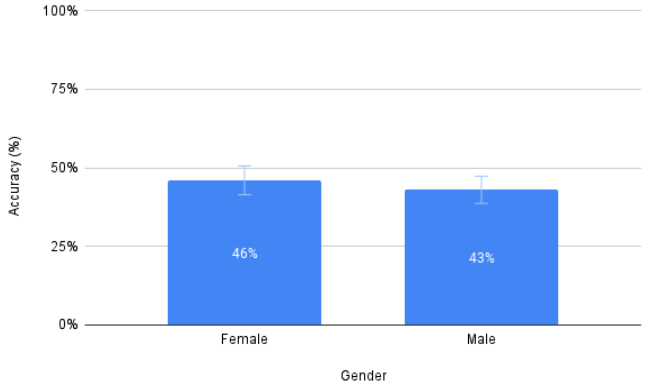

Figure 2: Average accuracy for each sex. Percentage of correct answers for Section A of the survey and quiz by participants of each sex. The percentage correct for each sex was calculated by finding the mean of the participants' individual scores.

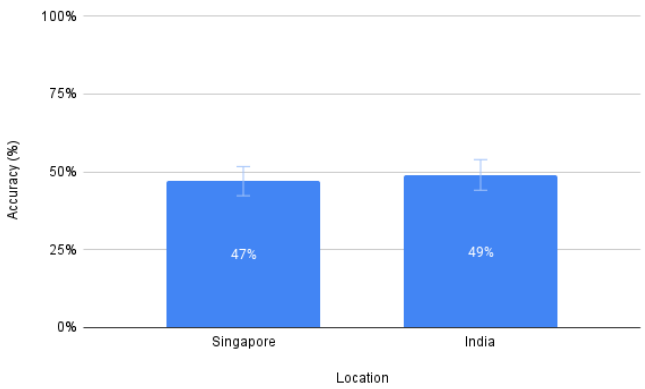

Figure 3: Average accuracy for each education level. Percentage of correct answers for Section A of the survey and quiz by participants of each education level. The percentage correct for each education level was calculated by finding the mean of the participants' individual scores.

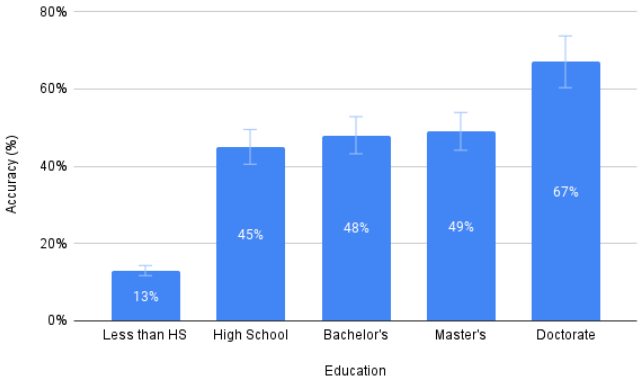

Figure 4: Average accuracy for each country of residence. Percentage of correct answers for Section A of the survey and quiz by participants of each country of residency. The percentage correct for each country was calculated by finding the mean of the participants' individual scores.

hepatitis than men (14). In spite of this difference, the *p*-value of the relationship between accuracy of individuals and their sex was 0.7492 which indicates that sex has no influence on the accuracy of responses. Since the difference isn't significantly different and both men and women are equally at risk of contracting the infection, information regarding the causes and consequences of viral hepatitis should be distributed to both sexes. By including information about the disease in discussions with patients of all sexes, doctors can help inform the population of the dangers of unprotected sex and encountering infected bodily fluids. These consultations should especially be emphasized in the adolescent and puberty stages before patients are sexually active to ensure they understand all the risks of unprotected sex.

We saw a severe lack of knowledge in individuals with less than a high school education; however, there was an ascending, linear trend amongst the high school, bachelor's, and master's degree cohorts, and individuals with a doctorate were the most knowledgeable about viral hepatitis. Our statistical analysis supported that education level does have a significant impact on an individual's knowledge about viral hepatitis (p = 4.856 E-5). Therefore, educating the public on viral hepatitis and facilitating access to education in rural areas are vital to ensure that widespread awareness reaches as many people as possible. The current Indian education system does not include any instruction on viral hepatitis in their primary and secondary school syllabus (16). Moreover, the Singaporean education system does not address the dangers of viral hepatitis despite its fatality, and many students misperceive the characteristics of the disease (17). Providing more information on fatal infections and their etiologies in primary and secondary schools can ensure more people are aware of how to avoid them.

The contrast in knowledge between residents of India and Singapore was minuscule, with only a 2% difference, thus demonstrating a lack of awareness about the lethality of the disease in both developing and developed countries. Worryingly, however, residents of both countries had a collective average accuracy of less than 50%, demonstrating there is a severe lack of knowledge. In developing countries where viral hepatitis is more prevalent, higher rates of poverty and lack of hospital facilities result in an elevated mortality rate (3). Our results show that country of residence has no impact on an individual's knowledge on viral hepatitis, since the *p*-value was 0.8775. Thus, by spreading awareness regarding the causes and symptoms of the disease in both countries

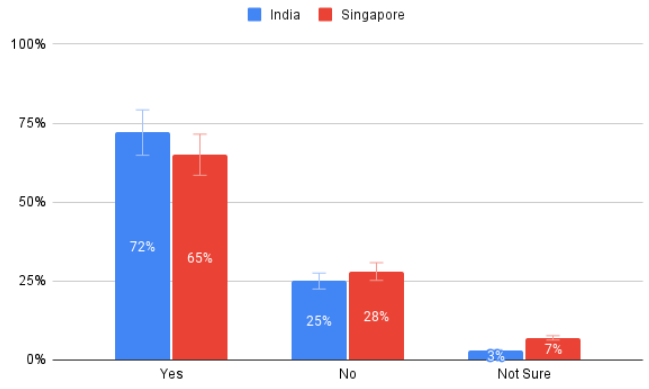

Figure 5: Awareness about viral hepatitis based on country of residence. Percentage of participants from Singapore and India that have heard of viral hepatitis before.

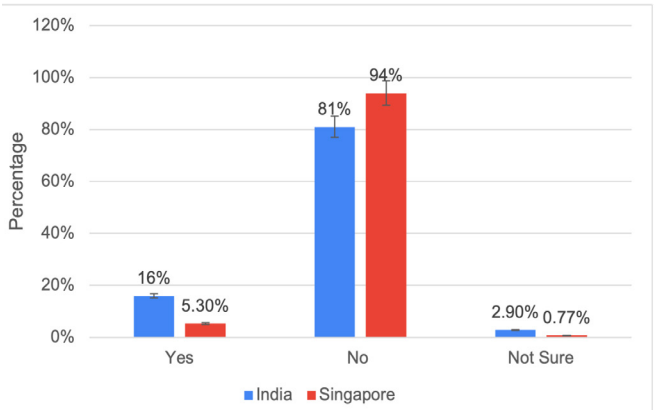

Figure 6: How often viral hepatitis is discussed based on country of residence. Percentage of participants from Singapore and India that have often had discussions of viral hepatitis in their household or school.

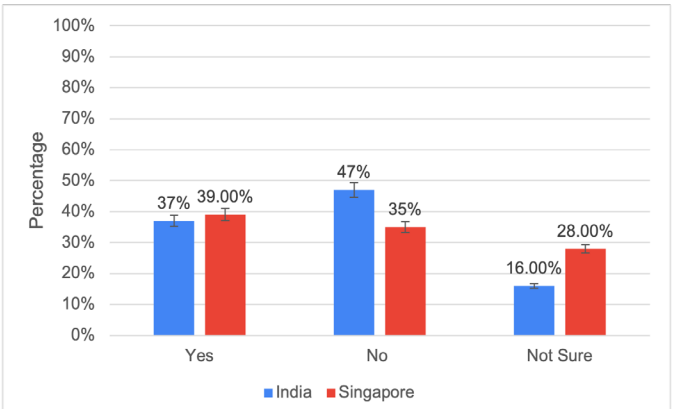

Figure 7: Vaccination rates based on country of residence. Percentage of participants from Singapore and India are vaccinated against viral hepatitis.

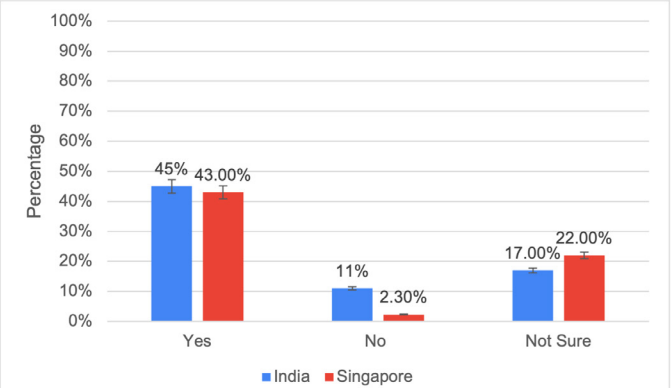

Figure 8: Willingness to receive vaccine based on country of residence. Percentage of participants from Singapore and India that are willing to get vaccinated against viral hepatitis.

through hospitals and medical clinics, deaths caused by viral hepatitis can be reduced considerably as more families will recognize the value of getting vaccinated and maintaining personal hygiene. Furthermore, recognizing which regions of a country have clustered cases will help medical associations focus on the appropriate population and promote immunization programs.

Previous research studies have found that many cases of viral hepatitis can be prevented if the individual had been vaccinated or been able to recognize the severity of the disease (3, 15). India has included the HBV vaccine in their vaccination schedule since 2004, but many families living in rural areas don't have easy access to it, if any (3). Consequently, we found that only 37% of those living in India and 39% of those living in Singapore are confident that they have received all doses of the hepatitis vaccine. This signifies the gap in education about viral hepatitis amongst people living in India and Singapore because many are not aware of the significance of the disease. Furthermore, only 63% of unvaccinated individuals in India and 66% of unvaccinated individuals in Singapore answered that they would be interested in receiving the viral hepatitis vaccine. The concern of the public about viral hepatitis is low—31% claimed they had not heard of the disease until they participated in the research study. Lastly, only 12% affirmed that viral hepatitis is discussed often in their schools, workplaces, or households. The low rates of awareness amongst families in Singapore and India indicate the lack of knowledge regarding viral hepatitis.

Due to limited access to resources, this study does hold some limitations. Firstly, since we did not randomly select the participants, we used a sample of convenience when gathering participants to take the survey and quiz. We derived the participants of the study through the personal contacts of the researchers and therefore do not represent the entirety of the Singaporean and Indian population. Thus, the sampling bias should be considered when analyzing the data collected. The majority of the participants in the study come from urban areas of both countries; consequently, the knowledge and attitudes demonstrated do not represent the diversity of both nations. Future studies should aim towards achieving a more representative sample by reaching out to people of diverse backgrounds.

Previous literature has shown that viral hepatitis is more common in developing countries than developed countries due to poverty, poor education, and lack of sanitation (4,15). Although the disease affects millions annually, very few of the participants were aware of its causes, symptoms, and prevention methods. Given the severity and complexity of viral hepatitis, it is important to pay more attention to viral hepatitis outbreaks, and take immediate action, such as requiring families with newborn babies to vaccinate their children. Additionally, programs should be put in place to begin educating new parents to ensure they understand the risks of choosing to forgo the HAV and HBV vaccines for their children. Awareness should be spread in both types of countries but given more attention and urgency to developing countries. Even amongst all age groups, sexes, and education, awareness is suboptimal as it was found the accuracy was less than 70%. Given that the sample was on the higher end of being educationally qualified, it must be noted that rural parts of India are very likely to have even lesser information. This study required participants to have Internet access in order to submit a response; to ensure a more representative sample, paper-based copies of the survey and quiz should be used.

Therefore, teaching about the disease in those parts of the country will target the appropriate population and be more efficient in reducing the infection rate of the disease. By introducing them to basic knowledge about the infection, families will be able to identify when someone has viral hepatitis and seek medical help earlier than they normally would. The data from this study also suggests a 10–15% difference in background knowledge of viral hepatitis between adolescents and adults. By including viral hepatitis in a school's syllabus, students will be familiar with the disease from a young age and refrain from participating in activities that could cause it, such as the sharing of needles and unprotected sex. All in all, a lack of education has led to many individuals living in developed and developing countries of all ages, sexes, and education qualifications to be unaware of basic information regarding viral hepatitis.

Finally, more government-mandated immunization programs against viral hepatitis would greatly benefit the rural and impoverished populations because they would have easier access to vital vaccines. By increasing awareness by distributing brochures in hospitals, teaching it in more classrooms, and implementing more vaccination programs, deaths caused by liver-related diseases could diminish to a

non-threatening percentage.

MATERIALS AND METHODS

This cross-sectional study was conducted among people of varying ages, levels of education, and sexes living in India and Singapore. A questionnaire was converted to a Google Form and distributed to potential participants through social media (WhatsApp, Instagram, Facebook), out of which 369 were eligible for the study (35% lived in Singapore, and 65% lived in India). In order to collect unbiased responses, the participants were given no previous information regarding the survey and quiz and were asked to complete it on the spot without access to additional assistance. For accessibility purposes, the questionnaire was available in both English and Hindi with the translations verified by native Hindi speakers. The questionnaire consisted of a section of 12 questions on basic knowledge regarding viral hepatitis (Section A) that included questions on the symptoms, treatments, fatality, and causes of viral hepatitis. The other section was regarding participants' personal attitudes towards the disease (Section B) that asked about their vaccination status and how often viral hepatitis is discussed in their workplaces and homes. In total, the survey and quiz took less than 10 minutes to complete. Consent for taking part in the study was collected prior to when the participants began it to guarantee their privacy. All participants who wished to take part in the study gave their permission for their data to be used. The survey questions, with Hindi translations are provided in the **Appendix**.

Once all the results were collected, the data was accumulated in a Microsoft Excel sheet to use for statistical analysis. The data was filtered into four groups based on the age, sex, country of residency, and education. First, the average accuracy of each question in each group was found (e.g., accuracy of 26-35 year old for question 1). Then, using the built-in ANOVA program in Excel, the accuracy and variance of each cohort in all the groups was calculated (e.g., accuracy of 26-35 year old for all 12 questions). Additionally, a comparative analysis was completed using ANOVA to determine whether each factor affected the participant's knowledge of viral hepatitis. The ANOVA calculations were performed automatically by Excel and produced a *p*-value that determined the significance of the relationship. We used a significance cut-off (α-value) of 0.05.

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