UK Health Security Agency

Effectiveness of antibiotics for Panton-Valentine leukocidin-positive *Staphylococcus aureus* (PVL-SA) associated bacteraemia

A rapid systematic review

Contents

Main messages

1. This rapid systematic review (search up to 13 September 2024) aimed to identify and summarise evidence relating to the effectiveness of antibiotics to treat Panton-Valentine leukocidin-positive *Staphylococcus aureus* (PVL-SA) associated bacteraemia.

2. In total, 3,731 records from 5 databases were screened. No studies were identified for inclusion in this review.

3. In summary, no published randomised controlled trials, non-randomised control trials or observational studies (case control or cohort studies) were identified looking at the effectiveness of antibiotics in treating PVL-SA associated bacteraemia.

Purpose

The purpose of this rapid systematic review was to identify and summarise the available evidence that discussed the effectiveness of antibiotics to treat Panton-Valentine leukocidin-positive *Staphylococcus aureus* (PVL-SA) associated bacteraemia.

The review question was:

1. What is the effectiveness of antibiotics in treating people with Panton-Valentine leukocidin *Staphylococcus aureus* (PVL-SA) associated bacteraemia?

Methods

A rapid systematic review was conducted, following streamlined systematic methods to accelerate the review process (1). A protocol was produced before the literature search was conducted, including the review question, the eligibility criteria, and all other methods. Full details of the methodology are provided in the protocol in Annexe A. There were no deviations from the protocol.

A literature search was undertaken to look for relevant interventional studies (randomised controlled trials, non-randomised controlled trials and cross over studies) and observational studies (case control and cohort studies) published up to 13 September 2024. The reference list of 2 systematic reviews identified during screening was also checked for any additional relevant primary studies.

The population of interest was adults or children with laboratory confirmed PVL-SA bacteraemia through a polymerase chain reaction (PCR) test, in inpatient settings. For this review, treatment could consist of any antibiotic or a combination of antibiotics, or antibiotic with immunoglobulin

(an antibody used by the immune system to recognise bacteria and viruses) used as treatment for PVL-SA bacteraemia through any route of administration. This was compared to other antibiotics, treatments such as supportive care, or placebo. Primary outcomes included mortality, morbidity and intensive care or high dependency unit admission. Adverse events, serious adverse events, or withdrawal due to adverse events ascribed to taking antibiotics were secondary outcomes that would have only been extracted from studies that had at least one of the primary outcomes.

Screening on title and abstract was undertaken in duplicate by 2 reviewers for 20% of the eligible studies, with the remainder completed by one reviewer. Screening on full text was undertaken by one reviewer and checked by a second.

Evidence

A total of 3,731 studies were screened at title and abstract and 82 studies were screened at full text. Of these, no studies met the inclusion criteria. A PRISMA diagram showing the flow of studies through the review is shown in Annexe B, and studies excluded at full text screening are available in Annexe C with the reasons why they were excluded. The main reasons for excluding records at full text were being in the wrong population (n=45) or wrong study type (n=20).

Health inequalities

Groups more likely to experience health inequalities, such as those with existing health conditions, children or young people were explicitly defined within the inclusion criteria in the review protocol. However, no studies were identified for inclusion in this review and therefore health inequalities could not be assessed.

Limitations

This rapid systematic review used streamlined systematic methods to accelerate the review process. Sources of evidence searched included databases of peer-reviewed and preprint research, but an extensive search of other sources was not conducted and most article screening was completed without duplication, so it is possible relevant evidence may have been missed.

Evidence gaps

No studies were identified for inclusion in this review highlighting a clear evidence gap relating to the effectiveness of antibiotics to treat PVL-SA bacteraemia.

Conclusion

The aim of this review was to identify and assess available evidence that evaluated the effectiveness of antibiotics in treating people with PVL-SA bacteraemia. However, no relevant evidence (from interventional, case control or cohort studies) was identified and therefore this review is unable to inform on the effectiveness of antibiotics in treating this population.

Acknowledgments

We would like to thank colleagues within the All Hazards Public Health Response division who either reviewed or input into aspects of the review.

Disclaimer

UKHSA's rapid systematic reviews and evidence summaries aim to provide the best available evidence to decision makers in a timely and accessible way, based on published peer-reviewed scientific papers, and papers on preprint servers. Please note that the reviews:

- use accelerated methods and may not be representative of the whole body of evidence publicly available
- have undergone an internal independent peer review but not an external peer review
- are only valid as of the date stated on the review

In the event that this review is shared externally, please note additionally, to the greatest extent possible under any applicable law, that UKHSA accepts no liability for any claim, loss or damage arising out of, or connected with the use of, this review by the recipient or any third party including that arising or resulting from any reliance placed on, or any conclusions drawn from, the review.

References

1. Tricco AC and others. 'Rapid reviews to strengthen health policy and systems: a practical guide' 2017
2. Aromataris E and others. 'JBI Manual for Evidence Synthesis. JBI' 2024
3. Group T. 'GRADE handbook for grading quality of evidence and strength of recommendations (updated October 2013)' 2013

Annexe A. Protocol

Review question

The review question is:

1. What is the effectiveness of antibiotics in treating people with Panton-Valentine leukocidin *Staphylococcus aureus* (PVL-SA) associated bacteraemia?

A search for primary evidence to answer this review question will be conducted up to 13th September.

Eligibility criteria

Table A.1 Inclusion and exclusion criteria

	Included	Excluded
Population	Adults and children with laboratory confirmed PVL-SA bacteraemia (through polymerase chain reaction test)	Animals
Context	Any context	
Settings	Hospital inpatient settings only	Laboratory settings
Intervention or exposure	Any antibiotic or combination of antibiotics, or antibiotic with immunoglobulin taken as treatment for PVL-SA bacteraemia Any route of administration	Any other form of treatment that does not include an antibiotic (such as monotherapy immunoglobulin)
Comparator	Comparison to other antibiotics or treatments such as supportive care, or placebo	
Outcomes	Primary outcomes: • mortality (as reported by the study) • morbidity, as measured by the following (and directly linked to having the infection): ○ intensive care or high dependency unit admission	

	Included	Excluded
	○ need for intubation and ventilation ○ need for vasopressors ○ clinical support with oxygen ○ end organ dysfunction - Need for renal replacement therapy (to include dialysis and renal transplant) - Evidence of acute liver failure ○ diagnosis of disseminated intravascular coagulation (DIC) Secondary outcomes (these will be extracted only from studies that have at least one of the primary outcomes): • prevalence, incidence, risk (relative or absolute), or count data (individual or total) of any adverse event or serious adverse event or withdrawal due to adverse events ascribed to taking antibiotics for treatment of PVL-SA bacteraemia even if not stated as outcome of interest of the study Types of outcome as defined by the European Medicines Agency for adverse events (any unfavourable and unintended sign (including an abnormal laboratory finding, for example), symptom, or disease temporally associated with the use of a medicinal product, whether or not considered related to the medicinal product) Or Serious adverse events (an adverse reaction that results in death, is life-	

	Included	Excluded
	threatening, requires hospitalisation or prolongation of existing hospitalisation, results in persistent or significant disability or incapacity, or is a birth defect) Or As described by the review	
Language	English	Non-English language studies
Date of publication	Up to 13 September 2024	
Study design	Interventional studies (Randomised Controlled Trials, Non-randomised controlled trials, cross over studies). Observational studies including case-control and cohort studies will only be included if there is no sufficient evidence presented in RCTs. Observational studies will still be included in the title and abstract stage of the review.	Systematic or narrative reviews Modelling studies Laboratory studies Case reports Case series Cross sectional studies Single-arm trials Qualitative research
Publication type	Peer-reviewed published research	Conference abstracts Editorials Letters News Articles Grey literature Preprints Books

Identification of studies

The following databases and trial registries will be searched for studies published up to 13 September 2024: Ovid Medline, Embase, CINAHL, Scopus and Cochrane Central Register of Randomised Controlled Trials. The search strategy is presented below.

Details of references that are included following full text screening will be used for backwards and forwards citation searching. Citation searching will be carried out using the Lens.org database via CitationChaser.

Screening

Title and abstract screening will be undertaken in duplicate by 2 reviewers for at least 20% of the eligible studies, with the remainder completed by one reviewer. Disagreement will be resolved by discussion or with involvement of a third reviewer where necessary.

Screening on full text will be undertaken by one reviewer and checked by a second.

Results of citation searching will be screened by one reviewer.

Data extraction

Summary information for each study will be extracted and reported in tabular form. Information to be extracted will include country, study period, study design, intervention, participants, results, and any relevant contextual data (including choice of antibiotic/regime according to any antibiotic resistance identified). This will be undertaken by one reviewer and checked by a second.

Risk of bias assessment

We will perform risk of bias assessment at the primary study level using the relevant JBI checklist (2). Risk of bias will be assessed by 2 reviewers independently with disagreements resolved through discussion or with a third reviewer.

Quality of evidence

The quality of evidence identified within this review will be assessed using a modified version of the Grading of Recommendations, Assessment, Development and Evaluations (GRADE) framework (3). Quality of evidence will be assessed at the outcome level, and be rated as one of 4 levels:

- very low (the true effect is probably different from the estimated effect)
- low (the true effect might be different from the estimated effect)
- moderate (the true effect is probably close to the estimated effect)
- high (the authors are confident that the true effect is similar to the estimated effect)

The quality of evidence will be assessed for each outcome across 4 domains:

1. Risk of bias: where results may not represent the true effect because of limitations in the design or conduct of the study. This will be measures as described under Risk of bias assessment.
2. Inconsistency: where studies show different effects for the same outcome of interest. This will be assessed where there are 2 or more studies measuring the same outcome. Inconsistency will be rated down if the point estimates are not similar, or the confidence intervals do not overlap. If there is only one study for the outcome of interest, then inconsistency will not be assessed. Inconsistency will be assessed by one reviewer and checked by a second.
3. Indirectness: where elements of the study differ from the intended elements in the review question (for example, the outcome of interest has not been directly measured). This will be rated down if the population, intervention, comparator, or outcome of interest have not been directly measured. Indirectness will be assessed by one reviewer and checked by a second.
4. Imprecision: a measure of how uncertain the estimate is. Imprecision will be rated down if the confidence intervals cross the line of no effect, or if the reviewer judges that the confidence intervals are overly wide and so the true effect is likely to be different at the upper versus the lower end of the confidence interval. Imprecision will be assessed by one reviewer and checked by a second.

Because the JBI checklist will be used to assess risk of bias, evidence from randomised controlled trials will start at high quality, and evidence from observational studies will start at low quality. Evidence may be downgraded one or 2 levels following the assessment of quality, or upgraded if there is a large magnitude of effect or clear dose-response gradient.

Synthesis

Where studies are similar enough to combine and present data in a consistent format, a narrative synthesis will be produced to interpret the findings. The number of studies, the number of participants in each study, effect size and variance and a summary of the risk of bias across studies reporting each outcome will be summarised and presented. Alternatively, if studies present methodological differences that would make synthesis inappropriate, a narrative summary of each study will be provided.

Health inequalities

Variations across individuals with health inequalities will be considered, as these may produce different outcomes following treatment with antibiotics for PVL-SA associated bacteraemia (such as those with existing health conditions, or children or young people).

Search strategy

Ovid MEDLINE(R) ALL (1946 to 3 September 2024)

1. Leukocidins/ (1745)
2. leukocidin*.tw,kf. (2227)
3. leucocidin*.tw,kf. (557)
4. leukotoxin*.tw,kf. (995)
5. leucotoxin*.tw,kf. (53)
6. Panton Valentine.tw,kf. (2315)
7. PVL.tw,kf. (5093)
8. (LukS* or Luk S*).tw,kf. (458)
9. (LukF* or Luk F*).tw,kf. (351)
10. (LukPV* or Luk pv*).tw,kf. (76)
11. (LukSF* or Luk SF*).tw,kf. (54)
12. Bacterial Toxins/ and (exp Staphylococcal Infections/ or exp Staphylococcus aureus/) (3574)
13. (bacteri* toxin* and (staph* or S* aureus)).tw,kf. (367)
14. or/1-13 (10043)
15. exp Sepsis/ (147419)
16. exp Bacteremia/ (33924)
17. (Bacteria/ or exp Staphylococcus aureus/ or Bacterial Infections/ or exp Staphylococcal Infections/) and exp Blood/ (16365)
18. ((bacter* or S* aureus or staph*) and blood*).tw,kf. (90785)
19. bacter?emi*.tw,kf. (40335)
20. sepsis.tw,kf. (130384)
21. septic*.tw,kf. (92541)
22. (infect* adj3 (blood or bloodstream)).tw,kf. (37292)
23. blood poison*.tw,kf. (60)
24. (bacteri* adj3 (blood or bloodstream)).tw,kf. (5605)
25. (S* aureus adj3 (blood or bloodstream)).tw,kf. (1370)
26. septic?emi*.tw,kf. (24074)
27. py?emi*.tw,kf. (264)
28. pyoh?emi*.tw,kf. (16)
29. or/15-28 (374763)
30. 14 and 29 (1933)

Embase (1974 to 3 September 2024)

1. leukocidin/ (1003)
2. leukotoxin/ (985)
3. Panton Valentine leukocidin/ (2747)
4. leukocidin*.tw,kf. (2736)
5. leucocidin*.tw,kf. (643)

6. leukotoxin*.tw,kf. (1075)
7. leucotoxin*.tw,kf. (65)
8. panton valentine.tw,kf. (2890)
9. PVL.tw,kf. (7790)
10. (LukS* or Luk S*).tw,kf. (619)
11. (LukF* or Luk F*).tw,kf. (441)
12. (Luk pv* or LukPV*).tw,kf. (89)
13. (LukSF* or Luk SF*).tw,kf. (66)
14. (exp Staphylococcus aureus/ or exp Staphylococcus infection/) and bacterial toxin/ (1533)
15. (bacteri* toxin* and (staph* or S* aureus)).tw,kf. (448)
16. or/1-15 (12699)
17. exp sepsis/ (360949)
18. exp bacteremia/ (65753)
19. exp staphylococcal bacteremia/ (3814)
20. (exp bacterium/ or bacterial infection/ or exp Staphylococcus aureus/ or exp Staphylococcus infection/) and exp blood/ (149431)
21. ((bacter* or S* aureus or staph*) and blood*).tw,kf. (131557)
22. bacter?emi*.tw,kf. (56074)
23. sepsis.tw,kf. (206733)
24. septic*.tw,kf. (129736)
25. (infect* adj3 (blood or bloodstream)).tw,kf. (52197)
26. blood poison*.tw,kf. (55)
27. (bacteri* adj3 (blood or bloodstream)).tw,kf. (7512)
28. (S* aureus adj3 (blood or bloodstream)).tw,kf. (2008)
29. septic?emi*.tw,kf. (27439)
30. py?emi*.tw,kf. (145)
31. pyoh?emi*.tw,kf. (2)
32. or/17-31 (694930)
33. 16 and 32 (2589)

CINAHL Complete

#	Query	Results
S1	leukocidin*	288
S2	leucocidin*	80
S3	leukotoxin*	38
S4	leucotoxin*	2
S5	"Panton Valentine"	347
S6	PVL	753
S7	LukS* OR Luk S*	79
S8	LukF* OR luk F*	70

#	Query	Results
S9	"Luk pv*" OR Lukpv*	4
S10	(MH "Bacterial Toxins")	1,586
S11	(MH "Staphylococcus Aureus+")	12,558
S12	S10 AND S11	269
S13	"luk SF*" OR LukSF* OR ("bacteri* toxin*" AND (staph* OR "S* aureus"))	327
S14	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S12 OR S13	1,171
S15	(MH "Sepsis+")	32,820
S16	(MH "Bacteremia")	6,592
S17	(MH "Bacteria+")	83,689
S18	(MH "Staphylococcus Aureus+")	12,558
S19	(MH "Bacterial Infections")	11,164
S20	S17 OR S18 OR S19	92,291
S21	(MH "Blood+")	81,213
S22	S20 AND S21	3,286
S23	bacter#emi* OR ((bacter* or S* aureus or staph*) and blood*)	25,672
S24	sepsis OR septic*	47,091
S25	(infect* N3 (blood or bloodstream))	13,012
S26	"blood poison*"	10
S27	(bacteri* N3 (blood or bloodstream))	2,833
S28	("S* aureus" N3 (blood or bloodstream))	329
S29	septic#emi*	2,032
S30	py#emi*	9
S31	pyoh#emi*	0
S32	S15 OR S16 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31	79,010
S33	S14 AND S32	198

Cochrane Central Register of Controlled Trials (CENTRAL)

Date run: 4 September 2024 17:20:32

ID	Search	Hits
#1	MeSH descriptor: [Leukocidins] explode all trees	9

ID	Search	Hits
#2	leukocidin*	20
#3	leucocidin*	5
#4	Leukotoxin*	2
#5	leucotoxin*	0
#6	"Panton Valentine"	20
#7	PVL	474
#8	(LukS* or Luk NEXT S*)	188
#9	(LukF* or Luk NEXT F*)	7
#10	(Luk NEXT pv* or LukPV*)	0
#11	(LukSF* or Luk NEXT SF*)	1
#12	MeSH descriptor: [Bacterial Toxins] this term only	144
#13	MeSH descriptor: [Staphylococcal Infections] explode all trees	1551
#14	MeSH descriptor: [Staphylococcus aureus] explode all trees	1186
#15	#13 OR #14	2036
#16	#12 AND #15	14
#17	(bacteri* toxin* AND (staph* OR S* aureus))	98
#18	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #16 OR #17	766
#19	MeSH descriptor: [Sepsis] explode all trees	6556
#20	MeSH descriptor: [Bacteremia] explode all trees	1311
#21	MeSH descriptor: [Bacteria] this term only	2326
#22	MeSH descriptor: [Staphylococcus aureus] explode all trees	1186
#23	MeSH descriptor: [Bacterial Infections] this term only	3787
#24	MeSH descriptor: [Staphylococcal Infections] explode all trees	1551
#25	#21 OR #22 OR #23 OR #24	7706
#26	MeSH descriptor: [Blood] explode all trees	21338
#27	#25 AND #26	207
#28	((bacter* or S* aureus or staph*) and blood*)	14716
#29	bacteremi* OR bacteraemi*	3359
#30	sepsis	15658
#31	septic*	7436
#32	(infect* NEAR/3 (blood or bloodstream))	4045
#33	blood NEXT poison*	93

ID	Search	Hits
#34	(bacteri* NEAR/3 (blood or bloodstream))	1516
#35	(S* NEXT aureus NEAR/3 (blood or bloodstream))	98
#36	septicemi* OR septicaemi*	1320
#37	pyemi* OR pyaemi*	16
#38	pyohemi* OR pyohaemi*	6
#39	#19 OR #20 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38	36622
#40	#18 AND #39	205

Cochrane Central Register of Controlled Trials (CENTRAL)

Date run: 16 September 2024

ID	Search	Hits
#1	MeSH descriptor: [Leukocidins] explode all trees	9
#2	leukocidin*	20
#3	leucocidin*	5
#4	Leukotoxin*	2
#5	leucotoxin*	0
#6	"Panton Valentine"	20
#7	PVL	474
#8	(LukS* or Luk NEXT S*)	188
#9	(LukF* or Luk NEXT F*)	7
#10	(Luk NEXT pv* or LukPV*)	0
#11	(LukSF* or Luk NEXT SF*)	1
#12	MeSH descriptor: [Bacterial Toxins] this term only	144
#13	MeSH descriptor: [Staphylococcal Infections] explode all trees	1551
#14	MeSH descriptor: [Staphylococcus aureus] explode all trees	1186
#15	#13 OR #14	2036
#16	#12 AND #15	14
#17	(bacteri* toxin* AND (staph* OR S* aureus))	98
#18	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #16 OR #17	766
#19	MeSH descriptor: [Sepsis] explode all trees	6556

ID	Search	Hits
#20	MeSH descriptor: [Bacteremia] explode all trees	1311
#21	MeSH descriptor: [Bacteria] this term only	2326
#22	MeSH descriptor: [Staphylococcus aureus] explode all trees	1186
#23	MeSH descriptor: [Bacterial Infections] this term only	3787
#24	MeSH descriptor: [Staphylococcal Infections] explode all trees	1551
#25	#21 OR #22 OR #23 OR #24	7706
#26	MeSH descriptor: [Blood] explode all trees	21338
#27	#25 AND #26	207
#28	((bacter* or S* aureus or staph*) and blood*)	14716
#29	bacteremi* OR bacteraemi*	3359
#30	sepsis	15658
#31	septic*	7435
#32	(infect* NEAR/3 (blood or bloodstream))	4046
#33	blood NEXT poison*	93
#34	(bacteri* NEAR/3 (blood or bloodstream))	1516
#35	(S* NEXT aureus NEAR/3 (blood or bloodstream))	98
#36	septicemi* OR septicaemi*	1319
#37	pyemi* OR pyaemi*	16
#38	pyohemi* OR pyohaemi*	6
#39	#19 OR #20 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38	36622
#40	#18 AND #39	205

Filtered to CENTRAL only: 100 results

Scopus

TITLE-ABS-KEY(leukocidin*) OR TITLE-ABS-KEY(leucocidin*) OR TITLE-ABS-KEY(leukotoxin*) OR TITLE-ABS-KEY(leucotoxin*) OR TITLE-ABS-KEY("panton valentine") OR TITLE-ABS-KEY(PVL) OR TITLE-ABS-KEY((LukS* or "Luk S*")) OR TITLE-ABS-KEY((LukF* or "Luk F*")) OR TITLE-ABS-KEY(("Luk pv*" or LukPV*)) OR TITLE-ABS-KEY((LukSF* or "Luk SF*")) OR TITLE-ABS-KEY(("bacteri* toxin*" and (staph* or "S* aureus")))

And:

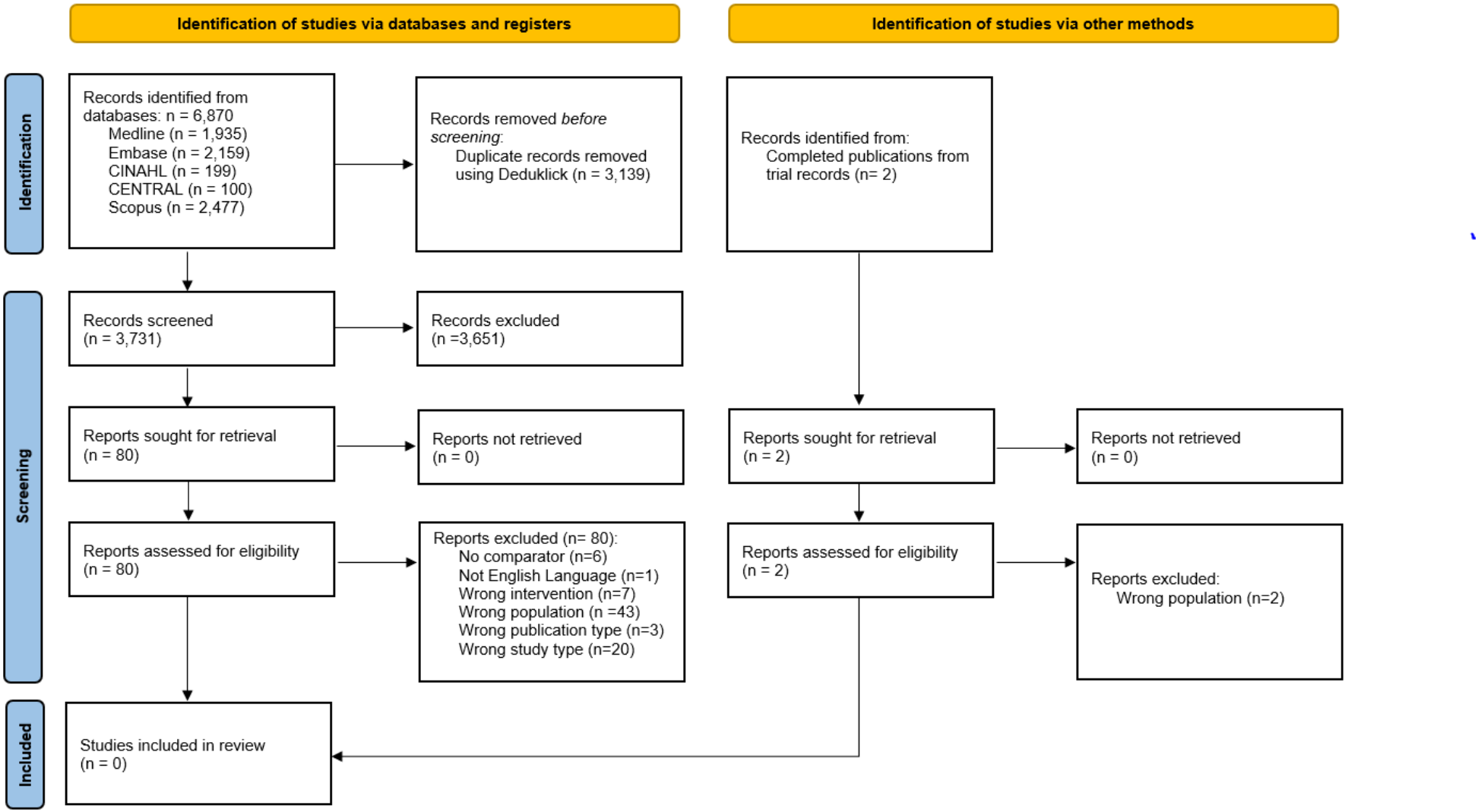
TITLE-ABS-KEY(((bacter* or "S* aureus" or staph*) and blood*)) OR TITLE-ABS-KEY(bacter*emi*) OR TITLE-ABS-KEY(sepsis) OR TITLE-ABS-KEY(septic*) OR TITLE-ABS-

KEY((infect* W/2 (blood or bloodstream))) OR TITLE-ABS-KEY("blood poison*") OR TITLE-ABS-KEY((bacteri* W/2 (blood or bloodstream))) OR TITLE-ABS-KEY(("S* aureus" W/2 (blood or bloodstream))) OR TITLE-ABS-KEY(septic*emi*) OR TITLE-ABS-KEY(py*emi*) OR TITLE-ABS-KEY(pyoh*emi*)

2,477 results

Annexe B. Study selection flowchart

Figure B.1. PRISMA diagram



Text version of Figure B.1. PRISMA diagram

A PRISMA diagram showing the flow of studies through this review, ultimately including n=0 studies.

From identification of studies via databases and registers, n=6,870 records identified from databases:

- Medline (n = 1,935)
- Embase (n = 2,159)
- CINAHL (n = 199)
- CENTRAL (n = 100)
- Scopus (n = 2,477)

From these, records removed before screening:

- duplicate records removed using Deduklick (n = 3,139)

n=3,731 records screened, of which n=3,651 were excluded, leaving n=80 papers sought for retrieval, of which n=0 were not retrieved.

n=2 studies were identified from a trial registry included at full text, of which n=0 were not retrieved.

Of the n=82 papers assessed for eligibility, n=82 reports were excluded:

- no comparator (n=6)
- not English Language (n=1)
- wrong intervention (n=7)
- wrong population (n =45)
- wrong publication type (n=3)
- wrong study type (n=20)

n=0 papers included in the review.

Annexe C. Excluded full texts

No comparator (6 studies)

Imauven and others. 'Paediatric and adult patients from New Caledonia Island admitted to the ICU for community-acquired Panton-Valentine leucocidin-producing *Staphylococcus aureus* infections' Scientific Reports 2022: volume 12, issue 1, article number 11,024

Isendahl and others. 'Prevalence of community-acquired bacteraemia in Guinea-Bissau: an observational study' BMC Infectious Diseases 2014: volume 14, article number 3,859

Kok and others. 'AsSOCIATION OF VANCOMYCin MIC and molecular characteristics with clinical outcomes in methicillin-susceptible *Staphylococcus aureus* acute hematogenous osteoarticular infections in children' Antimicrobial Agents and Chemotherapy 2018: volume 62, issue 5, page 5

McGuire and others. 'Is Panton-Valentine leucocidin (PVL) toxin associated with poor clinical outcomes in patients with community-acquired *Staphylococcus aureus* bacteraemia?' Journal of Medical Microbiology 2023: volume 72, issue 4

Neuner and others. 'Clinical, microbiologic, and genetic determinants of persistent methicillin-resistant *Staphylococcus aureus* bacteremia' Diagnostic Microbiology and Infectious Disease 2010: volume 67, issue 3, pages 228 to 233

Qu and others. 'Epidemiological and clinical features of Panton-Valentine leukocidin-positive *Staphylococcus aureus* bacteremia: a case-control study' PLoS ONE [Electronic Resource] 2022: volume 17, issue 3, article e0265476

Not English language (one study)

Šimkovičová and others. 'Coagulase negative staphylococci isolated from haemocultures' Epidemiologie, Mikrobiologie, Imunologie 2001: volume 50, issue 3, pages 117 to 120

Wrong intervention (7 studies)

Adhikari and others. 'Lower antibody levels to *Staphylococcus aureus* exotoxins are associated with sepsis in hospitalized adults with invasive *S. aureus* infections' Journal of Infectious Diseases 2012: volume 206, issue 6, pages 915 to 923

Alvarez and others. 'Nosocomial infections caused by community-associated methicillin-resistant *Staphylococcus aureus* in Colombia' American Journal of Infection Control 2010: volume 38, pages 315 to 318

Blaine and others. 'Progression to bacteremia in critical care patients colonized with methicillin-resistant *Staphylococcus aureus* expressing Panton-Valentine leukocidin' Diagnostic Microbiology and Infectious Disease 2010: volume 68, issue 1, pages 28 to 33

Chantratita and others. 'Comparison of community-onset *Staphylococcus argenteus* and *Staphylococcus aureus* sepsis in Thailand: a prospective multicentre observational study' Clinical Microbiology and Infection 2016: volume 22, issue 5, pages 458.e411 to 459

Eshwara and others. '*Staphylococcus aureus* bacteremia in an Indian tertiary care hospital: observational study on clinical epidemiology, resistance characteristics, and carriage of the Panton-Valentine leukocidin gene' International Journal of Infectious Diseases 2013: volume 17, issue 11, e1051 to 1055

Gonzalez and others. 'Severe Staphylococcal sepsis in adolescents in the era of community-acquired methicillin-resistant *Staphylococcus aureus*' Pediatrics 2005: volume 115, issue 3, pages 642 to 648

Knudsen and others. 'Increased age-dependent risk of death associated with lukF-PV-Positive *Staphylococcus aureus* bacteremia' Open Forum Infectious Diseases 2016: volume 3, issue 4, ofw220

Wrong population (45 studies)

Calderwood and others. 'Staphylococcal enterotoxin P predicts bacteremia in hospitalized patients colonized with methicillin-resistant *Staphylococcus aureus*' Journal of Infectious Diseases 2014: volume 209, issue 4, pages 571 to 577

Campbell and others. 'Clindamycin adjunctive therapy for severe *Staphylococcus aureus* treatment evaluation (CASSETTE): an open-labelled pilot randomized controlled trial' JAC-Antimicrobial Resistance 2022: volume 4

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Wrong publication type (3 studies)

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Wrong study type (20 studies)

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