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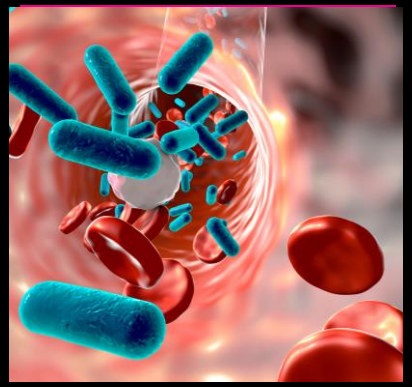

Blood culture ordering after sepsis alerts and subsequent patient outcomes: An Electronic Health Record-based study

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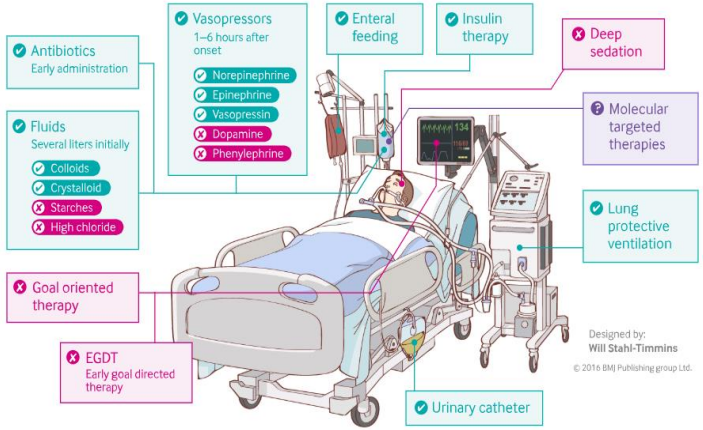
Sepsis

- A life-threatening condition that arises when the body's response to infection injures its own tissues (SEPSIS-3) (Singer 2016)
- Affects 50m people annually worldwide (Rudd 2020); Mortality: 30-50% (Angus 2001, Engel 2007)
- Sepsis can develop from a diverse range of microorganisms.
- Guidelines: 2 sets of blood culture(BC) prior to antibiotics administration – Timely BC collection recommended (NSW CEC; Surviving Sepsis Campaign)



Source: Sepsis: pathophysiology and clinical management BMJ 2016;353:i1585

Computerised clinical decision support (CCDS)

- Early recognition and diagnosis
- CCDS systems provide a valuable mechanism for incorporating sepsis recognition algorithms, which **automatically generate alerts** and provide decision support to guide appropriate, prompt treatment, into the hospital environment.
- Limited evidence exists on BC ordering following a sepsis alert and the associated impact on patient diagnosis and outcomes.

Aims

- To examine the rate and timing of BC ordering following a sepsis alert;
- To investigate the association between BC ordering and patient adverse outcomes.

Study design, population, CCDS

- A retrospective cohort study utilising data extracted from electronic health record (EHR) systems
- **CCDS**: Updated version of the St. John Sepsis Surveillance Agent (Cerner) and included additional clinical criteria for activating a sepsis alert
- Adult patients (aged 18 and over) admitted to an acute teaching hospital in Sydney from Dec 2014 to June 2016
- Patients who had at least one sepsis alert during admission; excluded if they had a BC before a sepsis alert

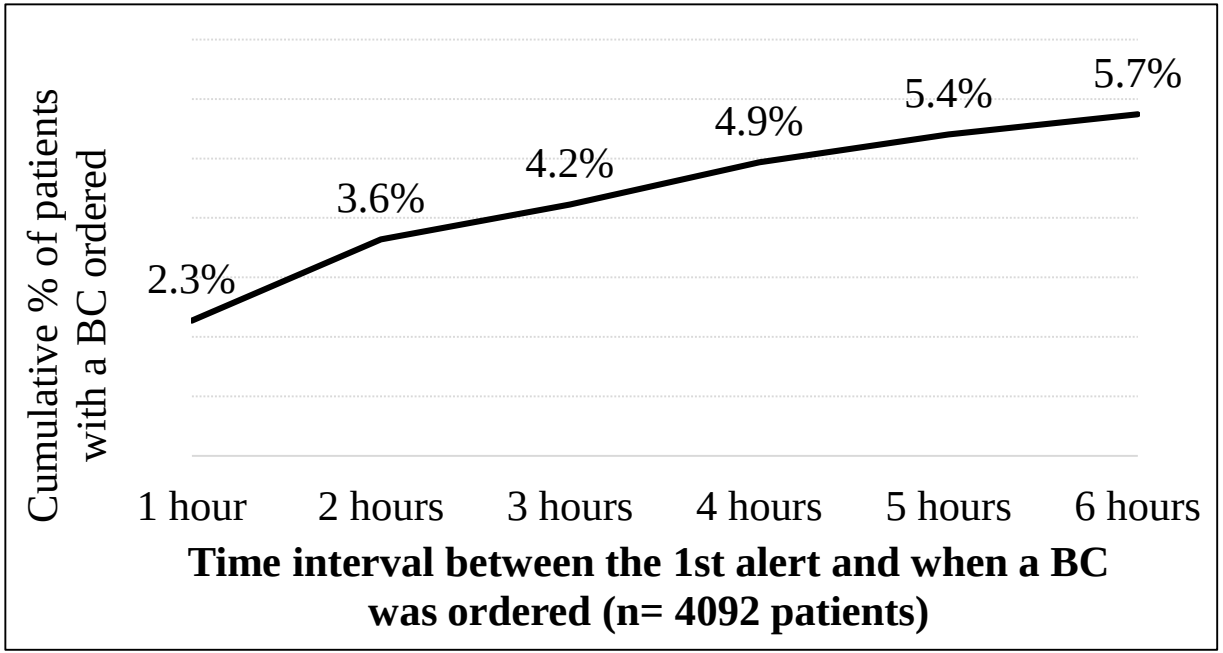
Patient characteristics by patient group

Characteristics	Patient group		Overall, N=4,092 patients
	BC following an alert, N=679 (17%)	No BC following an alert, N=3,413 (83%)	
Age, mean (SD)	67.0 (17)	66.5 (18)	66.6 (18)
Male, N (%)	335 (49)	1664 (49)	1999 (49)
Diabetes, N (%)	298 (44)	1262 (37)	1560 (38)
CCI, Median (IQR)	2 (0-4)	1 (0-3)	1 (0-3)

IQR: interquartile range; CCI: Charlson comorbidity index

Timing a BC ordered after the 1st alert

For 679 patients with a BC orders
Median b/w alert and BC: 15 hours (IQR: 3- 71)



Patient outcomes for patients with a sepsis alert

Patient groups	Sepsis diagnosis	Total	Admitted to ICU N (row %)	In hospital Mortality N (row %)
BC following an alert (n=679)	No	459	111 (24)	34 (7)
	Yes	220	113 (51)	**29 (13)**
No BC following an alert (n=3,413)	No	3,156	265 (8)	148 (5)
	Yes	257	65 (25)	**36 (14)**

Patient outcomes for patients with a sepsis alert

- Patients were 5.9 times more likely to be diagnosed with sepsis if a BC was ordered following a sepsis alert than those who received an alert, but no BC ordered (Ajusted Odds ratio [aOR]: 5.9, 95% CI: 4.8-7.2; p<0.0001)
- These patients with a BC were 3.2 times more likely to be admitted to an ICU than those without a BC (aOR: 3.2, 95% CI:2.6-4.0; p<0.0001)
- There was no evidence of difference in mortality between the two patient groups (aOR:1.3, 95% CI: 0.9-1.8; p=0.1)

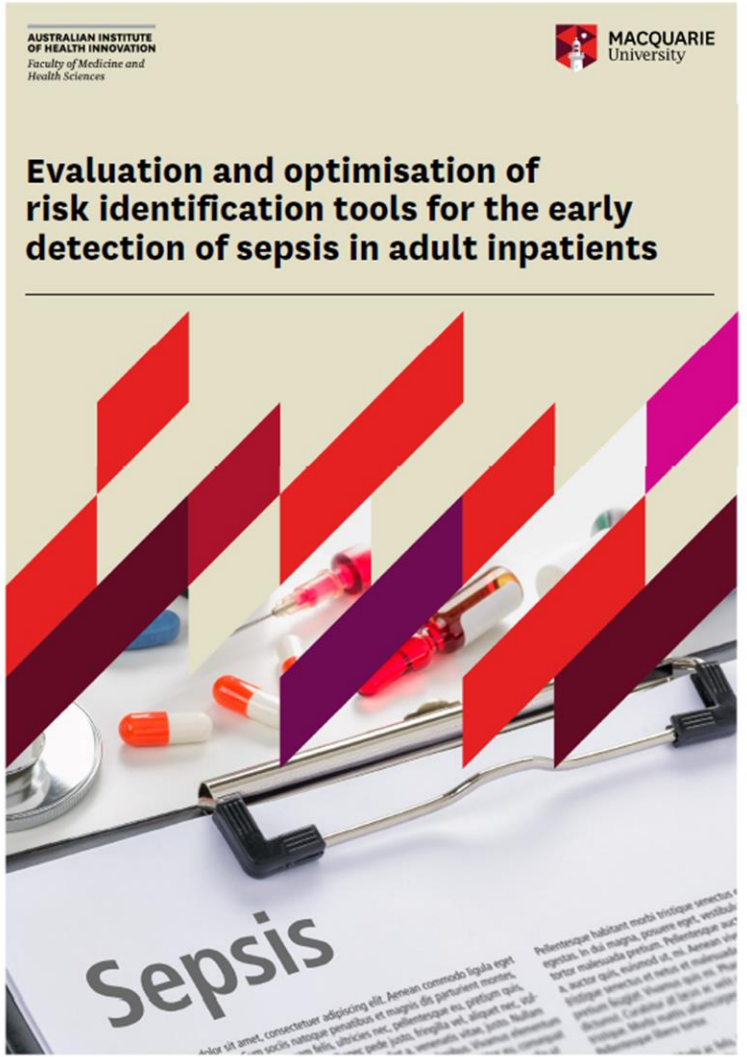
Discussion

- This study has important implications for subsequent appropriate antibiotics administration and patient survival (Shetty 2022).
- Further investigation is needed to understand the reasons behind the delay in BC ordering and low BC ordering rate.
- The adoption of CCDS requires close attention to determine the specificity and sensitivity of sepsis alerting to avoid the increasingly recognized problem of alert fatigue (Li 2019).
- We utilised a large EHR dataset, which consists of extensive laboratory, sepsis alert and admission data, allowing us to compare timing of sepsis alerts and BC ordering efficiently.

Acknowledgment

- **Co-authors:** Kasun Rathnayake, Scott Walter, Mary Fullick, Amith Shetty, Paul Hudson, Harvey Lander, Johanna I Westbrook
- This project was funded by the Clinical Excellence Commission (CEC) and eHealth NSW

- Full report is available online: http://www.cec.health.nsw.gov.au/__data/assets/pdf_file/0005/423662/Sepsis-Report-Final.pdf



Selected references

- Li L, Walter SR, Rathnayake K, Westbrook JI. Evaluation and optimisation of risk identification tools for the early detection of sepsis in adult inpatients. Report to the Clinical Excellence Commission (CEC), NSW, Australia. Australian Institute of Health Innovation, Macquarie University, Sydney 2018.
- Singer M, Deutschman CS, Seymour C, et al. The third international consensus definitions for sepsis and septic shock (sepsis-3). JAMA. 2016;315:801-10.
- K.E. Rudd, S.C. Johnson, K.M. Agesa, K.A. Shackelford, D. Tsoi, D.R. Kievlan, D.V. Colombara, K.S. Ikuta, N. Kissoon, and S. Finfer, Global, regional, and national sepsis incidence and mortality, 1990–2017: analysis for the Global Burden of Disease Study, The Lancet 395 (2020), 200-211..
- Shetty A, Baker J, Kabil G, Saavedra A, Suster CJ, Moscova M, Iredell J, Li L. Association between timing and adequacy of antibiotics and adverse outcomes in patients with sepsis and septic shock: A multicentre retrospective cohort study. Emerg Med Australas. 2023 Apr;35(2):325-332. doi: 10.1111/1742-6723.14143. Epub 2022 Dec 12.
- Li L, Rathnayake K, Green M, Fullick M, Shetty A, Walter S, Braithwaite J, Lander H, Westbrook JI. Improving the Performance of Clinical Decision Support for Early Detection of Sepsis: A Retrospective Observational Cohort Study. Stud Health Technol Inform. 2019 Aug 21;264:679-683. doi: 10.3233/SHTI190309

Thank you!

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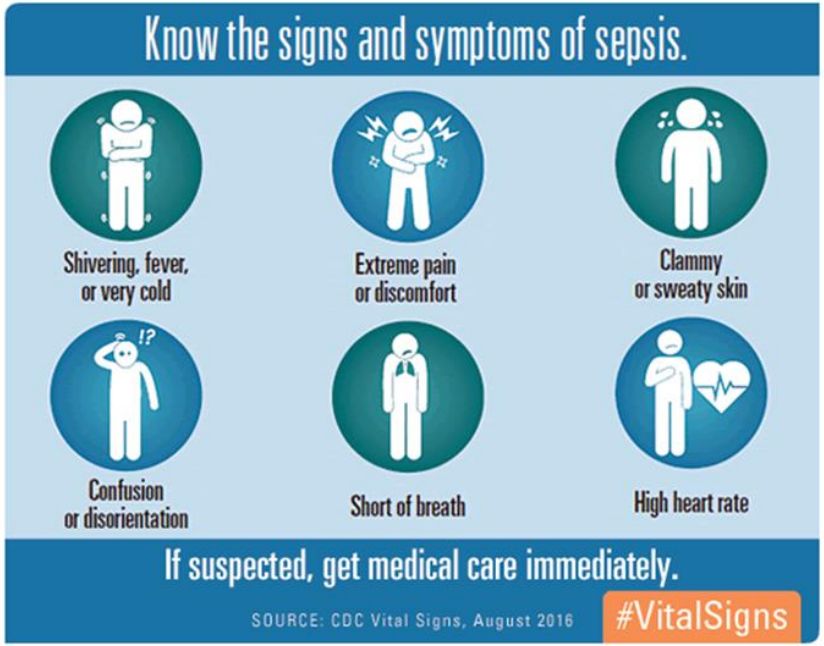

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