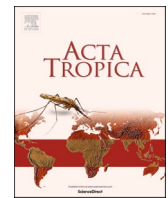


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Knowledge of health workers relating to sepsis awareness and management in Lambaréné, Gabon

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ABSTRACT

Background In 2016, the third international consensus definitions for sepsis and septic shock (Sepsis-3) task force provided revised definitions for sepsis and septic shock. This study explores knowledge regarding sepsis among health workers in Lambaréné, Gabon.

Methods We conducted a self-administered questionnaire-based survey about sepsis among health workers from the referral regional hospital, the research center, and primary care health facilities in the Lambaréné region. Participants were from the referral regional hospital, the research center, and primary health care facilities. A score of one was given to each correct answer. The global score out of a possible score of twenty was calculated, and the proportion of correct responses was determined.

Results A total of 115 health workers (physicians, nurses and assistant nurses) completed the questionnaire, of which 48.7% (56/115) provided a valid definition of sepsis, but 74% (85/115) had never heard about the quick Sequential Organ Failure Assessment (qSOFA) score. The proportion of correct answers was comparable across the three health profession categories. The median global score across all health workers was 11 [IQR, 9-14.5] out of 20. Physicians attained higher global scores [14 (IQR, 11-15)] than assistant nurses [11 (IQR, 8-13), $P=0.007$]; their global score was comparable to that of nurses.

Conclusion There are considerable knowledge gaps regarding sepsis among health workers in Lambaréné, potentially impairing the prompt recognition and management of sepsis. There is a need to establish periodic up-to-date training to improve sepsis knowledge.

1. Background

Nearly fifty million people worldwide are afflicted by sepsis every year, resulting in eleven million deaths annually (Rudd et al., 2020), and sub-Saharan Africa countries are amongst those most heavily affected (Rudd et al., 2020). The definition of sepsis has been revised recently,

with sepsis now being defined as a life-threatening organ dysfunction caused by a dysregulated host response to infection (Singer et al., 2016). Septic shock is clinically characterised by vasopressor requirement to maintain a mean arterial pressure of 65 mmHg or higher, and a serum lactate level greater than 2 mmol/L (>18 mg/dL) in the absence of hypovolemia (Singer et al., 2016). The quick SOFA (qSOFA) score,

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consisting of a respiratory rate of 22/min or greater, altered mentation, and systolic blood pressure of 100 mmHg or less, was established as bedside method for the prompt identification of severely ill patients who might have sepsis. The previous definition using the systemic inflammatory response syndrome (SIRS) criteria lead to the inclusion of an excess of patients with infection or inflammation, and yielded a low specificity (Schmedding et al., 2019; Singer et al., 2016). In a cohort of patients recruited at the Albert Schweitzer Hospital (HAS) in Lambaréné, Gabon, sepsis (using the old definition based on SIRS criteria) was diagnosed in 28.1% of patients, with an associated mortality of 17.2% (Huson et al., 2015). Knowledge about signs and symptoms of sepsis and prompt medical treatment are essential for the successful management of sepsis. While studies assessing the knowledge on sepsis have been performed in various settings (Eitze et al., 2018; Rubulotta et al., 2009; Watkins et al., 2020; Zaccone et al., 2017; Ziglam et al., 2006), few studies were performed in low-and-middle-income countries (LMICs) to date (Brizuela et al., 2019; Marshall-Brown et al., 2016). We hypothesise that in LMICs within Africa such as Gabon, knowledge about sepsis among health workers is sub-optimal. This study investigates knowledge regarding sepsis awareness and management among health workers in Lambaréné, Gabon.

2. Methods

2.1. Study design and setting

From February 2020 to June 2020, we conducted a cross-sectional survey in health workers from seven health facilities, including a referral hospital (HAS), a medical research center (CERMEL), and five primary care health facilities (PHFs) in Lambaréné, in Moyen-Ogooué province of Gabon. While CERMEL and the PHFs have capacity to manage cases of suspected infectious diseases, they refer patients to the regional referral hospital in case of severe infection or complication (Gabon's Ministry of Public Health, 2011). Participating care providers included in our study were physicians, nurses, and assistant nurses.

2.2. Survey instrument

We developed the questionnaire using World Health Organization (WHO) recommendations, Surviving Sepsis Campaign international guidelines (Dellinger et al., 2017; World Health Organization, n.d.), and content from previously published articles on the knowledge of sepsis among health care practitioners (Fleischmann et al., 2016; Marshall-Brown et al., 2016; Rahman et al., 2019). A panel comprising two local physician-researchers and one senior expert reviewed the questionnaire. The questionnaire was submitted in a pilot test to ten health workers to check comprehension and clarity of the questions. The reliability of the questionnaire was tested, and the final questionnaire's Cronbach's alpha coefficient was 0.8. Each correct answer given to the question scored one point. The total correct answer score possible was 20 (Additional file 1).

2.3. Data collection

The researchers visited study sites to explain the study details to potential participants, who were subsequently approached individually. A self-administered questionnaire was distributed to all eligible health workers (physicians, nurses and assistant nurses).

2.4. Sample size

Due to the limited human resources of the health facilities of the Lambaréné region, we included all consenting health workers amongst those who were eligible and available.

2.5. Statistics

Study data was collected and doubly entered into a Research Electronic Data Capture (REDCap) database (Harris et al., 2009). Percentages were calculated for the categorical data. Fisher's exact test was used to compare proportions. In addition, the global score was calculated from the sum of correct answers to each question. The global score variable normality and variance homogeneity were tested using Shapiro-Wilk and Bartlett tests, respectively. Thus, in the analyses of subgroups, the Student's t-test was used. A two-sided p-value < 5% was considered statistically significant. The analysis was performed using Rstudio version 4.0.2 ("RStudio Team (2020). RStudio: Integrated Development for R. RStudio, PBC, Boston, MA URL," n.d.).

3. Results

A total of 122 subjects were invited to participate in the study, of which 115 (94%) completed the entire questionnaire. A total of 57/115 (49.6%) participants were from the regional referral hospital; fifteen percent (17/115) were physicians and 53% (61/115) were nurse assistants. The median length of service of the health worker included was 7 years [IQR 3-14] (Table 1). Fifty-six of 115 (48.7%) responded that 'sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection'. The sign of sepsis recognised by the greatest proportion of participants was fever (92%, 106/115), followed by altered mental status (74.8%, 86/115) and tachycardia (67%, 77/115); the least recognised signs were tachypnoea and hypothermia. A large proportion agreed that securing large-bore intravenous access, initiation of blood cultures, and broad-spectrum antibiotic therapy are important for successful sepsis management. However, only 32% (37/115) responded that in case of hypotension, initial resuscitation with crystalloid fluids is important. While thirty (26%) interviewees reported knowledge of the qSOFA score, a total of 13% (15/115) recognised the three criteria that comprise it.

3.1. Comparison of correct answer according to professional categories

The median global score across all health worker respondents was 11 [IQR, 9-14.5]; however, there were statistically significant performance differences across the three professional categories.

For individual questions, physicians provided correct responses more frequently than nurses and nurse assistants. However, the difference was not statically significant except for the questions related to the definition of qSOFA and the practical management of sepsis (Table 2). When comparing the global score of health worker per the type of health facilities, assistant nurses from the research center performed significantly

Table 1
Baseline characteristics of health workers.

Characteristics	[ALL] N=115 (%)	Referral Hospital N=57 (%)	Research center N=28(%)	Primary care health facilities N=30 (%)
Gender				
F	82 (71.3)	42 (73.7)	21 (75.0)	19 (63.3)
M	33 (28.7)	15 (26.3)	7 (25.0)	11 (36.7)
Profession category				
Physicians	19 (16.5)	7 (12.3)	9 (32.1)	3 (10.0)
Nurses	29 (25.2)	19 (33.3)	0 (0.00)	10 (33.3)
Assistant nurses	67 (58.3)	31 (54.4)	19 (67.9)	17 (56.7)
Education level:				
Secondary	87 (75.7)	47 (82.5)	20 (71.4)	20 (66.7)
University	28 (24.3)	10 (17.5)	8 (28.6)	10 (33.3)
Length of service (years), Median [IQR]	7.00 [3.00- 14.0]	7.00 [3.00- 17.0]	4.00 [2.75- 7.00]	14.0 [7.00- 17.2]

Table 2
Awareness and sepsis knowledge: distribution of correct, incorrect answers per item per professional group.

Questionnaire items	[ALL] N=115 (%)	Assistant nurses N=67(%)	Nurses N=29 (%)	Physicians N=19(%)	P-value*
1. Have you ever heard about the qSOFA score?					0.914
No	85 (73.9)	49 (73.1)	21 (72.4)	15 (78.9)	
Yes	30 (26.1)	18 (26.9)	8 (27.6)	4 (21.1)	
2. What do you think is the most appropriate definition of sepsis?					0.233
Sepsis is a life-threatening organ dysfunction caused by a dysregulated host response to infection (<i>Correct answer</i>)					
No	59 (51.3)	31 (46.3)	15 (51.7)	13 (68.4)	
Yes (<i>Correct answer</i>)	56 (48.7)	36 (53.7)	14 (48.3)	6 (31.6)	
3. Do you think the following symptoms and signs could be associated with sepsis?					0.700
a) Fever					
No	9 (7.83)	6 (8.96)	1 (3.45)	2 (10.5)	
Yes (<i>Correct answer</i>)	106 (92.2)	61 (91.0)	28 (96.6)	17 (89.5)	
b) Hypothermia					0.079
No	48 (41.7)	33 (49.3)	11 (37.9)	4 (21.1)	
Yes (<i>Correct answer</i>)	67 (58.3)	34 (50.7)	18 (62.1)	15 (78.9)	
c) Tachycardia					0.074
No	38 (33.0)	25 (37.3)	11 (37.9)	2 (10.5)	
Yes (<i>Correct answer</i>)	77 (67.0)	42 (62.7)	18 (62.1)	15 (89.5)	
d) Tachypnoea					0.022
No	53 (46.1)	38 (56.7)	10 (34.5)	5 (26.3)	
Yes (<i>Correct answer</i>)	62 (53.9)	29 (43.3)	19 (65.5)	14 (73.7)	
e) Hypotension					0.021
No	50 (43.5)	31 (46.3)	16 (55.2)	3 (15.8)	
Yes (<i>Correct answer</i>)	65 (56.5)	36 (53.7)	13 (44.8)	15 (84.2)	
f) Alteration of consciousness					0.500
No	29 (25.2)	18 (26.9)	5 (17.2)	6 (31.6)	
Yes (<i>Correct answer</i>)	86 (74.8)	49 (73.1)	24 (82.8)	13 (68.4)	
4. Which of the following is NOT a component of the qSOFA score?					0.022

Table 2 (continued)

Questionnaire items	[ALL] N=115 (%)	Assistant nurses N=67(%)	Nurses N=29 (%)	Physicians N=19(%)	P-value*
Tachycardia (<i>good answer</i>)					
No	100 (87.0)	56 (83.6)	29 (100)	15 (78.9)	
Yes (<i>Correct answer</i>)	15 (13.0)	11 (16.4)	0 (0.00)	4 (21.1)	
5. The blood culture must be performed in case of sepsissuspicion					0.438
No	17 (14.8)	12 (17.9)	4 (13.8)	1 (5.26)	
Yes (<i>Correct answer</i>)	98 (85.2)	55 (82.1)	25 (86.2)	18 (94.7)	
6. Which patients do you think should be monitored for the onset of sepsis?					0.456
a) Patients suffering from tuberculosis					
No	59 (51.3)	37 (55.2)	12 (41.4)	10 (52.6)	
Yes (<i>Correct answer</i>)	56 (48.7)	30 (44.8)	17 (58.6)	9 (47.4)	
b) Patients admitted to the emergency room for severe infection					0.384
No	39 (33.9)	24 (35.8)	7 (24.1)	8 (42.1)	
Yes (<i>Correct answer</i>)	76 (66.1)	43 (64.2)	22 (75.9)	11 (57.9)	
c) Patients infected with HIV					0.349
No	57 (49.6)	36 (53.7)	11 (37.9)	10 (52.6)	
Yes (<i>Correct answer</i>)	58 (50.4)	31 (46.3)	18 (62.1)	9 (47.4)	
d) All patients					0.506
No	88 (76.5)	51 (76.1)	24 (82.8)	13 (68.4)	
Yes	27 (23.5)	16 (23.9)	5 (17.2)	6 (31.6)	
7. Which of the following are appropriate for the management of sepsis?					0.018
a) Secure large-bore IV access					
No	35 (30.4)	26 (38.8)	8 (27.6)	1 (5.26)	
Yes (<i>Correct answer</i>)	80 (69.6)	41 (61.2)	21 (72.4)	18 (94.7)	
b) If hypotension, initially resuscitate with crystalloid					<0.001
No	78 (67.8)	56 (83.6)	15 (51.7)	7 (36.8)	
Yes(<i>Correct answer</i>)	37 (32.2)	11 (16.4)	14 (48.3)	12 (63.2)	
c) Collect blood for blood culture and start broad-spectrum					0.059

(continued on next page)

Table 2 (continued)

Questionnaire items	[ALL] N=115 (%)	Assistant nurses N=67(%)	Nurses N=29 (%)	Physicians N=19(%)	P-value*
antibiotic therapy					
No	29 (25.2)	21 (31.3)	7 (24.1)	1 (5.26)	
Yes (Correct answer)	86 (74.8)	46 (68.7)	22 (75.9)	15 (94.7)	
d) Maintain good oxygen saturation					<0.001
No	52 (45.2)	41 (61.2)	8 (27.6)	3 (15.8)	
Yes	63 (54.8)	26 (38.8)	21 (72.4)	16 (84.2)	
8. Do you think the following attitudes and practice may be essential for the management of sepsis?					
a) Use of antibiotics					0.493
No	9 (7.83)	6 (8.96)	3 (10.3)	0 (0.00)	
Yes (Correct answer)	106 (92.2)	61 (91.0)	26 (89.7)	15 (100)	
b) Use of crystalloid					0.351
No	47 (40.9)	30 (44.8)	12 (41.4)	5 (26.3)	
Yes (Correct answer)	68 (59.1)	37 (55.2)	17 (58.6)	14 (73.7)	
c) Use of vasopressor					0.004
No	89 (77.4)	57 (85.1)	23 (79.3)	9 (47.4)	
Yes (Correct answer)	26 (22.6)	10 (14.9)	6 (20.7)	10 (52.6)	
d) Earlier identification of the source of infection					0.232
No	78 (67.8)	44 (65.7)	18 (62.1)	16 (84.2)	
Yes (Correct answer)	37 (32.2)	23 (34.3)	11 (37.9)	3 (15.8)	

*Fisher's exact test for p-values comparing the number of correct responses in the three professional categories.

better than their colleagues from PHFs (Fig. 2).

4. Discussion

This study of sepsis knowledge among health workers representing all level of health facilities from Lambaréné, Gabon, demonstrates important knowledge gaps in sepsis awareness and management. To the best of our knowledge, this study is the first of its kind from sub-Saharan Africa assessing the knowledge of health workers on sepsis, since the publication of the Sepsis-3 definitions.

While our results are similar to studies from Malawi (Marshall-Brown et al., 2016), Malaysia (Rahman et al., 2019), and Brazil (Assunção et al., 2010), which reported insufficient knowledge of health workers on sepsis, the proportion of correct responses in our study is lower compared with these studies. The difference between studies could be due to differences between the respective questionnaires applied. The knowledge assessment in our questionnaire is based on the Sepsis-3 definition, which was published four years ago. The lower number of infectious diseases and intensive care specialists in our study

population offers an additional explanation.

As to be expected according to the level of formal education, physicians provided correct answers in higher frequency than nurses and nurse assistants. Overall, our findings were not unexpected because there were no recent specific training or educational activities related to sepsis for health workers in Lambaréné. Furthermore, there is no national guideline or recommendation for the management of sepsis. When comparing performance of health worker across the type of health facilities, assistant nurses from the research center scored better than their counterparts from the PHFs, despite the fact that the research center does not often manage complicated infectious disease cases like sepsis. Though unexpected, this better performance of assistant nurses from the research center might be due to the shorter median period of service employment [4 years (IQR 2.75-7)], which reflects recent graduation from nursing school and therefore more recent exposure to formal teaching on sepsis.

A small number of participating health worker recognised tachypnoea and hypothermia as signs of sepsis. Moreover, only 32% of health workers responded that the crystalloid is appropriate for management of sepsis. This illustrates the gap that apparently exists in the management of sepsis by Gabon's health workers. The Surviving Sepsis Campaign (SSC) guidelines recommends to rapidly administer a minimum of 30 mL/kg crystalloid solution intravenously in patients with septic shock and those with elevated blood lactate levels (Levy et al., 2018). However, recent findings suggest an individualised, conservative and physiology-guided approach to fluid resuscitation (Marik et al., 2020). Due to the absence of national guidelines, the practitioners manage sepsis cases according to their own experience, knowledge, training and drugs and equipment available.

Our study also highlights the need for policy makers to contextualise international guidelines. Guidelines International Network (G-I-N) defines guideline adaptation as "the systematic approach to the modification of a guideline(s) produced in one ... setting for application in a different context" (Wang et al., 2018). It requires substantial time and resources to develop and update high-quality guidelines that are feasible and useful (Fervers et al., 2011). There are at least eight published frameworks for adaptation of clinical, public health and health services guidelines (Darzi et al., 2017). Critical to the success of this process is collaboration and local ownership, engaging with key stakeholders to co-create guidelines that are relevant and responsive to contextual needs. Specifically, there is a need to ensure buy-in and input from the future guardians of the guidelines (district or provincial health offices); the future implementers of the guidelines (community health workers and health service providers); and future beneficiaries of the guidelines (community members). To ensure the guidelines' content, quality, consistency between sources and acceptability/applicability of the recommendations, these guidelines can be validated in accordance with the criteria of the Appraisal of Guidelines for Research and Evaluation (AGREE) checklist (Brouwers et al., 2016). Following such an adaptation process, there is a need to review the perceptions and challenges of adaptation and implementation of guidelines, which can use a modified method of the ADAPTE process (Fervers et al., 2011).

As with most surveys, our study has certain limitations. Despite delivering the survey similarly across respondents, there is a possibility that respondents felt compelled to provide 'socially acceptable answers' rather than answers that reflected their true opinion or awareness of the topic. This study was not performed on the full scale of a comprehensive Knowledge, Attitudes, and Practice (KAP) study, due to a shortened period available to conduct the study. Whilst we believe that our findings are most likely generalisable to a certain degree to other regions in Gabon because of shared context, we call for a national survey to fully assess and further understand the knowledge, attitudes and practice regarding sepsis among health workers in order to increase awareness.

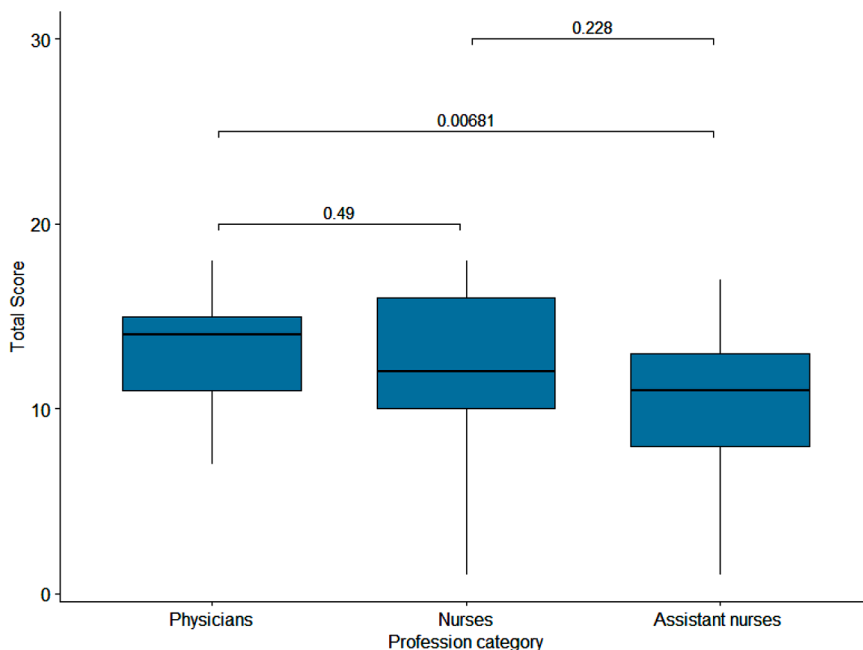


Fig. 1. Global score comparison according to the professional categories.

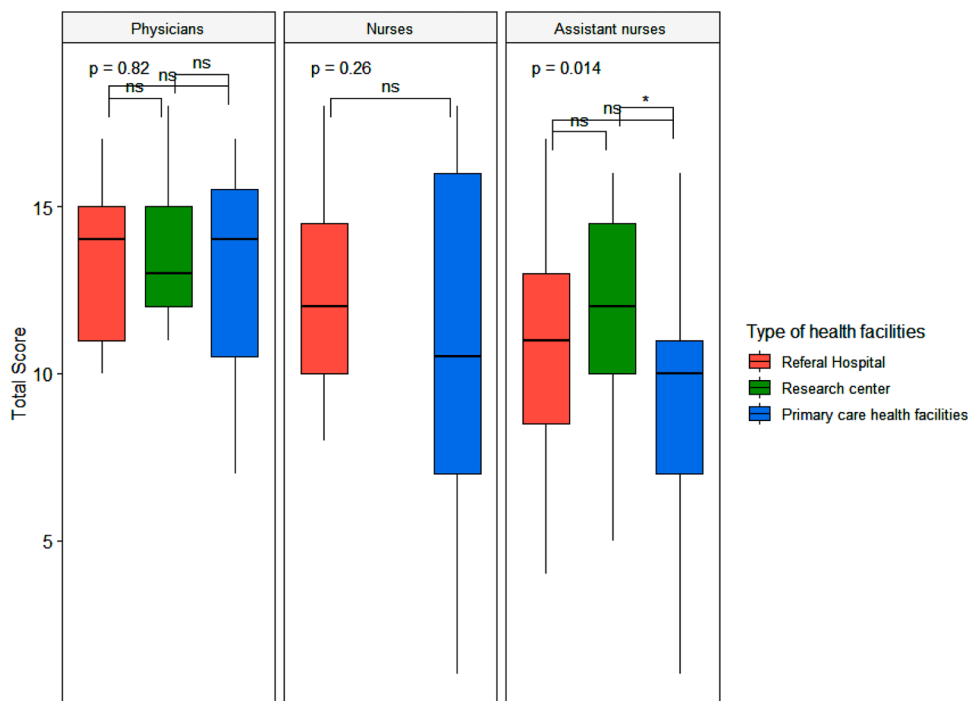


Fig. 2. Global score comparison of the professional categories with respect to type of health facilities. **Figure 2 legend text.** Assistant nurse’s profession category: Research center [12 (IQR,10-14.5)] vs referral hospital [11 (IQR 8.5-13)], P=0.432; Referral hospital [11 (IQR 8.5-13)] vs primary care health facility [10 (IQR 7-11)], P=0.055.; Research center [12 (IQR 10-14.5)] vs primary care health facilities [10 (IQR 7-11)], *P=0.016. There was no statistically significant difference when comparing global score of physicians or with respect to type of health facilities.

5. Conclusion

There is a knowledge gap of Lambaréné health workers about sepsis. The majority of respondents were unaware about the new Sepsis-3 definition. In general, physician’s knowledge is better than that of nurses and nurse assistants. There is an opportunity to introduce regular training programs in sepsis irrespective of the type of health facilities surveyed.

Additional Files

Additional file 1.Sepsis KAP questionnaire (translated from the French original)

KAP SEPSIS QUESTIONNAIRE

SECTION A: Basic information

1. ID
2. Gender: M F
3. Health facility _____
4. Hospital service: _____
5. Type of health facility

- Referral hospital
 Secondary hospital (health center)
 First level hospital (dispensary)
 Research center
 Other
6. Education level: O primary O secondary O university
 7. Profession: Doctor O assistant nurse O nurse O Others O
 8. Duration of medical career

SECTION B-KAP

Knowledge and perception of sepsis

1. Have you ever heard of the Third International Consensus on Definitions of Sepsis and Septic Shock (Sepsis-3) and qSOFA

Yes No

2. What do you think is the most appropriate definition of sepsis?

- a) Blood contamination by a microbe
 b) life-threatening organ dysfunction caused by a dysregulated host response to infection.
 c) Systemic inflammatory response caused by infection
 d) Allergic reaction against germs

3. Do you think the following symptoms and signs are associated with sepsis? a) Fever Yes No or not sure b) Hypothermia Yes No or not sure c) Tachycardia Yes No or not sure d) Tachypnea Yes No or not sure e) Hypotension Yes No or not sure f) Altered state of consciousness Yes No or not sure

4. Which of the following is NOT a component of the qSOFA score?

- a) Glasgow score <15
 b) Respiratory rate ≥ 22 c / min
 c) Tachycardia > 90 beats / min
 d) Systolic blood pressure ≤ 100 mmHg

5. The blood culture must be requested in the event of any suspicion of sepsis

True False

6. Which patients do you think should be monitored for the onset of sepsis. a) Patients suffering from tuberculosis b) Patients admitted to the emergency room for severe infection c) Patients infected with HIV d) All patients e) I don't know

7. Which of the following are urgently appropriate for the management of sepsis? a. Secure large-bore IV access b. If hypotension, initially resuscitate with crystalloid c. Collect blood for blood culture and start broad-spectrum antibiotic therapy d. Maintain good oxygen saturation

8. Do you think the following practice could be useful for the management of sepsis? a) using of antibiotics Yes No or not sure b) using of crystalloids Yes No or not sure c) using of vasopressors Yes No or not sure d) Earlier identification of the source of infection Yes No or not sure

For section, where appropriate, single to multiple answers were correct:

2-b;3- a-b-c-d-e-f; 4-c; 5-True; 6-a-b-c; 7-a-b-c-d; 8-a-b-c-d

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