



## **Sepsis Awareness and Perception: An Alarming Deficit Unveiled among Indian Working Professionals**

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**Abstract****Purpose**

*Sepsis, characterized by systemic and dysregulated host responses and possible multi-organ failure leading to septic shock, is a leading cause of mortality globally. Despite its severity and prevalence, studies from around the world have reported a severe lack of awareness about sepsis and its consequences. The objective of the study is to measure the level of sepsis awareness within the professional community in India and to statistically evaluate participants' perspectives on sepsis to acquire valuable insights into their comprehension and knowledge of the subject.*

**Materials and Methods**

*A cross-sectional study was conducted among the working professionals of various states of India. Qualitative as well as descriptive data was collected using a questionnaire.*

**Results**

*This cross-sectional study targeting working professionals across various Indian states, uncovered a staggering 93.17% unawareness about sepsis. The study further exposed widespread misperceptions and incomplete knowledge about sepsis, extending even to healthcare professionals.*

**Conclusion**

*This research underscores significant knowledge deficiencies in sepsis awareness among professionals from various fields. A thorough understanding of sepsis is crucial for both healthcare professionals and the public. Despite the increasing global incidence of sepsis, there is a lack of information on sepsis awareness in India. The data from this investigation will serve as a vital resource for tailoring awareness campaigns to local needs, potentially filling the void in understanding and addressing sepsis in the current context.*

**Key words:** *Sepsis, India, awareness, perception, deficit.*

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## Introduction

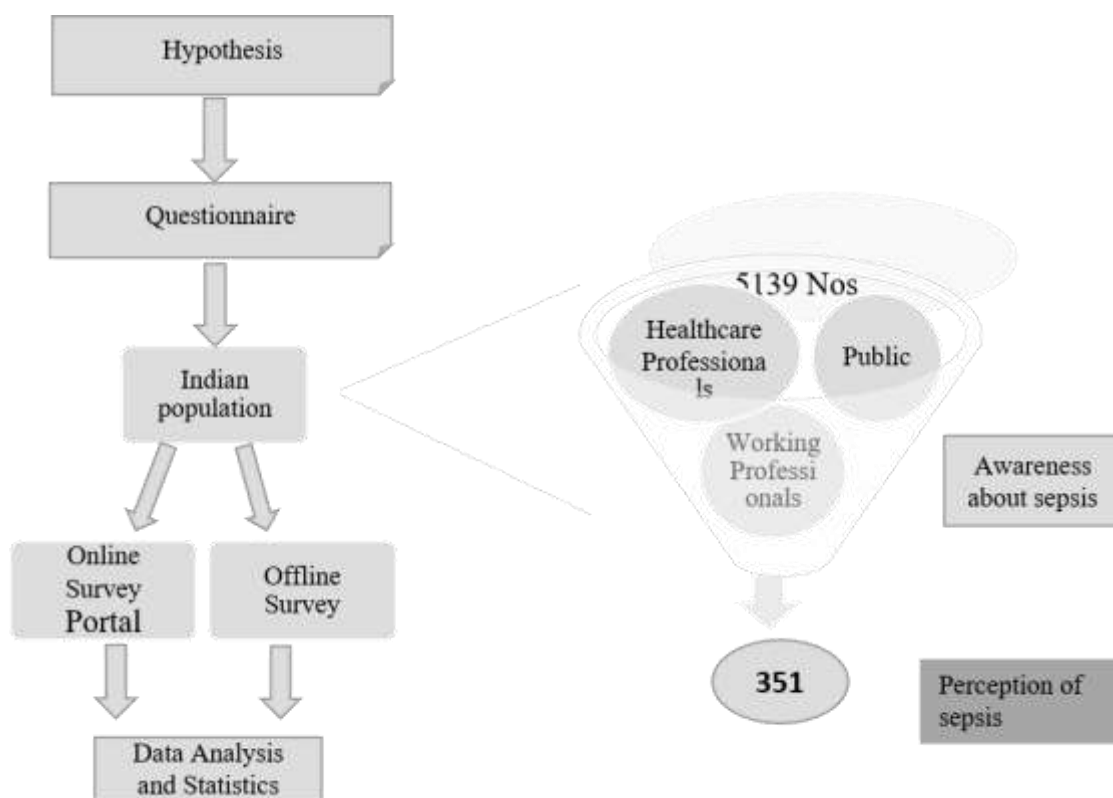
Sepsis affects 50 million people worldwide and causes eleven million deaths a year. Developing countries share a larger fraction of sepsis incidence, and more than 40% of the incidence occurs in children under 5 years old [1]. Sepsis is a systemic and dysregulated host response to an infection presenting with non-specific or non-localising symptoms to severe signs of multi-organ dysfunction and septic shock[2]. Schottmueller in 1914 defined septicemia as a state of microbial invasion from a portal of entry into the blood stream that causes a sign of illness. The terms bacteremia, septicaemia, sepsis, septic syndrome, and septic shock were used similarly in earlier days and led to a vague understanding of sepsis and interpretation of the symptoms.

The Consensus Conference introduced the term systemic inflammatory response syndrome (SIRS) and validated the role of endogenous factors in infection, along with microbial components. Acute-phase reactants are released, and the subsequent activation of the inflammatory cascade leads to organ damage and even death. SIRS, sepsis, severe sepsis, and septic shock are a continuum of clinical and pathophysiological severity[3]. SIRS is the condition of having two or more of the following: i) core body temperature greater than 38.3°C or less than 36°C; ii) elevated heart rates above 90 beats per minute; iii) elevated respiratory rate above 20 breaths per minute, with PaCO<sub>2</sub> less than 32 mm Hg or having the need for mechanical ventilation; iv) displaying a White Blood Corpuscle (WBC) count of greater than 12000 per mm<sup>3</sup> or less than 4000 per mm<sup>3</sup>. Sepsis may lead to severe sepsis complicated by predefined organ dysfunction. Septic shock causes multiple organ dysfunction syndrome (MODS) and is fatal. Septic shock is characterised by the collapse of the cardiovascular system and is associated with severe sepsis despite adequate fluid resuscitation. Organ dysfunction associated with septic shock is characterised by i) hypoxemia (PaO<sub>2</sub>/FiO<sub>2</sub> ratio < 300); ii) acute oliguria with urine 0.5 ml/kg/h for 2h or creatinine > 2.0 mg/dL; iii) coagulopathy with platelet count < 100,000, INR > 1.5, or pTTa > 60s; iv) plasma bilirubin > 4 mg/dL[4].

Even with advanced knowledge about the pathology, hemodynamic diagnosis tools, and resuscitation measures, sepsis continues to be one of the leading causes of mortality and morbidity around the world. The heterogeneity of patients has hindered the better classification of sepsis and the development of effective therapeutic measures. In 2017, sepsis was declared a global health priority by the UN, and member nations were urged to improve their measures to prevent, diagnose, and manage sepsis. Consequently, strategic efforts were made for the early diagnosis and right management of sepsis in hospitals [5,6]. Studies from

around the world have shown that awareness about sepsis, its prevalence, symptoms, diagnosis, and treatment is very limited among the public and even health care professionals [5–8]. Comprehensive knowledge about the burden and epidemiology is essential for the development of a thorough strategy to prevent and detect sepsis.

The objective of this research is to gauge the extent of sepsis awareness within the professional community in India. Employing statistical analysis, we will assess participants' perceptions of sepsis to glean insights into their understanding and knowledge.



## Methodology

The objectives presented were investigated using a cross-sectional study. The study was qualitative as well as descriptive research that was conducted across the population of India. 5139 professionals participated in the survey. A questionnaire was sent to the public, working professionals like IT professionals, teachers, defence force personnel (police, navy, etc.), and the healthcare workforce, and their responses were

collected and analysed. The study was approved by the institutional ethical committee.

### Data analysis and techniques

A chi-square test was done to determine if the correct responses reflected a genuine understanding. The level of confidence was set at 95% ( $p \geq 0.05$ ) to identify questions to which responses were randomly distributed between correct and incorrect options.

A single-factor analysis of variance (ANOVA) test was also performed to test for a significant difference in the percentage of correct answers between the different groups of participants. The analyses were performed using SPSS version 26.

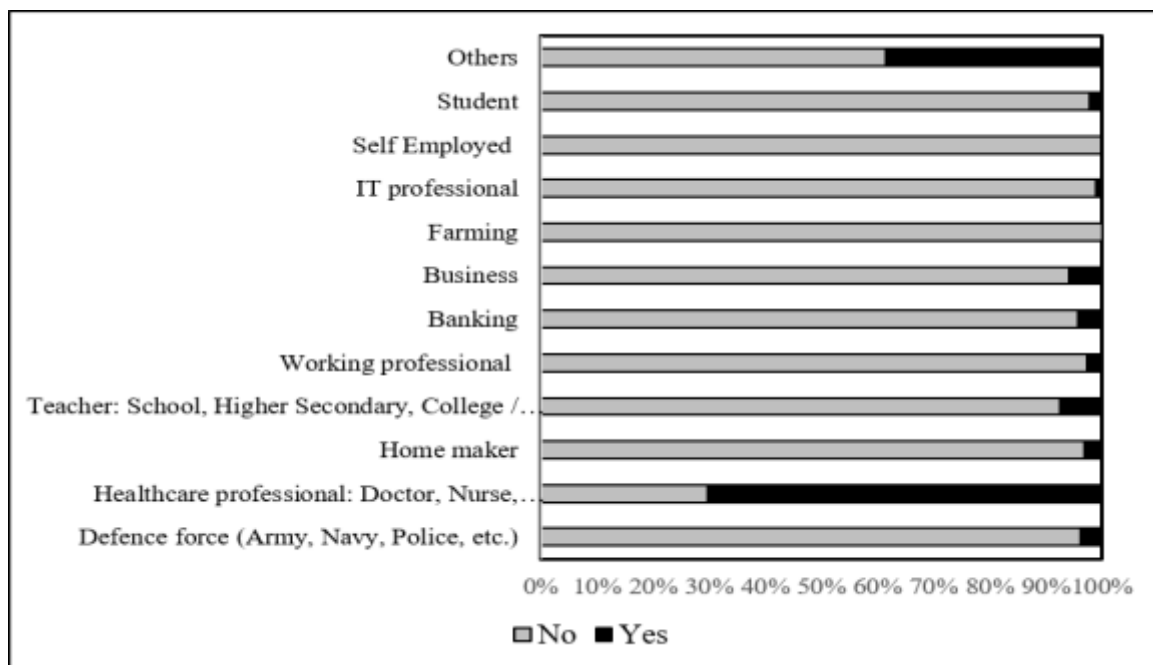


Figure 1 Awareness about sepsis. Response to the question ‘Have you heard about the term sepsis?’ in absolute numbers and percentage comparison

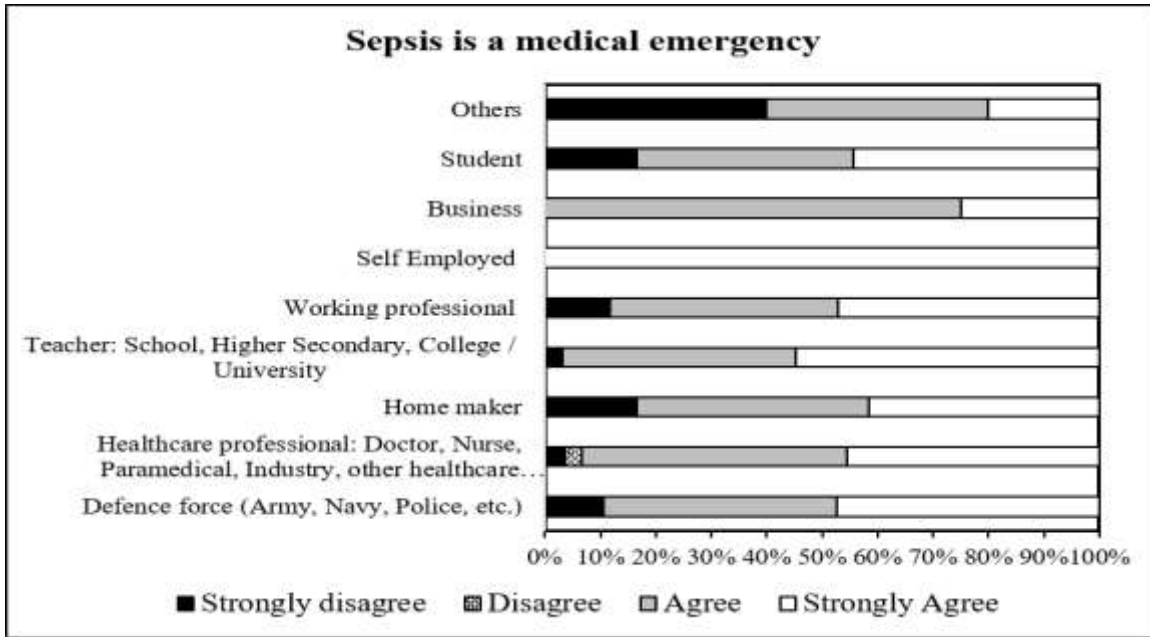


Figure 2 Perception of Sepsis. Response to the statement ‘Sepsis is a medical emergency, in percentage comparison

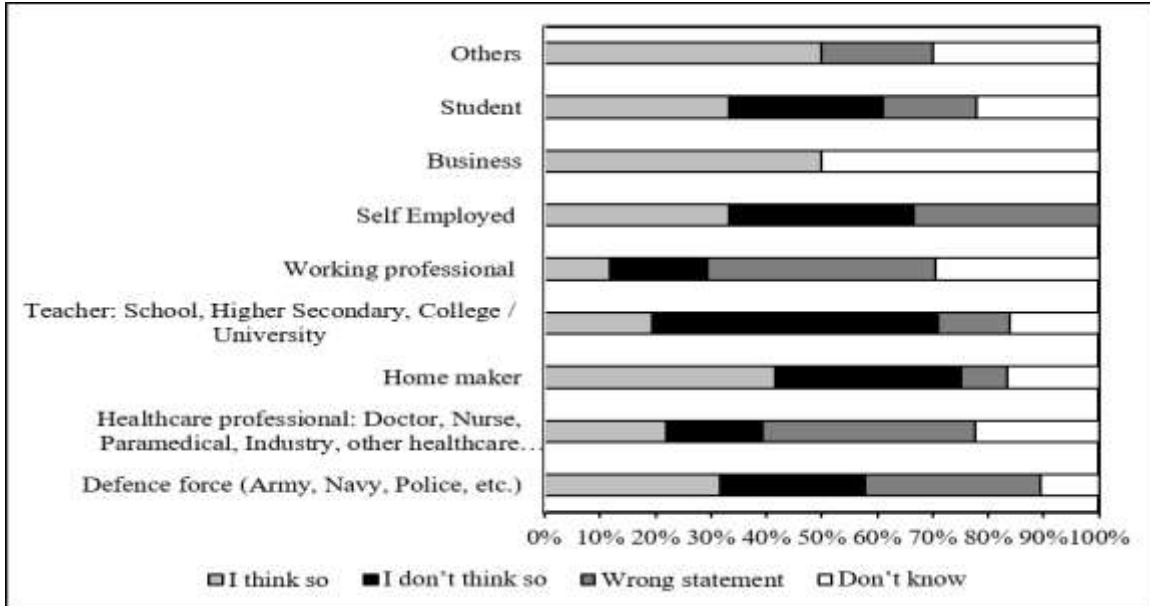


Figure 3 Perception of sepsis. Response to the statement ‘Tetanus is a synonym of sepsis, in percentage comparison

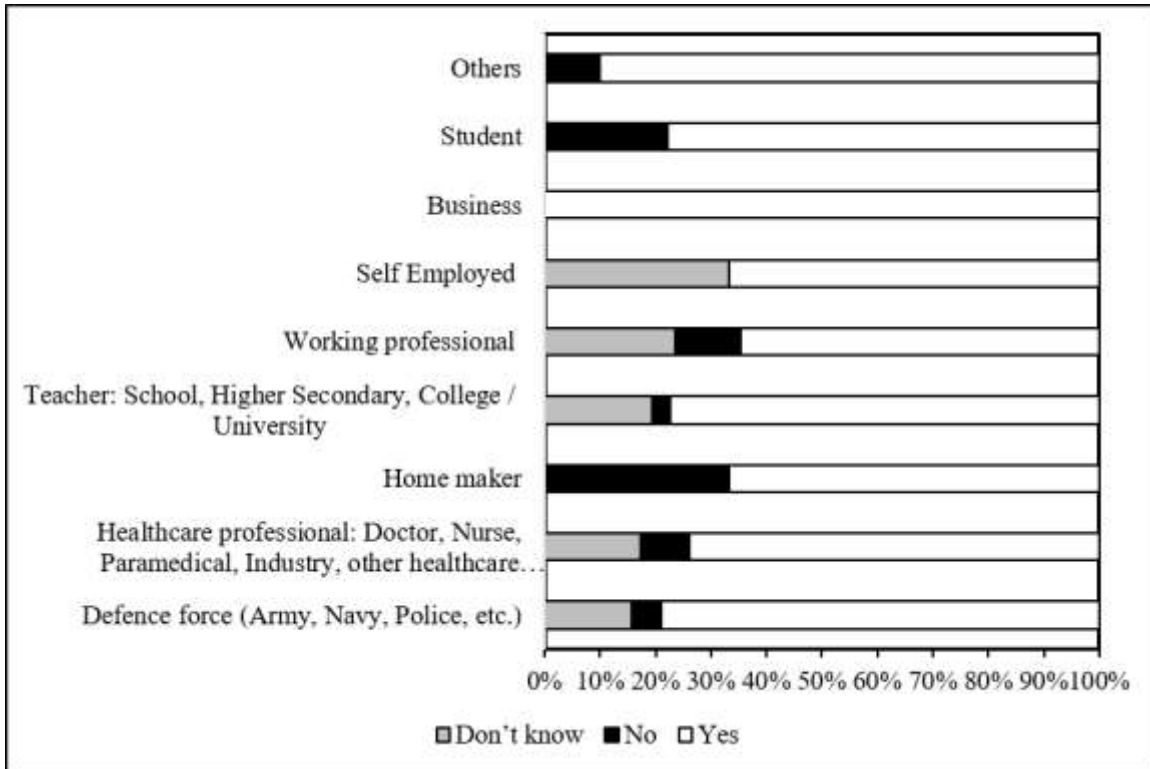


Figure 4 Response to the question ‘Do you think lack of knowledge makes sepsis the number one preventable cause of death worldwide?’ in percentage comparison

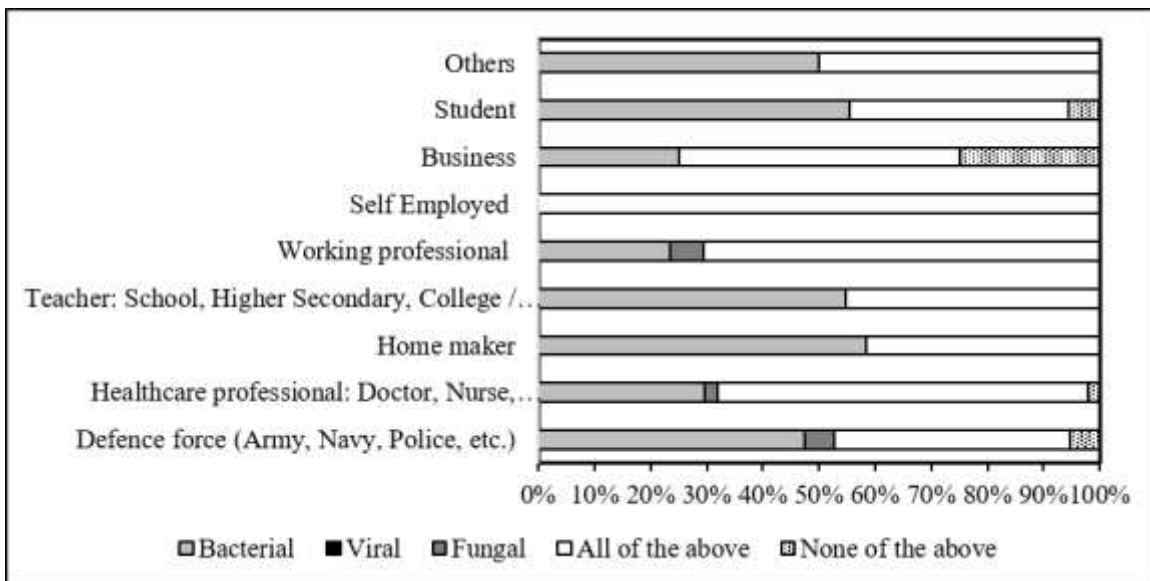


Figure 5 Response to the question ‘What kind of infections can lead to Sepsis?’ in percentage Comparison

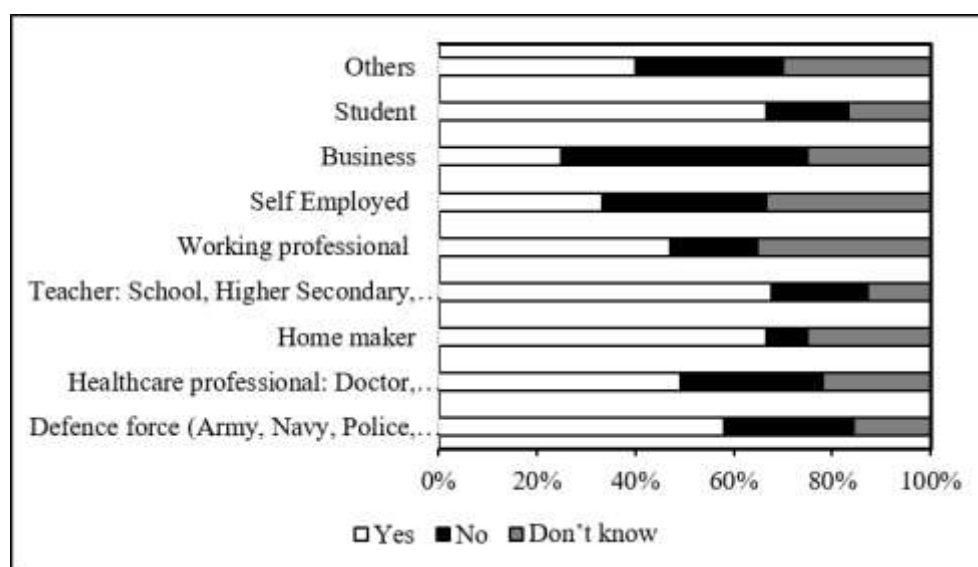


Figure 6 Response to the question ‘Do you think Sepsis can be easily cured with antibiotics?’ in percentage comparison

## Results

### The population of India exhibits a significant deficiency in awareness regarding Sepsis.

The question, ‘Have you ever heard about the medical term sepsis?’ was posed to the participants to assess the level of awareness among the participants about sepsis. 4788 of the 5139 participants admitted that they had never heard of the term. This showed that 93.17% of the participants were clearly unaware of sepsis. Only 351 participants stated that they were aware of sepsis (table 1). Among the different groups of participants, based on their profession, a significant number of healthcare professionals showed awareness of sepsis (Figure 1). Of the 344 health care professionals, 242 stated that they were aware of sepsis, and 102 (29.65%) stated that they were unaware of it. In general sepsis awareness was very low and ranged between 0 and 7.4% (excluding the group of 'others' due to the low number of samples). Teachers had the highest level of awareness of the topic at 7.4%, while awareness among the farmers was the lowest at 0%. Among the other professionals with a significant number of participants, 3.91% of defence personnel were aware while homemakers were at 3.08%, and working professionals had an awareness of 2.69%.



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**Indian professionals hold inaccurate and incomplete perception of sepsis**

Only the participants who were aware about sepsis were considered to analyse the perception of sepsis. Total number of participants involved was reduced to 531. This was done after analysing their responses to the statements related to sepsis. Of the participants, 163 strongly agreed to the statement 'sepsis is a medical emergency'. 110 of the healthcare professionals strongly agreed (table 2, figure 2), while 116 of them agreed to the presented fact. The highest percentage of correct responses (54.84%) came from teachers, where 17 of them strongly agreed to the statement. 47.37% of the defence personnel and 41.67% of homemakers strongly agreed that sepsis is a medical emergency. Chi square test revealed (chi square = 69.6,  $p = 6.02 \times 10^{-12}$ ) that statistically significant number of participants were aware of the statement.

The participants were presented with the statement 'Tetanus is a synonym for sepsis' and had to choose from the options, 'I think so', 'I don't think so', 'Wrong statement', and 'Don't know'. The correct option to be chosen was 'Wrong statement'. 38.43% of healthcare professionals chose correctly, while 31.58% of defence personnel chose the right option. The highest percentage of correct choice was seen among working professionals at 41.18% (Figure 3). The group of teachers who chose 'I don't think so' had the highest percentage of a single incorrect option (51.61%). Interestingly, among the healthcare professionals, 54 (22.31%) chose the option, 'Don't know'. Among the teachers, 6 (19.35%) chose 'I think so', 16 (51.61%) chose 'I don't think so', and 5 (16.13%) went with the option of 'Don't know'. Among the students participating in the survey, 3 gave the correct answer, while 6 chose 'I think so', 5 chose 'I don't think so', and 4 stated that they 'Don't know' (table 3). The response of the participants with respect to the correct answer was still not found to be statistically random (chi-square = 24.4,  $p = 0.002$ ).

**Significant number of participants were aware about importance of acquiring knowledge about sepsis**

Most of the participants were aware that lack of knowledge makes sepsis the number one preventable cause of death worldwide. Among healthcare professionals, 179 (table 4, figure 4) chose the correct option of 'Yes', which amounted to 73.97% of the group. Among defence personnel, 78.95% opted for 'Yes', while 5.26% chose 'No' and 15.79% stated 'Don't know'. Among healthcare professionals, 8.68% opted for 'no', while 17.36% chose the option of 'don't know'. Among homemakers, 66.67% chose 'yes' and 33.33% stated 'no'. 77.42% of teachers stated, 'Yes', and 3.23% chose 'No', while 19.35% stated that they 'don't know'. Among working professionals, 64.71% stated 'Yes', 11.76% stated 'No', and 23.53% stated 'Don't know'. Statistical

analysis revealed that there was no significant value to indicate that the recorded responses were not random (chi-square = 185.45,  $p = 7.35 \times 10^{-36}$ ).

### **Healthcare professionals demonstrated a higher level of awareness regarding the causes of sepsis compared to other groups**

The participants were asked whether sepsis is caused by bacteria, viruses, or fungi—all of them or none of them. Sepsis may be caused by all of them. Among defence personnel, 47.37% (9) chose the first option, and 42.11% (8) chose the third option. Among the healthcare personnel, 29.75% (72) chose 'Bacterial', and 66.12% (160) chose 'All of the above' (table 5, figure 5). 58.33% of homemakers chose the first option, while 41.67% chose the correct option of 'All of the above'. A similar trend was also observed among teachers, with 54.84% choosing 'bacterial' infection and 45.16% choosing 'all of the above'. Statistical analysis revealed that there was no significant value to indicate that the recorded responses were not random (chi-square = 198.01,  $p = 1.68 \times 10^{-38}$ ).

### **Participants were unaware that treating sepsis is not easy with antibiotics alone.**

The participants were asked whether sepsis can be treated easily with antibiotics and were given three responses to choose from: 'Yes', 'No', and 'Don't know'. 57.89% of defence groups said that sepsis can be easily cured with antibiotics, while 49.17% of healthcare professionals chose the same (table 6, figure 6). 28.93% of healthcare professionals chose the correct option. The percentages of correct answers among homemakers, teachers, working professionals, self-employed people, business owners, students, and others were 8.33%, 19.35%, 17.65%, 33.33%, 50%, 16.67%, and 30%. Statistical analysis revealed that a significant portion of the participants answered this question randomly (chi-square = 8.87,  $p = 0.35$ ).

## **Discussion**

Awareness about sepsis is very poor in India, as shown by the data from this study. This is in coincidence with the studies from other parts of the world, including the developed countries [5–9]. In this study, the participants were from different parts of the country and had different professional backgrounds. They were asked to respond to questions and statements associated with sepsis.

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93.17% of the participants in this survey reported that they had never heard of the word sepsis. Among the participants, health care professionals and teachers were moderately aware of the syndrome. The awareness of sepsis among farmers was nearly zero. In an international study by Rubulotta et al. (2009), the percentage of participants who had heard of the term 'sepsis' ranged from 4% in France to 53% in Germany [5]. More recent studies showed a trend towards better awareness of sepsis. Public awareness and knowledge about sepsis in Saudi Arabia were lower than awareness about AMI and stroke [10]. In a study conducted in Germany, 88.6% of the participants had heard about sepsis, but 50% of them had poor knowledge about it [11].

Knowledge about sepsis was limited, even among participants who had heard about it. To statistically analyse the perception of sepsis, only those participants who were aware of sepsis were considered. Even the majority of the HCP were ignorant that sepsis is a medical emergency. According to Rubulotta et al., 90% of the population has never heard about sepsis, while 60% are not aware that it is a leading cause of death [5]. Improved survival rates and long-term outcomes may be achieved with early recognition of the signs and symptoms of sepsis [12,13]. Clinical guidelines and practices based on evidence play a central role in hospitals to improve sepsis diagnosis and treatment [2,14]. Since sepsis cases originating in the community are very common (20), awareness of sepsis in outpatient settings and in the public is crucial [11,15,16].

Multiple questions were asked to assess the perception of sepsis among the participants. Some of these questions could be answered intuitively, while others required in-depth knowledge on the topic. This was done on purpose to identify if the answers were coming from true knowledge or were the results of intuitive selection. It was alarming that almost 45% of healthcare professionals stated that they were unaware of or thought that both tetanus and sepsis were the same. The response of the participants summarises that perception of 'sepsis' is still underdeveloped in India.

Most of the participants were aware that knowledge about sepsis would prevent mortality due to sepsis. Epidemiological studies from the US and India have reported a reduction in mortality due to sepsis, even though the incidence has increased significantly over the last few decades [17]. The increase in sepsis incidence could be due to an ageing population with predisposing comorbidities, the use of immunosuppression, invasive procedures and medical devices, and multi-drug-resistant pathogens [6]. Better sepsis recognition, prompt treatment, increasing uptake of sepsis bundles, and general improvements in health care might have contributed to the improved sepsis mortality rates [6].

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The majority of the participants were unaware of the cause of the sepsis. Most of them believed bacteria were the cause of sepsis. Sepsis can be caused by bacteria, viruses, and fungi, even though the most identified pathogen is bacteria [18,19]. Gram-positive bacteria, as a cause of sepsis, have increased in frequency over time and are now almost as common as gram-negative infections. The latest European Prevalence of Infection in Intensive Care (EPIC II) study reported more gram-negative organisms (62.2% vs. 46.8%) [20]. Less than 1% of the documented cases of sepsis are caused by viruses. Dengue, rhinovirus, influenza, and respiratory syncytial virus are the common viruses identified to cause sepsis. Many of the COVID-19 patients in the ICU met the sepsis-3 criteria [21]. In a study by Bilgin et al., the mortality rate was higher in fungal sepsis patients than in gram-positive bacterial sepsis [22].

In this study, at least half of the participants believed that sepsis could be easily treated with antibiotics. Early administration of appropriate antibiotics and adequate intravenous fluid is recommended in sepsis for better survival outcomes [23]. But delays in the first administration of antibiotics have been reported to increase in-hospital mortality [24]. The degree of appropriateness of the antibiotics chosen is challenged by the discretion of the physician. The overuse of large-spectrum antibiotics may lead to antibiotic resistance and have detrimental effects in the long run.

This national survey provides a unique insight into the awareness of sepsis among people from different professional backgrounds in India. The survey indicates considerable deficits in understanding about recognition, perception, and response to possible sepsis. There may also be a profession-based difference in sepsis recognition based on sepsis awareness opportunities.

## **Conclusion**

This study highlights substantial knowledge gaps in sepsis awareness and understanding among professionals from diverse backgrounds. A comprehensive understanding of sepsis is imperative for both healthcare professionals and the general public. Despite the global surge in sepsis cases, there is a paucity of information on sepsis awareness in India. The data from this study offers valuable insights for the generation of tailored campaigns and resources for both the public and healthcare practitioners, aiming to enhance awareness and knowledge in the face of the growing burden of sepsis worldwide.

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### Conflict of interest

There is no conflict of interest between the authors.

### Acknowledgement

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