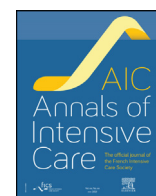




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Research

Temporal trends and social determinants of sepsis knowledge in Brazil: findings from three national cross-sectional surveys



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ABSTRACT

Background: Public awareness of sepsis is essential for early recognition of warning signs and timely healthcare seeking behavior, but data from resource-limited settings remain scarce.

Methods: We evaluated sepsis knowledge in Brazil using cross-sectional surveys conducted in 2014, 2017, and 2026. Standardized questionnaires were administered through face-to-face interviews using random sampling stratified by age, sex, and geographic region. Adequate basic knowledge was defined as having heard the term sepsis and correctly identifying it as a severe host response to infection. In 2026, we additionally assessed knowledge of sepsis time-dependent nature and long-term disability after sepsis. Multivariable logistic regression identified factors associated with knowledge.

Results: A total of 6,312 participants were interviewed (2014: n = 2,126; 2017: n = 2,100; 2026: n = 2,086). Adequate basic knowledge increased from 2.6% in 2014 to 5.8% in 2017 (OR 2.25, 95% CI 1.63–3.16; p < 0.001) and 10.3% in 2026 (OR 3.45, 95% CI 2.54–4.75; p < 0.001). In 2026, 70.0% of participants acknowledged that earlier diagnosis and treatment improve survival. Awareness of long-term disabilities was lower (24.4%). Higher educational attainment was the strongest determinant of knowledge across all domains. Younger age, male sex, residence outside state capitals, and lower household income were independently associated with lower knowledge.

Conclusion: Public awareness of sepsis in Brazil has improved substantially over the past decade, suggesting a positive impact of national and international awareness initiatives. Nevertheless, important knowledge gaps persist, and awareness continues to be strongly influenced by socioeconomic factors, highlighting the need for continued efforts to improve sepsis awareness and promote equitable access to health information.

Background

Sepsis is a major global health problem and remains one of the leading causes of death among hospitalized patients [1]. According to the Global Burden of Disease Study, more than 40 million cases and 11 million sepsis-related deaths occur annually worldwide [2] with more recent estimates suggesting approximately 21.4 million sepsis-related deaths in 2021 when COVID-19-associated deaths are included. Brazilian epidemiological studies also demonstrate high prevalence and mortality, with an estimated 240,000 deaths annually

among adults admitted to intensive care units [3,4] and approximately 8,000 among children [5].

Despite advances in care, sepsis mortality remains high and is influenced not only by pathogen, host, and healthcare system factors, but also by delays in recognition and inadequate treatment [6,7]. Public awareness is particularly important in community-acquired sepsis, where early recognition of warning signs and prompt healthcare-seeking behavior may contribute to timely diagnosis and treatment. However, public awareness of sepsis remains limited worldwide and varies substantially across countries and healthcare settings [8,9]. In a recent scoping review, the proportion of individuals who had heard the term “sepsis” ranged from 2% in Japan to 88.6% in Germany, while the proportion able to correctly define sepsis ranged from 4.2% in Singapore to 92% in Sweden [9].

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Although awareness appears to have improved over time, rates above 50% were reported in only a few countries. Younger age, female sex, higher educational attainment, healthcare-related employment, and previous personal or family experience with sepsis are associated with greater awareness [10]. Importantly, data from low- and middle-income countries remain scarce.

In Brazil, the Latin America Sepsis Institute (LASI) conducted nationwide population-based surveys evaluating public awareness of sepsis in 2014 and 2017, demonstrating low levels of awareness [11,12]. Since then, multiple educational initiatives directed at both healthcare professionals and the general public may have modified this scenario [4]. Therefore, the aim of this study was to evaluate the temporal trends on public awareness and knowledge of sepsis among the Brazilian population, comparing it with acute myocardial infarction awareness. We also sought to evaluate the current public perception regarding the time-dependent nature of sepsis treatment and long-term disabilities after sepsis. We hypothesized that, despite increasing health initiatives, knowledge regarding sepsis would remain inadequate and below that reported in high-income countries.

Methods

Study design

This was a nationally representative, cross-sectional, face-to-face survey conceived and coordinated by the Latin American Sepsis Institute. Fieldwork and interviews were conducted by the Datafolha Institute, an independent national research agency specialized in population-based surveys. Interviewers are required to be at least 18 years old, have completed secondary or higher education, and have prior research experience. All interviewers receive standardized training in research ethics, good research practices, and the Institute's data collection procedures. For each survey wave, detailed written instructions regarding questionnaire administration were provided to field coordinators. These standardized guidelines ensured uniformity in the application of procedures across survey waves. Interviewers were instructed to administer all questions exactly as worded and in the predefined order specified in the survey instrument. The survey was performed through direct interviews in high-flow public areas. The study was approved by the Ethics Committee of the Federal University of São Paulo (CAAE 54357815.7.0000.5505), and all participants provided informed consent. Reporting followed the Checklist for Reporting of Survey Studies (CROSS) guidelines.

Sampling

Participants were randomly approached in high-traffic public locations, including squares, street intersections, avenues, and commercial streets, geographically distributed across the study areas, using the "flow point" methodology developed by Datafolha in collaboration with the University of São Paulo in 1983 [13]. Adults aged ≥ 16 years were eligible, and participation was voluntary and not incentivized.

This methodology improves efficiency and facilitates access to population groups often underrepresented in household surveys, including residents of high-income condominiums, informal settlements (favelas), and areas with high levels of violence. Sampling points were randomly selected and proportionally distributed according to the resident population, ensuring representation across all Brazilian geographic regions. Recruitment was controlled through quotas based on sex, age, geographic region, and socioeconomic distribution to ensure representativeness of the Brazilian population.

To ensure methodological reliability, Datafolha maintains an updated database containing demographic and socioeconomic

characteristics of all survey locations. In-person or telephone quality checks were conducted in at least 20% of interviews performed by each interviewer.

Data collection

A preliminary questionnaire was developed in 2014 based on theoretical constructs and previous international studies evaluating sepsis awareness [10]. Content validity and comprehensibility were assessed by sepsis experts, resulting in minor modifications before the final version.

The surveys applied in 2014, 2017 and 2026, included both spontaneous and prompted questions (Electronic Supplement 1). Although the core questions remained consistent across the three surveys, minor differences existed over time. Participants were initially asked whether they had ever heard the term "sepsis." In 2014 and 2017, only participants who answered "yes" to the question "Have you ever heard the term sepsis?" were asked additional questions assessing whether they correctly recognized sepsis as a severe host response to infection. In 2026, this question was applied to all participants regardless of their previous familiarity with the term. However, to ensure comparability across survey waves, the temporal trend analyses considered only participants on the 2026 survey who answered "yes" to the initial question. Accordingly, adequate basic knowledge of sepsis was defined identically in all survey waves as (1) heard the term *sepsis* and (2) correctly identified it as a severe host response to infection.

In 2017, recognition of the term "septicemia" was additionally evaluated to assess possible underestimation of sepsis awareness. Similar questions regarding myocardial infarction and recognition of its major symptoms were also included. To further assess participants' understanding of the healthcare impact of sepsis, additional prompted questions explored whether sepsis was perceived as a rare disease, a hospital-only disease, a medical emergency, or a leading cause of death. In 2026, an additional option describing sepsis as "the body attacking its own tissues and organs in response to infection" was included and considered correct.

The 2026 survey additionally evaluated two additional domains of sepsis knowledge: (1) understanding of time-dependent nature of sepsis treatment (hereafter referred to as time-dependency knowledge) and (2) awareness of long-term disability after sepsis.

Adequate knowledge on time-dependency was defined as correctly recognizing that earlier diagnosis and treatment increase survival chances. Adequate knowledge on long-term disability was defined as recognizing that sepsis survivors may experience fatigue, cognitive impairment, depression, or functional limitations after recovery. Incorrect and "I do not know" responses were categorized as inadequate knowledge.

Demographic and socioeconomic variables included age, sex, educational attainment, household income, and geographic region. Educational attainment was categorized according to the Brazilian Institute of Geography and Statistics (IBGE) classification [15]. In addition, the surveys included a socioeconomic status (SES) score, a measure commonly used in Brazilian population surveys that is based on household characteristics and assets and reflects a construct closely related to household income [14].

All survey versions (2014, 2017, and 2026) are available in the electronic supplementary material.

Sample size calculation

The estimated minimum sample size was 2,100 participants, based on the Brazilian population aged ≥ 16 years, assuming a margin of error of 2 percentage points and a 95% confidence level.

Statistical analysis

The sampling strategy was designed to reflect the Brazilian population distribution according to age, sex, geographic region, type of city (capital versus countryside), household income, and socioeconomic class, based on data from the Brazilian Institute of Geography and Statistics (IBGE) and the National Household Sample Survey (PNAD) corresponding to each survey year.

Categorical variables were presented as frequencies and percentages. Continuous variables were assessed for normality using graphical methods and the Kolmogorov–Smirnov test and are presented as mean $\pm$ standard deviation or median (interquartile range), as appropriate. Comparisons of response rates across survey years were performed using the chi-square test, followed by partitioned chi-square analyses when appropriate.

Prior to multivariable modelling, unadjusted logistic regression models were fitted for each outcome (basic knowledge, time-dependency and long-term disability) with each sociodemographic covariate entered individually. Predicted probabilities of each outcome across categories of each covariate were estimated from these models.

To identify factors independently associated with basic sepsis knowledge in the overall study population, a multivariable logistic regression model was fitted using the pooled dataset from the 2014, 2017, and 2026 surveys, with survey year included as a categorical covariate to account for temporal differences across waves. Covariates were selected a priori based on epidemiological plausibility and previous literature and included survey year, age group, sex, educational attainment, household income, geographic region, and type of city. The presence of interactions between survey year and the remaining covariates was assessed using a likelihood ratio test comparing a model including all two-way interactions with survey year to a main-effects model. Post hoc, we fitted another logistic regression model including survey year, educational attainment, and their interaction to assess whether the magnitude of the increase in knowledge along the years differed according to educational attainment. Results were presented as odds ratios (ORs) with 95% confidence intervals (CIs).

For the 2026 survey, separate multivariable logistic regression models were fitted to evaluate factors associated with knowledge of the time-dependent nature of sepsis treatment and awareness of long-term disability after sepsis. These outcomes were analyzed separately because correct responses to these questions were not necessarily contingent upon fulfilling the definition of basic sepsis knowledge. Results are presented as odds ratios with corresponding 95% confidence intervals. The relative importance of predictors was evaluated using permutation-based variable importance analysis, complementing the odds ratios derived from the logistic regression models. For each outcome, the area under the receiver operating characteristic curve (AUROC) of the full multivariable model was first calculated as the reference performance. Subsequently, each predictor was randomly permuted 1,000 times, while all remaining variables were kept unchanged, thereby disrupting its association with the outcome while preserving its distribution and the structure of the remaining predictors. The AUROC was recalculated after each permutation, and variable importance was quantified as the mean reduction in AUROC relative to the full model. Larger reductions indicate greater contribution of the predictor to model discrimination, and 95% confidence intervals were derived from the distribution of AUROC reductions across permutations. Because the objective of the multivariable logistic regression models was to identify factors independently associated with sepsis knowledge rather than to develop or validate prediction models, calibration and goodness-of-fit statistics were not formally assessed.

Missing data were minimal and were limited to participants who answered "I do not know" or "Prefer not to answer" to specific survey

questions. These responses were treated as missing for the corresponding analyses, and complete-case analyses were performed. Because missingness resulted exclusively from these non-substantive survey responses rather than incomplete data collection, multiple imputation was not considered appropriate.

All analyses were performed using R software version 4.2.2 (R Foundation for Statistical Computing, Vienna, Austria). Statistical significance was defined as a two-sided p -value < 0.05 .

Results

The 2014 survey included 2,126 participants from 134 Brazilian cities and was conducted between March 7 and 9, 2014. The 2017 survey included 2,100 participants from 130 cities and was conducted between June 6 and 10, 2017. The 2026 survey included 2,086 participants from 130 cities and was conducted between January 12 and 13, 2026. Survey duration ranged from 6–10 min across the study years. Demographic and socioeconomic characteristics of the respondents are presented in [Table 1](#). As expected, higher educational attainment was generally concentrated among higher household income categories ([Figure S1](#)).

Public awareness of sepsis remained low throughout the study period. In 2014, only 140 of 2,126 participants (6.6%) reported having previously heard the term sepsis, and only 56 (2.6%) demonstrated adequate basic knowledge by correctly identifying sepsis as a severe host response to infection ([Table 2](#)). Considering only participants who answered "yes" to the initial question in all survey waves, adequate basic knowledge increased over time, reaching 121 participants (5.8%) in 2017 and 214 participants (10.3%) in 2026 ($p < 0.001$) ([Fig. 1](#)). Of note, in 2026, when all respondents regardless of their answer on the knowledge of the term sepsis were subsequently presented with the recognition question, 764 (36.6%) participants also correctly recognized sepsis as a severe host response to infection. In 2017, a higher percentage of participants recognized the term septicemia (941; 44.8%).

Awareness of the clinical impact of sepsis remained limited. Recognition of sepsis as a medical emergency was low and changed little over time (2014: 392 [18.4%]; 2017: 322 [15.3%]; 2026: 369 [17.7%]). Similarly, only a small proportion of respondents identified sepsis as a major cause of death (2014: 286 [13.4%]; 2017: 116 [5.5%]; 2026: 122 [5.8%]). In contrast, awareness of myocardial infarction remained consistently high across all surveys (2014: 2,086 [98.1%]; 2017: 2,081 [99.1%]; 2026: 2,042 [97.9%]), and most participants correctly identified its major symptoms (2014: 1,878 [90.0%]; 2017: 1,837 [87.5%]; 2026: 1,873 [89.8%]). Detailed responses are presented in [Table 2](#).

In the 2026 survey, knowledge regarding specific aspects of sepsis remained heterogeneous ([Table 2](#)). Most participants recognized that earlier diagnosis and treatment improved sepsis survival [1,460, 70.0%]. Awareness of long-term consequences was considerably lower. Only 509/2086 participants (24.4%) recognized that sepsis survivors may experience long-term physical, cognitive, or psychological impairments, whereas 970 (46.2%) underestimated these consequences and 421 (20.2%) reported not knowing whether long-term disabilities could occur.

Participant characteristics according to basic knowledge status are shown in [Table S1](#). Predicted probabilities of adequate basic knowledge across categories of each demographic and socioeconomic covariate are displayed in [Figures S2–S7](#). In the multivariate model, survey year was independently associated with higher knowledge, with respondents in 2017 (OR 2.25, 95% CI 1.63–3.16) and 2026 (OR 3.45, 95% CI 2.54–4.75) demonstrating substantially greater odds of adequate knowledge compared with those surveyed in 2014 ([Table 3](#)). Higher educational attainment was the strongest sociodemographic determinant of basic knowledge, showing a

Table 1

General characteristics of the population across the 2014, 2017, and 2026 surveys.

Variáveis	2014 n = 2,126	2017 n = 2,100	2026 n = 2,086
Age, years, mean $\pm$ SD	39.6 $\pm$ 16.89	39.2 $\pm$ 16.4	42.6 $\pm$ 16.7
Age, years, n (%)			
16 – 24	446 (21.9)	453 (21.6)	348 (16.6)
25 – 34	496 (23.3)	534 (25.4)	410 (19.6)
35 – 44	407 (19.1)	366 (17.4)	407 (19.5)
45 – 59	446 (21.0)	441 (21.0)	499 (23.9)
60 ou mais	311 (14.6)	306 (14.6)	422 (20.2)
Sex at birth, female, n (%)	1101 (51.8)	1066(50.7)	1074 (51.5)
Education level, n (%)			
Illiterate/Incomplete elementary I	251 (11.8)	215 (10.2)	139 (6.7)
Incomplete/complete elementary II	577 (27.1)	509 (24.2)	398 (19.1)
Complete/incomplete high school	929 (43.7)	972 (46.3)	962 (46.1)
Complete/incomplete university level	323 (15.2)	345 (16.4)	488 (23.4)
Postgraduate level	46 (2.2)	59 (2.8)	99 (4.7)
Socioeconomic classification, n (%)			
A	38 (1.8)	.*	75 (3.6)
B	642 (30.2)	–	535 (25.6)
C	1094 (51.4)	–	1007 (48.3)
D/E	352 (16.6)	–	469 (22.5)
Household income (minimal wage)			
<2	929 (43.7)	938 (44.7)	886 (42.5)
2 – 3	435 (20.5)	444 (21.1)	367 (17.6)
3 – 5	338 (15.9)	350 (16.7)	363 (17.4)
5 – 10	232 (10.9)	165 (7.9)	258 (12.4)
> 10	90 (4.2)	62 (3.0)	96 (4.6)
Don't know/didn't answer	102 (4.8)	141 (6.7)	102 (4.9)
Employment status, n (%)			
Active			
Inactive			
Socioeconomical score	1.0 (0.97–1.0)	0.96 (0.79–1.19)	1.04 (0.68–1.23)
Region, n (%)			
Southeast	914 (42.3)	891 (42.4)	896 (42.9)
Northeast	573 (26.9)	546 (26.0)	546 (26.2)
South	307 (14.4)	308 (14.6)	308 (14.8)
Middle west	165 (7.7)	168 (8.0)	168 (8.0)
North	167 (7.9)	187 (8.9)	168 (8.0)
City classification, n (%)			
Capitals	534 (25.1)	539 (25.7)	744 (35.7)
Countryside	1243 (58.5)	1209 (57.6)	1022 (49.0)
Other municipalities in metropolitan region	349 (16.4)	352 (16.7)	320 (15.3)

*Data on socioeconomic classification was not available for the 2017 poll.

marked dose-response relationship across educational categories. Younger age, male sex, residence outside state capitals, and lower household income were independently associated with lower levels of knowledge (Table 3). No significant interactions were observed between survey year and the sociodemographic variables included in the model ($p = 0.628$). In our post-hoc model, while visual inspection suggests a larger increase in knowledge among participants with higher educational attainment, formal testing did not demonstrate a significant interaction between survey year and educational level (Fig. 2, $p = 0.42$). Variable importance assessed through permutation analysis confirmed educational attainment and survey year as the most influential predictors of basic sepsis knowledge (Fig. 3).

Separate multivariable logistic regression models were fitted for knowledge regarding the time-dependent nature of sepsis treatment and awareness of long-term disability after sepsis. Participant characteristics according to these outcomes are shown in Tables S2 and S3, and the predicted probabilities of knowledge across categories of each demographic and socioeconomic covariate are displayed in the Figures S8–S13 (time-dependency) and Figures S14–S19 (long-term disability). For knowledge regarding time-dependency, higher educational attainment remains as the strongest sociodemographic determinant. Higher household income, and female sex were independently associated with correct responses (Table S4). For awareness of long-term disability, associations were generally weaker (Table S5). Despite differences in the regression models, permutation analyses consistently identified educational attainment as the most important predictor across all knowledge domains evaluated. In

contrast, geographic region and city type contributed minimally to model discrimination (Fig. 3)

Discussion

In this large population-based analysis spanning more than a decade, public awareness of sepsis in Brazil increased substantially between 2014 and 2026, suggesting a positive impact of sustained national and international efforts to improve sepsis recognition. Although only a minority of participants fulfilled our strict definition of adequate basic knowledge, a considerably larger proportion demonstrated some understanding of sepsis and its time-dependency nature. Educational attainment emerged as the strongest determinant of sepsis knowledge across all domains evaluated. Importantly, despite the overall improvement in awareness over time, socioeconomic inequalities in knowledge persisted, suggesting that gains in awareness were not driven by reductions in disparities.

Our findings are also consistent with previous studies demonstrating substantial heterogeneity in public sepsis awareness across countries and healthcare settings [8,9,16–20]. A scoping review showed large disparities in awareness, with higher knowledge in high-resource settings and among populations with greater access to education and healthcare information [8]. In this study, the awareness increased over time, particularly after major international sepsis campaigns and the establishment of World Sepsis Day. Our results extend these observations by demonstrating that, even within a

Table 2
Public Knowledge of Sepsis and Myocardial Infarction Across the 2014, 2017, and 2026 Surveys.

Variables	2014 n = 2, ¹ 26	2017 n = 2100	2026 n = 2086	P value
Have you ever heard of sepsis? (yes) ¹	140 (6.6)	304 (14.5)	434 (20.8)	< 0.001
What does it mean? ^{1,2}				< 0.001
A severe body response to infection	56 (2.6)	121 (5.8)	764 (36.6)	
Blood infection	37 (1.7)	85 (4.0)	700 (33.6)	
A rock band	6 (0.3)	8 (0.4)	105 (5.0)	
A step of “lava-jato” operation	–	16 (0.8)	–	
None of the above/ don’t know	41 (1.9)	74 (3.6)	517 (24.8)	
Don’t know				
Adequate basic knowledge	56 (2.6)	121 (5.8)	214 (10.3)	< 0.001
Have you ever heard of septicemia (yes) ^{1,3}	–	941 (44.8)	–	
What does it mean ¹				
A severe body response to infection	–	475 (22.6)	–	
Blood infection	–	375 (17.9)	–	
A rock band	–	2 (0.1)	–	
A step of “lava-jato” operation	–	12 (0.6)	–	
None of the above/ I don’t know	–	77 (3.7)	–	
In your opinion, sepsis is ⁴ :				< 0.001
Something that happens when your body attacks its own tissues and organs in response to infection	–	503 (23.9)	708 (33.9)	
A rare disease	226 (10.6)	305 (14.5)	308 (14.8)	
A medical emergency	392 (18.4)	322 (15.3)	369 (17.7)	
Something you only catch at hospitals	187 (8.8)	268 (12.8)	198 (9.5)	
Something that kills more than myocardial infarction and cancer	286 (13.4)	116 (5.5)	122 (5.8)	
None of the above/don’t know	1035 (48.6)	586 (27.9)	381 (18.3)	
Have you ever heard of myocardial infarction? (yes) ¹	2086 (98.1)	2081 (99.1)	2042 (97.9)	0.005
What are the symptoms of myocardial infarction? ³				
Chest pain radiating to the arm, cold sweats, and nausea	1878 (90.0)	1837 (87.5)	1873 (89.8)	
Fever, cough, and wheezing	25 (1.2)	27 (1.3)	33 (1.6)	
Abdominal pain and vomiting	15 (0.7)	16 (0.7)	12 (0.6)	
Paralysis on one side of the body	110 (5.3)	114 (5.4)	112 (5.3)	
None of the above/ don’t know	58 (2.8)	106 (5.1)	56 (2.7)	
2026 survey additional questions on sepsis knowledge				
Time-dependency nature ¹				
The faster the diagnosis and start of sepsis treatment, the greater the chances of survival.	–	–	1460 (70.0)	
Time has some influence in the outcomes, but the most important factor is treatment choices.	–	–	224 (10.7)	
I’ve never heard that time influences sepsis treatment.	–	–	193 (9.3)	
Time doesn’t make that much difference; what’s important is to be in a good hospital.	–	–	129 (6.2)	
None of the above/ don’t know	–	–	80 (3.8)	
Long-term disabilities ¹				
They may have some long-term effects, but without affecting the person’s quality of life.	–	–	789 (37.8)	
Many people may experience fatigue, memory loss, depression, or other limitations after sepsis.	–	–	509 (24.4)	
I have never heard that sepsis can have lasting effects.	–	–	421 (20.2)	
Sepsis can be fatal while the person is in the hospital, but afterwards the person recovers completely.	–	–	181 (8.7)	
None of the above/ don’t know	–	–	186 (8.9)	

¹Single spontaneous answer. ²In 2026, this question was available also to those who answered “no” in the first question. ³This question was available only for 2017 survey. ⁴Single prompted answer.

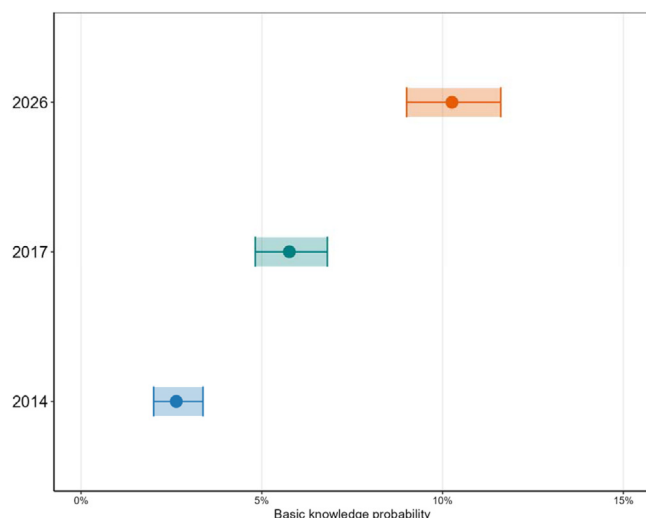


Fig. 1. Predicted probability of adequate basic sepsis knowledge according to survey year. Probabilities were estimated from an unadjusted logistic regression model including survey year as the only independent variable. Points represent predicted probabilities and horizontal bars represent 95% confidence intervals. The figure illustrates the progressive increase in basic sepsis knowledge between 2014 and 2026.

middle-income country, sepsis awareness is strongly socially patterned. Together, these findings suggest that disparities in knowledge occur not only between countries, but also within populations, reinforcing the importance of locally adapted and socially targeted strategies. This is particularly relevant for middle-income countries, where educational inequalities and heterogeneous access to health information may limit the reach of broad public awareness campaigns [21,22].

Importantly, public awareness of sepsis increased substantially over the study period. Although only 10.3% of participants in 2026 fulfilled the standardized definition of adequate basic knowledge used for temporal comparisons, the broader picture was more encouraging. When presented with a stimulated question, regardless of whether they had previously heard the term *sepsis*, a considerably larger proportion of respondents correctly recognized sepsis either as an abnormal response of the body to infection or, albeit imprecisely, as a “blood infection.” This finding was analyzed separately because incorporating it into the temporal trend analysis would have compromised comparability with the 2014 and 2017 surveys. Nonetheless, our findings suggest that public understanding of sepsis extends beyond the strict definition used in our primary outcome and likely reflects the impact of national and international efforts over the past decade to increase awareness of the condition. Interestingly,

Table 3

Factors associated with adequate basic knowledge in the pooled 2014–2026 survey population.

Variables	Odds ratio (95%CI)	p-value
Year		
2014	Reference	–
2017	2.25 (1.63, 3.16)	< 0.001
2026	3.45 (2.54, 4.75)	< 0.001
Sex		
Female	Reference	–
Male	0.68 (0.54, 0.85)	0.001
Age group		
16–19	Reference	–
20–29	2.10 (1.27, 3.65)	0.006
30–39	2.48 (1.51, 4.31)	0.001
40–49	2.09 (1.23, 3.71)	0.008
50–59	2.20 (1.27, 3.95)	0.006
60–69	2.25 (1.26, 4.16)	0.008
70+	3.88 (1.66, 8.74)	0.001
Educational level		
Illiterate/Incomplete elementary I	Reference	–
Incomplete/complete elementary II	1.53 (0.70, 3.84)	0.323
Complete/incomplete high school	3.84 (1.86, 9.31)	0.001
Complete/incomplete university level	7.48 (3.56, 18.37)	< 0.001
Postgraduate level	9.14 (4.00, 23.73)	< 0.001
Household income (minimal wage)		
Don't know/none/didn't answer	0.62 (0.31, 1.13)	0.145
Up to 2	Reference	–
2 to 3	1.31 (0.96, 1.79)	0.090
3 to 5	1.31 (0.94, 1.81)	0.110
5 to 10	1.54 (1.07, 2.20)	0.019
More than 10	1.88 (1.17, 2.97)	0.008
City type		
Capital	Reference	–
Countryside	0.60 (0.47, 0.76)	< 0.001
Other municipalities in the metropolitan region	0.72 (0.52, 0.99)	0.045
Region		
Middle-West	Reference	–
Northeast	1.27 (0.84, 1.99)	0.272
North	1.02 (0.59, 1.76)	0.934
Southeast	1.23 (0.83, 1.87)	0.312
South	0.69 (0.41, 1.17)	0.166

CI: confidence interval. Results are presented as adjusted odds ratios (ORs) with 95% confidence intervals (CIs) obtained from a multivariable logistic regression model including survey year, age group, sex, educational attainment, household income, geographic region, and type of city.

knowledge regarding the time-dependent nature of sepsis treatment was substantially higher than basic awareness of sepsis itself. This finding reinforces that individuals may understand the concept of severe infection requiring urgent treatment even when they are unfamiliar with the term 'sepsis'. Future public awareness strategies may therefore benefit from focusing not only on the term itself, but also on recognition of severe infection and the need for urgent medical evaluation.

Nevertheless, important gaps remain. The striking contrast between awareness of myocardial infarction and awareness of sepsis suggests that low sepsis awareness may not simply reflect limited health literacy. Rather, it may also reflect decades of sustained public education efforts for cardiovascular diseases that have no equivalent to sepsis. The reasons for persistently low adequate awareness of sepsis are likely multifactorial. First, sepsis itself remains a complex and difficult syndrome to define and recognize, even among healthcare professionals [23–25]. This complexity may impair communication with patients and families, leading healthcare professionals to describe the underlying infection rather than explicitly using the term "sepsis". Of note, a higher percentage of the participants in 2017 recognized the term "septicemia". Another challenge may be related to the nonspecific nature of sepsis manifestations. In contrast to acute myocardial infarction or stroke, sepsis lacks a highly recognizable symptom that can be easily

disseminated through public campaigns and readily identified by laypersons. Most manifestations are related to the underlying infection or become apparent only after organ dysfunction develops, which may limit public recognition and delay healthcare-seeking behavior.

Improving public awareness of sepsis may have important implications at multiple levels. In other acute conditions like stroke and acute myocardial infarction, educational campaigns have been associated with reductions in delays in seeking emergency care [26–28]. In sepsis, earlier recognition and timely treatment are strongly associated with improved outcomes [29]. Increased awareness among the public and policymakers may also contribute to greater prioritization of sepsis as a healthcare problem, potentially influencing resource allocation, implementation of quality improvement initiatives, and research funding.

An important finding of our study is that different dimensions of sepsis knowledge appear to be shaped by partially distinct social determinants. Basic awareness of sepsis was independently associated with both educational attainment and socioeconomic conditions. In contrast, the contribution of socioeconomic variables became less consistent when evaluating knowledge regarding the time-dependent nature of sepsis treatment and its long-term consequences. This pattern suggests that different forms of health knowledge may rely on distinct mechanisms of information acquisition and processing. Basic awareness may depend on broader exposure to healthcare systems, media, and social networks. Complex concepts, such as time-dependent treatment and post-sepsis morbidity, likely require higher health literacy and may therefore depend more directly on formal education.

Importantly, although awareness increased substantially over the study period, inequalities did not significantly narrow. We did not identify statistically significant interactions between survey year and key socioeconomic variables, including educational attainment. Nevertheless, the observed temporal patterns are noteworthy. While awareness improved across educational groups, the absolute gains appeared more pronounced among individuals with higher educational attainment, whereas improvements among the least educated groups were comparatively modest. Although these differences should be interpreted cautiously given the absence of a formal interaction, they raise the possibility that gains in sepsis awareness have not been evenly distributed across the population. These findings have important public health implications. Broad awareness campaigns may be sufficient to increase general recognition of sepsis, but improving deeper understanding likely requires educational strategies adapted to different levels of health literacy. This is particularly relevant because previous studies have shown that public awareness of sepsis is generally higher in high-resource settings and tends to improve following awareness campaigns and educational initiatives. Efforts targeting vulnerable populations should therefore move beyond dissemination of the term "sepsis" and incorporate accessible communication regarding warning signs, the urgency of treatment, and the potential long-term consequences of sepsis.

Our study has several strengths, including its population-based design, large sample size, standardized methodology, and the ability to evaluate temporal trends over more than a decade. However, some limitations should be acknowledged. First, certain survey questions differed slightly across years, which may have affected temporal comparisons. Second, as in most survey-based studies, residual selection bias and limitations in response rate assessment cannot be completely excluded. Third, we evaluated awareness and knowledge rather than actual healthcare-seeking behavior. Therefore, we cannot determine whether greater awareness would necessarily translate into earlier presentation, faster diagnosis, or improved clinical outcomes. Finally, although the Datafolha Institute employs a rigorous sampling strategy designed to obtain a sample representative of the Brazilian population, no post-survey weighting was applied in the statistical

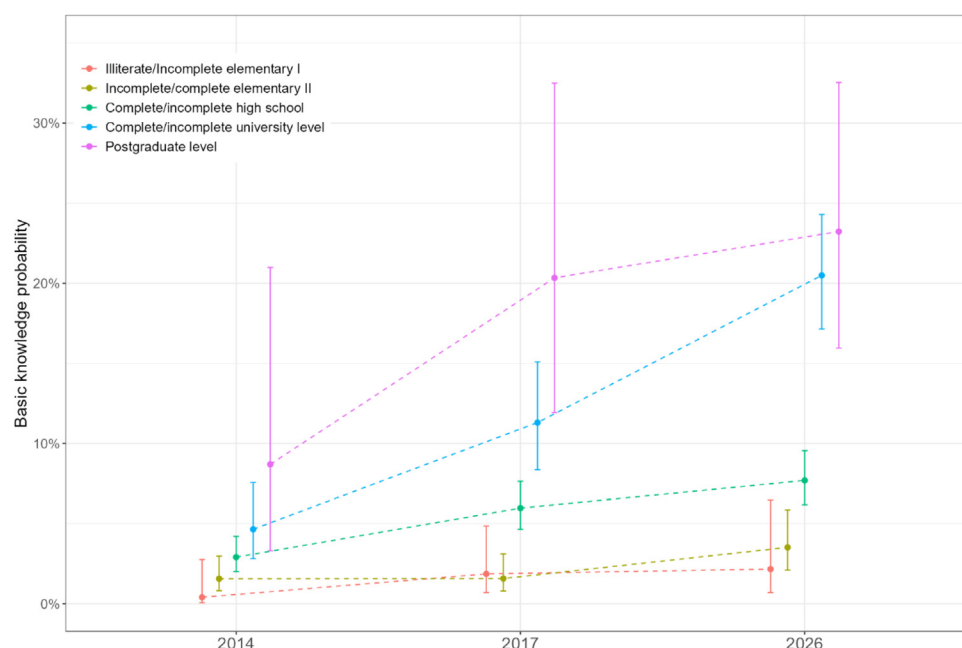


Fig. 2. Predicted probability of adequate basic sepsis knowledge according to educational attainment across survey years. Probabilities were estimated from a logistic regression model including survey year, educational attainment, and their interaction. Points represent predicted probabilities and error bars indicate 95% confidence intervals. While visual inspection suggests a larger increase in knowledge among participants with higher educational attainment, formal testing did not demonstrate a significant interaction between survey year and educational level ($p = 0.42$).

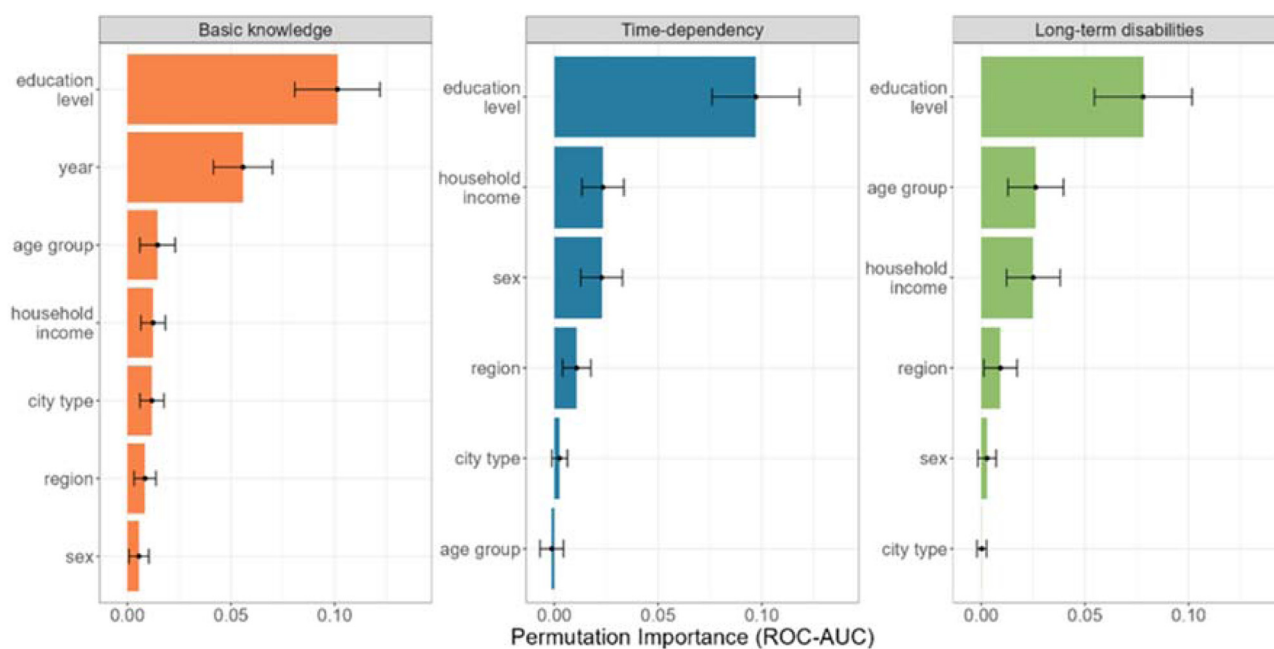


Fig. 3. Relative importance of sociodemographic variables for predicting basic sepsis, time-dependency and long-term disability knowledge. Variable importance was assessed using permutation analysis based on the reduction in the area under the receiver operating characteristic curve (AUROC) following random permutation of each predictor in the final multivariable logistic regression models. Larger reductions in AUROC indicate greater contribution of the predictor to model discrimination. Error bars represent 95% confidence intervals. Educational attainment emerged as the most important predictor across all knowledge domains.

analyses. Consequently, small differences between the study sample and the target population may have remained.

Conclusion

In conclusion, public awareness of sepsis in Brazil has improved substantially over the past decade, reflecting the success of sustained

national and international efforts to increase recognition of this major public health problem. Nevertheless, important gaps remain, and awareness continues to be strongly influenced by educational attainment and socioeconomic factors. These findings highlight both the progress achieved and the need for continued efforts involving public health authorities, healthcare professionals, educators, researchers, and policymakers to further improve sepsis awareness and promote equitable access to health information.

Author contributions

Conceptualization: FRM, LCPA, DCS.
 Formal analysis: TMS, FRM.
 Funding acquisition: FRM, DCS.
 Investigation: FRM, LCPA, LRP, JFF, JLDS, TL, RBM, RS, RR, DCS.
 Methodology: FRM, LCPA.
 Project administration: LRP, JFF, JLDS.
 Writing – original draft: FRM, LCPA.
 Writing – review and editing designed the study: FRM, LCPA, LRP, JFF, JLDS, TL, RBM, RS, TMS, RR, DCS.

Ethical approval and consent to participate

The study was approved by the Ethics Committee of the Federal University of São Paulo (CAAE 54357815.7.0000.5505), and all participants provided informed consent.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used ChatGPT only for English editing. The authors reviewed and edited the output as needed and take full responsibility for the content of the published article.

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Consent for publication

Not applicable

Availability of data

All the data sets and data dictionary generated for this study will be publicly available immediately following publication (no end date) upon reasonable from researchers who provide a methodologically sound proposal request to the Latin America Sepsis Institute (LASI, secretaria@ilas.org.br), subject to prior assessment and approval of the proposal by LASI council. To gain access, data requestors will need to sign a data access agreement.

Data availability

The data that has been used is confidential.
 Data will be made available on request.

Declaration of competing interest

The authors declare no conflicts of interest.

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Not applicable

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.aicj.2026.100128>.

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