
# Report on the survey of practical diagnostic criteria for sepsis in different resource settings in the Asia Pacific region

Asia Pacific Sepsis Alliance

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# Background

The Global Burden of Disease (GBD) sepsis project provided an estimation of global of sepsis incidence in 2017 at 48.9 million patients (1). It improved on previous attempts to study global sepsis incidence by including indirect data from low- and middle-income countries (2). Since the GBD sepsis estimates were indirectly calculated from death records and case fatality data, mostly from obtained resource-rich settings, further direct epidemiological studies are needed to assess global sepsis burden across various resource settings.

The current Sepsis-3 criteria provides a precise and objective epidemiological sepsis definition using the sequential organ failure assessment score (SOFA) (3). However, it is often challenging to apply the Sepsis-3 criteria in low resource settings(4, 5, 6, 7). This is due to the requirement of conducting several lab tests to apply SOFA which is not accessible at most resource-limited settings due to resource constraints(8). Moreover, there is concern that the current sepsis-3 definition might be less sensitive to recognise sepsis patients with unfavorable outcomes and tropical infections in low and middle income countries(6). This means it is not feasible to apply Sepsis-3 criteria in low resource settings to recognise sepsis cases as well as study sepsis epidemiology. As about half of the global sepsis cases are present in the Asia pacific region(9), an alternative, pragmatic diagnostic criteria of sepsis is needed which can be easily used in clinical practice by healthcare providers across various clinical specialties and healthcare settings which are resource constraint as well as to estimate the burden of sepsis in this region.

This survey was conducted to gather information on how sepsis is diagnosed clinically in different resource settings and develop a pragmatic diagnostic criterion of sepsis applicable across all healthcare settings.

# Method

### Survey design

This was an online international, cross-sectional survey. The survey was conceptualised, designed, coordinated, and executed by the Asia Pacific Sepsis Alliance (APSA) which is a regional network of the Global Sepsis Alliance. A steering committee composed of critical care clinicians and researchers from the Asia Pacific region with representation from both HICs and LMICs and led by Dr. Lowell Ling, provided the oversight.

The Chinese University, Survey and Behavioural Research Ethics Committee, Hong Kong provided ethics approval (SBRE-22-0760).

*Steering committee*

- Dr. Lowell Ling – Hong Kong (Lead)
- Dr Brett Abbenbroek - Australia
- Dr Ashwani Kumar – Australia/India
- Prof Simon Finfer AO - Australia
- Prof Bala Venkatesh – Australia/India
- A/Prof Naomi Hammond – Australia
- A/Professor Toh Leong Tan – Malasia
- Prof Ganbold Lundeg – Mongolia
- Dr Gentle Shreshtha - Nepal
- Dr Ee ling Goh - Singapore
- Dr Kay Cee Choong – Singapore
- Dr Vu Quoc Dat - Vietnam

**Survey administration**

The survey was conducted between October and November 2023. The potential survey participants included health care providers involved in the diagnosis, treatment, or study of sepsis from all income countries and regions in the Asia Pacific region. Healthcare settings included in-hospital such as accident and emergency, medical, surgical, intensive care along with outside hospital such as primary or community care and ambulance. At the time of the survey the APSA network included 33 countries from the Asia Pacific region ranging from high income countries (HICs) to low-income countries (LICs).

The potential participants were first invited via email obtained through personal contacts within the Asian Pacific Sepsis Alliance and other research networks. Respondents were then asked to suggest other suitable participants to join this study (snowball sampling). Respondents were also asked about their interest to participate in a subsequent Delphi study to consolidate the survey results and construct a pragmatic definition of sepsis relevant for the Asia Pacific region. Each respondent provided confirmation that they understood participation was voluntary and that survey completion implied consent for researchers to share and publish the data. Two reminders were sent to increase the participation in survey.

### Questionnaire

The questionnaire was in English and included 20 questions, divided in to three parts. First part included 10 questions related to the demographics of the participants. Second part included six questions on sepsis recognition. The last part included four questions related to other experts and willingness to participate in the planned Delphi study (Appendix A)

### Data collection

The survey data was collected using a commercial application Survey Monkey Inc. (San Mateo, California, USA; www.surveymonkey.com).

### Data analysis

Survey data was recoded, analysed, and reported using descriptive statistics as frequency with percentage. Data analysis was performed using Microsoft Excel (Microsoft Corporation 2018; https://office.microsoft.com/excel).

## Results

Survey was sent out to 141 potential participants including 105 individuals and 36 professional organisations representing a range of country income categories including low income (10%), low-middle income (44%), upper-middle income (18%) and high income (28%). Twelve email addresses bounced, 23 didn't open and 2 individuals opted out. Of the remaining 103 invited participants, 34 (24.1%) started the survey and 33 (23.4%) completed it (Figure 1).

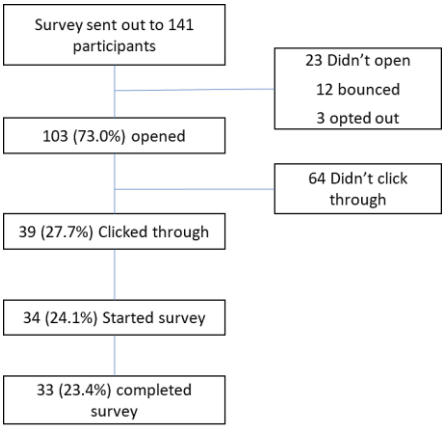
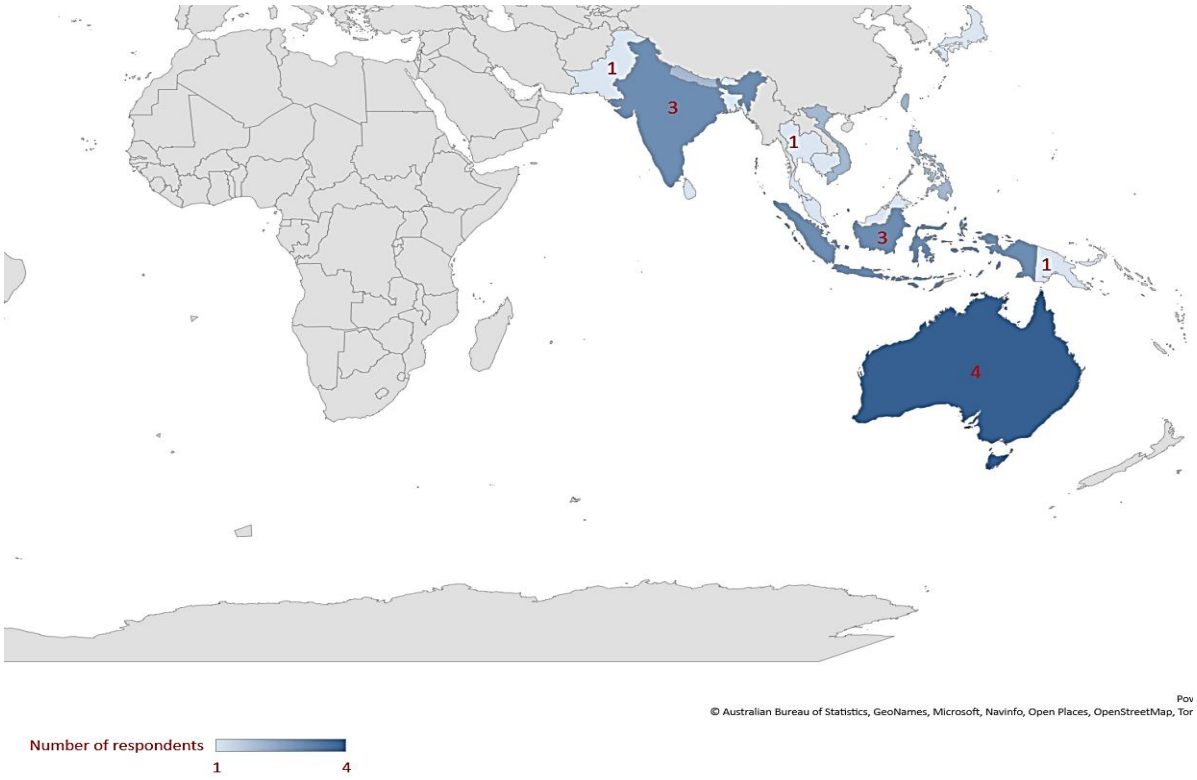



Figure 1 Study flow

The respondents who completed the survey were from 19 countries. There were four respondents from Australia (12.1%), three (9.1%) each from India, Hong Kong and Indonesia, and two (6.1%) each from Nepal, Philippines, Singapore, Taiwan and Vietnam with respondents. (Figure 2) Sixteen (48.5%) respondents were from lower middle-income countries (LMIC), 12 (36.4%) from HICs, 3 (9.1%) from upper middle-income countries (UMIC) and 2 (6.1%) from LICs.

**Figure 2 Geographical distribution of survey respondents**




The demographic characteristics of the survey respondents are shown in Table 1. About three-fourth (25; 75.7%) respondents were males and two-third (21, 63.6%) were aged between 45 to 64 years. Most respondents worked in Intensive Care (23; 69.7%) unit of a public hospital (21, 63.6%) with a university affiliation (24; 72.7%). About 70% (23) respondents had more than 15 years of experience and all except one were involved in the clinical management of sepsis.

**Table 1 Demographic characteristics of survey respondents**

| | Number of respondents (N) | | n | % |
|---|---|---|---|---|
| Age groups (years) | 33 | 25-34 | 2 | 6.1% |
| | | 35-44 | 6 | 18.2% |
| | | 45-54 | 14 | 42.4% |
| | | 55-64 | 7 | 21.2% |
| | | 65 or more | 4 | 12.1% |
| Gender | 33 | Male | 25 | 75.8% |
| | | Female | 8 | 24.2% |
| Primary area of practice | 33 | Primary Care/Community Health | 1 | 3.0% |
| | | Ambulance | 0 | 0.0% |
| | | Anaesthesiology | 2 | 6.1% |
| | | Emergency | 3 | 9.1% |
| | | General Medicine | 1 | 3.0% |
| | | Intensive Care | 23 | 69.7% |
| | | Infectious Diseases | 2 | 6.1% |
| | | Surgery | 0 | 0.0% |
| | | Paediatrics | 1 | 3.0% |
| Practice setting type | 33 | Public | 21 | 63.6% |
| | | Private | 12 | 36.4% |
| University affiliation | 33 | Yes | 24 | 72.7% |
| | | No | 9 | 27.3% |
| Years in clinical practice | 33 | 1 - 5 | 1 | 3.0% |
| | | 6 - 10 | 4 | 12.1% |
| | | 11 - 15 | 5 | 15.2% |
| | | 16 - 20 | 8 | 24.2% |
| | | > 20 | 15 | 45.5% |

The most common healthcare setting where sepsis is diagnosed was Emergency Department of a public hospital, reported by 28 (84.9%) respondents, followed by Critical Care or Intensive Care Unit (ICU) and acute care ward of public hospital reported by 24 (72.7%) and 22 (66.7%) respondents, respectively. Notably, about 60% (23) respondents said that they can diagnosis sepsis using Sepsis-3 criteria without any difficulty and various resources to confirm infection were available at the practice setting of the most respondents. About two-third (20; 64.5%) reported using Sepsis-3 criteria to identify sepsis cases and various Sepsis-3 components were readily available at practice setting of the most respondents. Thirteen (42%) respondents said that SOFA was either not available or not practical to implement. Among various non-Sepsis-3 criteria to diagnose sepsis, the need of organ support and clinical assessment were reported by 14 (45.2%) respondents, each while Systemic Inflammatory Response Syndrome was reported by 12 (37.8%) respondents (Table 2).

## Table 2 Sepsis recognition and diagnosis

| | No. of respondents | | n | % |
|---|---|---|---|---|
| *Settings for sepsis diagnosis | 33 | Primary Care/Community Health Centre (Public) | 6 | 18.2 |
| | | Primary Care/Community Health Centre (Private) | 5 | 15.2 |
| | | Ambulance (Public) | 3 | 9.1 |
| | | Ambulance (Private) | 2 | 6.1 |
| | | Emergency Department (Public) | 28 | 84.9 |
| | | Emergency Department (Private) | 17 | 51.5 |
| | | Acute Care/Ward (Public) | 22 | 66.7 |
| | | Acute Care/Ward (Private) | 16 | 48.5 |
| | | Critical Care/Intensive Care (Public) | 24 | 72.7 |
| | | Critical Care/Intensive Care (Private) | 18 | 54.6 |
| *Challenges in making sepsis diagnosis | 31 | Limited access to standard microbiological tests | 8 | 25.8 |
| | | Limited access to medical imaging for site of infection | 5 | 16.1 |
| | | Lack of access to resources (e.g. Blood Tests) needed to calculate SOFA score for Sepsis-3 criteria | 8 | 25.8 |
| | | None | 18 | 58.1 |
| | | Others | 6 | 19.4 |
| *Resources availability to confirm infection | 31 | Bacterial Culture | 30 | 96.8 |
| | | Fungal Culture | 23 | 74.2 |
| | | Respiratory Virus Polymerase Chain Reaction | 26 | 83.9 |
| | | Malaria Screening | 28 | 90.3 |
| | | Hepatitis A/B/C/D/E Serology | 29 | 93.6 |
| | | Acid Fast Bacilli Smear Test | 27 | 87.1 |
| | | Mycobacterium Tuberculosis Culture | 26 | 83.9 |
| | | Mycobacterium Tuberculosis Polymerase Chain Reaction | 27 | 87.1 |
| | | Serology (Dengue, Rickettsia, Leptospirosis, Schistosomiasis, Leishmaniasis, others) | 26 | 83.9 |
| | | Procalcitonin | 26 | 83.9 |
| | | C-reactive protein | 30 | 96.8 |
| | | White Cell Count | 31 | 100.0 |
| Routine use of Sepsis-3 criteria for sepsis diagnosis | 31 | Yes | 20 | 64.5 |
| | | No | 11 | 35.5 |

**Table 2 Sepsis recognition and diagnosis (Cont'd.)**

| | No. of respondents | | n | % |
|---|---|---|---|---|
| *Availability of Sepsis-3 criteria components | 21 | Bilirubin Level | 19 | 90.5% |
| | | Platelet Count | 20 | 95.2% |
| | | Creatinine Level | 20 | 95.2% |
| | | Urine Output Measurement | 19 | 90.5% |
| | | Pa02 Level | 19 | 90.5% |
| | | SpO2 Measurement | 21 | 100.0 % |
| | | Mean Arterial Blood Pressure | 21 | 100.0 % |
| | | Lactate Measurement | 18 | 85.7% |
| Reason for not routinely using Sepsis-3 criteria to diagnose sepsis | 31 | SOFA score is not readily available | 10 | 32.3% |
| | | SOFA score is available but not practical | 3 | 9.7% |
| | | N/A (if you do use Sepsis-3 criteria) | 17 | 54.8% |
| | | Other | 1 | 3.2% |
| *Non-Sepsis-3 criteria used for sepsis diagnosis | 31 | SIRS | 12 | 38.7% |
| | | Organ support required: vasopressors, oxygen, invasive or non-invasive ventilation, renal replacement therapy | 14 | 45.2% |
| | | Clinical assessment and intuition | 14 | 45.2% |
| | | N/A (use Sepsis-3 criteria) | 10 | 32.3% |
| | | qSOFA | 2 | 6.5% |
| | | Other | 2 | 6.5% |

*Respondents could choose more than one answers. SOFA: Sequential Organ Failure Assessment; N/A: Not applicable; SIRS: Systemic Inflammatory Response Syndrome; PaO2: Arterial partial pressure of oxygen; SpO2: Saturation of Peripheral Oxygen; qSOFA: quick SOFA

## Discussion

Most healthcare providers who responded to our survey had requisite resources to apply the Sepsis-3 criteria for identifying sepsis. This could be because most survey respondents were healthcare providers from critical care setting of university affiliated hospitals which are not necessarily resource-constraint. As less than one-fourth of the invited potential respondents completed the survey, this could have potentially contributed to this skewed representation of the survey respondents.

Findings from this survey contrast with the previous published data which have highlighted the challenges of applying Sepsis-3 criteria to identify sepsis in low resource settings.(4, 10)

## Strengths and limitations

The strengths of this survey include the representation of all World Bank income classification of countries(11) from the Asia Pacific region. Among limitations, we used convenience sampling which can lead to selection bias; however, the existing network of the Asia Pacific Sepsis Alliance in the Asia Pacific region allowed us to send the survey invitation to the healthcare providers from most countries in the Asia Pacific region. Despite our best efforts to obtain a representative sample of healthcare providers across all hospital's settings and clinical area of practice, most survey respondents were from university affiliated public hospital working in ICU resulting in low generalizability of the findings. As a large burden of sepsis is likely first diagnosed in non-ICU setting across any income setting, this is a major limitation of the study.

## Implications and next steps

Given the poor response rate and limited representation of healthcare providers working in non-ICU and low-resource settings of the Asia Pacific region, the survey findings might not accurately reflect the true state of sepsis recognition and diagnosis in this region. It highlights that relying solely on data from lower income countries is insufficient; it is equally important to get representation of diverse resource settings within those countries. As a result, the steering committee made a decision to discontinue the Delphi study. Instead, they opted to focus on the Asia Pacific Global Burden of Disease (GBD) sepsis project which aims to provide the local sepsis epidemiological estimate. This will allow for a more nuanced understanding of sepsis in the region, considering the granularity of the GBD dataset.

## Conclusion

Most healthcare providers in the Asia Pacific region working in university affiliated hospital ICUs have requisite resources to apply the Sepsis-3 criteria to identify sepsis cases. However, this might not be a true representation of how sepsis is diagnosed in the region.

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# Appendix A: Survey questionnaire

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## APSA Clinical and Practical Sepsis Diagnostic Criteria Survey

### Introduction and consent

**This is an international multi-center survey conducted by the Asia Pacific Sepsis Alliance (ASPA) to understand how clinicians working in different healthcare practice settings recognise and diagnose sepsis.**

**Please answer all sections according to your usual scope of practice and what is actually feasible in your practice setting, rather than what is theoretically possible.**

**The results of this survey will be used to inform a Delphi study on developing a set of pragmatic diagnostic criteria for sepsis that can be used to study the epidemiology of sepsis across low, middle and high income countries.**

**The survey should take less than 3 minutes to complete. All data will be confidential and respondents will not be identifiable in any publications.Your email address will be removed from your entered responses and only stored on a secured server for subsequent studies if you indicate interest in participation. The data generated will be deleted after 3 years from date of survey study completion.**

**This study has been approved by SBREC (Survey and Behavioural Research Ethics Committee SBRE-22-0760, fssc02@cuhk.edu.hk) of The Chinese University of Hong Kong.**

**Please direct any questions or comments to Dr. Lowell Ling via lowell.ling@cuhk.edu.hk**

**Thank you for participating!**

* 1. Email

* 2. Please confirm that you understand participation is voluntary and that by completing this survey you give consent for researchers to use the data collected and to share/publish the data to help understand how sepsis is recognised in different healthcare settings.

- [ ] Yes
- [ ] No


## APSA Clinical and Practical Sepsis Diagnostic Criteria Survey

### Participant Demographics

* 3. Country/Region

* 4. Age

- ◯ 18-24
- ◯ 25-34
- ◯ 35-44
- ◯ 45-54
- ◯ 55-64
- ◯ 65+

* 5. Gender

- ◯ Male
- ◯ Female
- ◯ Prefer not to specify

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* 6. Primary area of practice

- ◯ Primary Care/Community Health
- ◯ Ambulance
- ◯ Aneasthesiology
- ◯ Emergency
- ◯ General Medicine
- ◯ Intensive Care
- ◯ Infectious Diseases
- ◯ Surgery
- ◯ Other (please specify)

* 7. Practice setting

- ◯ Public
- ◯ Private

* 8. Practice setting is university affiliated

- ◯ Yes
- ◯ No

* 9. Years in primary area of clinical practice

- ◯ 1 - 5
- ◯ 6 - 10
- ◯ 11 - 15
- ◯ 16 - 20
- ◯ > 20

* 10. Involved in the clinical management of patients with sepsis

- ◯ Yes
- ◯ No

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* 11. In your country/region in which of the following settings is sepsis mostly diagnosed. (Please select public or private and all that apply)

- [ ] Primary Care/Community Health Centre (Public)
- [ ] Primary Care/Community Health Centre (Private)
- [ ] Ambulance (Public)
- [ ] Ambulance (Private)
- [ ] Emergency Department (Public)
- [ ] Emergency Department (Private)
- [ ] Acute Care/Ward (Public)
- [ ] Acute Care/Ward (Private)
- [ ] Critical Care/Intensive Care (Public)
- [ ] Critical Care/Intensive Care (Private)
- [ ] Other (please specify)

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## APSA Clinical and Practical Sepsis Diagnostic Criteria Survey

### Sepsis Recognition

**Please answer according to your practice setting (Private/Public) specified in the previous section to respond to the remaining questions.**

* 12. What are the challenges in making a diagnosis of sepsis in your clinical practice

- ◯ Limited access to standard microbiological tests
- ◯ Limited access to medical imaging for site of infection
- ◯ Lack of access to resources (e.g Blood Tests) needed to calculate Sequential Organ Failure Assessment score for Sepsis-3 criteria
- ◯ Other (please specify)

  [ ]
- ◯ None of the above

* 13. What resources are available in your immediate practice setting to confirm infection (Please note, if tests are available in a nearby hospital but not within your clinical setting then answer not available. Please select all that apply)

- [ ] Bacterial Culture
- [ ] Fungal Culture
- [ ] Respiratory Virus Polymerase Chain Reaction
- [ ] Malaria Screening
- [ ] Hepatitis A/B/C/D/E Serology
- [ ] Acid Fast Bacilli Smear Test
- [ ] Mycobacterium Tuberculosis Culture
- [ ] Mycobacterium Tuberculosis Polymerase Chain Reaction
- [ ] Serology (Dengue, Rickettsia, Leptospirosis, Schistosomiasis, Lesihmaniasis, others)
- [ ] Procalcitonin
- [ ] C-reactive protein
- [ ] White Cell Count
- [ ] Other (please specify)

- [ ] None of the above

* 14. Do you routinely use Sepsis-3 criteria to identify adult patients with sepsis in your practice setting (Note. Sepsis-3 criteria = infection + ≥ 2 increase in Sequential Organ Failure Assessment score)

- ◯ Yes
- ◯ No - please go to question 16

15. Which of the following Sepsis-3 criteria components are readily available in your practice setting? Please answer according to your immediate practice setting e.g. if blood tests are available in a nearby hospital but not within your practice setting, then answer not available. (Please select all that apply)

- [ ] Bilirubin Level
- [ ] Platelet Count
- [ ] Creatinine Level
- [ ] Urine Output Measurement
- [ ] Pa02 Level
- [ ] SpO2 Measurement
- [ ] Mean Arterial Blood Pressure Measurement
- [ ] Lactate Measurement

* 16. The reason for not routinely using Sepsis-3 criteria to diagnose sepsis is

- ◯ SOFA criteria is not readily available
- ◯ SOFA criteria is available but not practical
- ◯ N/A (if you do use Sepsis-3 criteria)
- ◯ Other (please specify)

* 17. Instead of Sepsis-3 criteria I use the following to diagnose sepsis in my clinical practice

- ◯ Systemic Inflammatory Response Syndrome
- ◯ Organ support required: vasopressors, oxygen, invasive or non-invasive ventilation, renal replacement therapy
- ◯ Clinical assessment and intuition
- ◯ N/A (If you use Sepsis-3 criteria)
- ◯ Other (please specify)

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## APSA Clinical and Practical Sepsis Diagnostic Criteria Survey

### Study Participation

**This study involves:**

- **Phase 1 - this Survey for which we seek additional participants.**
- **Phase 2 - a Delphi Study and we invite you to participate.**

18. Do you know other colleagues in your area of clinical practice in your country/region that you think we should include in this survey? (If so, please provide the following information)

Name:

Email:

* 19. Would you be interested in joining a Delphi study (Phase 2) on developing a set of pragmatic diagnostic criteria for sepsis across different healthcare settings?

- ◯ Yes, please include me
- ◯ No, please do not contact me