

ISSN (P): 2788-9815
ISSN (E): 2788-791X

JM
L&P
HEALTH

Vol. 3 No. 1 (2023): Jan-Mar



Expedited Publication:
28/03/2023

Prevalence of Positive Blood Cultures in the Emergency Department of a Tertiary Hospital: A Retrospective Single-Centre Study

Osama Barakat

Emergency Department, King Abdulaziz Specialist Hospital, Taif's Health Cluster,
Taif, Saudi Arabia

Muath Alsafrani

Emergency Department, King Abdulaziz Specialist Hospital, Taif's Health Cluster,
Taif, Saudi Arabia

Hassan Alasmari

Emergency Department, King Abdulaziz Specialist Hospital, Taif's Health Cluster,
Taif, Saudi Arabia

Faisal Alasmari

Emergency Department, King Abdulaziz Specialist Hospital, Taif's Health Cluster,
Taif, Saudi Arabia

Abdullah Alzahrani

College of Medicine, Taif University, Taif, Saudi Arabia

Reem Barakat

College of Business Administration, Umm Al-Qura University, Makkah, Saudi Arabia

Wedad Alzahrani

Department of Foreign Language, College of Arts, Taif University, Taif, Saudi Arabia

Ali Alsaheel

Emergency Department, King Abdulaziz Specialist Hospital, Taif's Health Cluster,
Taif, Saudi Arabia

Article Link: <https://jmlph.net/index.php/jmlph/article/view/71>

DOI: 10.52609/jmlph.v3i2.71

Citation: Barakat, O., Alsafrani, M. ., Alasmari, H. ., Alasmari, F., Alzahrani, A. ., Barakat, R. ., Alzahrani, W., & Alsaheel, A. (2023). Prevalence of Positive Blood Cultures in the Emergency Department of a Tertiary Hospital: A Retrospective Single-Centre Study. *The Journal of Medicine, Law & Public Health*, 3(1), 209–214.

<https://doi.org/10.52609/jmlph.v3i2.71>

Conflict of interests: The authors have no conflicts of interest to declare.

Copyright: The Author.



Licensed under [Creative Commons Attribution 4.0 International](https://creativecommons.org/licenses/by/4.0/).

Prevalence of Positive Blood Cultures in the Emergency Department of a Tertiary Hospital: A Retrospective Single-Centre Study

Osama Barakat, Muath Alsafrani, Hassan Alasmari, Faisal Alasmari, Abdullah Alzahrani, Reem Barakat, Wedad Alzahrani, and Ali Alsaheel

Abstract—Background: Blood cultures (BCs) are frequently ordered during the course of investigation in emergency departments (EDs). However, there are few studies examining the clinical value of BCs and the prevalence of positive BCs in the adult ED.

Objective: This study aimed to determine the prevalence of positive BCs, as well as to specify the most commonly isolated microorganism, in the ED of a single tertiary care centre in Saudi Arabia.

Methods: This was a retrospective study conducted by reviewing patient charts to obtain all BCs collected in our ED over the course of one year. Out of 214,566 ED visits over the period from 1 July 2021 to 30 June 2022, a total of 1034 blood cultures were collected. The study was conducted in the ED of a teaching hospital in Taif, Makkah Region, Saudi Arabia, that has 500 beds for adults.

Results: The most commonly isolated organisms were *Staphylococcus hominis* (19.8%), *Staphylococcus epidermidis* (14.1%), *Escherichia coli* (9%), *Klebsiella pneumoniae* (8%), *Staphylococcus capitis* (7.3%), and *Staphylococcus aureus* (5.6%). Methicillin-resistant *Staphylococcus aureus* (MRSA)

and *Pseudomonas aeruginosa* were isolated from 3.4% and 1.1% of positive blood cultures, respectively. In the context of antimicrobial sensitivity, the organisms isolated from positive BCs in this study showed the highest sensitivity to vancomycin (57.6%). This was followed by levofloxacin (48.6%), linezolid (48%), gentamycin (41.8%), amoxicillin clavulanate (39.5%), and clindamycin (39%). The highest prevalence of antimicrobial resistance was to ampicillin (42.4%). Resistance to clindamycin, azithromycin, piperacillin-tazobactam, and imipenem was 22%, 8.5%, 3.4% and 0.6%, respectively.

Conclusion: The prevalence of positive blood cultures in the ED of this tertiary hospital was high. The most commonly isolated organisms were *Staphylococcus hominis*, *Staphylococcus epidermidis*, *Escherichia coli*, and *Klebsiella pneumoniae*. Vancomycin elicited the highest antimicrobial sensitivity, followed by levofloxacin.

Index Terms—Blood Culture, Emergency Department, Prevalence, Saudi Arabia.

I. INTRODUCTION

Sepsis is a progressive disease caused by a dysregulated inflammatory cascade, leading to organ dysfunction and circulatory compromise in severe cases. The diagnosis of bloodstream infections (BSIs), which frequently rank among the top seven causes of death, requires blood cultures (BCs) [1]. Even when the primary disease is one with a low likelihood of association with bacteraemia, such as pneumonia or cellulitis, BCs are often taken in the emergency department (ED) from patients with suspected infections. As a result, the ED's positive blood culture yield is minimal.

Despite the frequent collection of blood cultures during the course of investigation in the ED, there

Osama Barakat, Muath Alsafrani, Hassan Alasmari, and Faisal Alasmari are with the Emergency Department, King Abdulaziz Specialist Hospital, Taif's Health Cluster, Taif, Saudi Arabia, e-mail: osamabarakat.1415@gmail.com, e-mail: Dr.moath@msn.com, e-mail: hasan_gm@hotmail.com, e-mail: Faisaluni35@gmail.com (Corresponding author: Osama Barakat).

Abdullah Alzahrani is with the College of Medicine, Taif University, Taif, Saudi Arabia, e-mail: Aakz2001@gmail.com

Reem Barakat is with the College of Business Administration, Umm Al-Qura University, Makkah, Saudi Arabia.

Wedad Alzahrani is with the Department of Foreign Language, College of Arts, Taif University, Taif, Saudi Arabia, e-mail: wid.za@outlook.sa

Ali Alsaheel is with the Emergency Department, King Abdulaziz Specialist Hospital, Taif's Health Cluster, Taif, Saudi Arabia, e-mail: Ali.alsaheel@gmail.com

DOI:10.52609/jmlph.v3i2.71

remain few studies that examine the clinical value of BCs, and few published criteria for obtaining BCs [1].

The true positive rate has been modest (1.8-5%) in the few trials conducted in adult ED populations, and only 0.5-4.8% of those studies have produced clinically meaningful results [2-4]. In the majority of investigations, almost similar false-positive rates have been discovered, which have drawbacks. The only study to quantify this, conducted in a paediatric ED, demonstrated considerable unfavourable effects of false-positive BCs in terms of staff time, and resource [5]. No studies have been conducted to detect the prevalence of positive BCs in the ED setting; our study therefore aimed to determine the prevalence of positive BCs and to specify the most commonly isolated microorganism in the ED of a single tertiary centre in Saudi Arabia

II. METHODOLOGY

This was a retrospective study, conducted by reviewing patient charts to obtain all BCs collected in our ED over the period between 1 July 2021 and 30 June 2022. A total of 1034 blood cultures were collected in that time. It was carried out in the ED of a teaching hospital in Taif, Makkah Region, Saudi Arabia, with a 500-bed capacity. The hospital covers adult medical and surgical specialities, with the exception of burns, obstetrics, and gynaecology, and is one of three significant hospitals providing care for Taif's population of 1.7 million. Every year, the ED sees about 200,000 patients, of whom 45% are admitted. The study population was comprised entirely of patients who had BCs taken in the ED during the study period; both those admitted to the hospital and those who were discharged from the ED were included.

Four of the authors handled the task of data collection, and the record of each patient in the research population was thoroughly reviewed. Patients' demographics, culture indication, chief complaint at presentation, BC result, and antibiotic culture sensitivity were all collected.

Microsoft Excel 2010 was used to enter the data, which was then translated from Arabic to English and coded for statistical analysis using Statistical Package for Social Science (SPSS) version 21.0. The research is exempt from ethical review.

III. RESULTS

Of 214,566 visits during the study period, 1034 BC samples were collected.

The mean age of the patients 69 ± 21 years. Males and females constituted 60% and 40% respectively, and 88.7% were Saudi. The chief complaint leading to BC collection was classified per symptom; the most common symptoms were fever (29.4%), neurological symptoms (6.2%), and respiratory symptoms (5.1%). The prevalence of positive BCs among the collected samples was 17.1% (n=177).

The most commonly isolated organisms were *Staphylococcus hominis* (19.8%, n=35), *Staphylococcus epidermidis* (14.1%, n=25), *Escherichia coli* (9%, n=16), *Klebsiella pneumoniae* (8%, n=14), *Staphylococcus capitis* (7.3%, n=13), and *Staphylococcus aureus* (5.6%, n=10). Methicillin-resistant *Staphylococcus aureus* (MRSA) and *Pseudomonas aeruginosa* were isolated from 3.4% (n=6) and 1.1% (n=2) of positive blood cultures, respectively.

In the context of antimicrobial sensitivity, the isolated organisms showed the highest sensitivity to vancomycin (57.6%). This was followed by levofloxacin (48.6%), linezolid (48%), gentamycin (41.8%), amoxicillin clavulanate (39.5%) and clindamycin (39%). The highest antimicrobial resistance was to ampicillin (42.4%). Resistance to clindamycin, azithromycin, piperacillin-tazobactam, and imipenem was 22%, 8.5%, 3.4% and 0.6%, respectively.

IV. DISCUSSION

The prevalence of positive BCs in the ED of this tertiary centre in Taif was high when compared with those of the several studies in the literature, which ranged from 1.8% to 5% [2-4]. Blood cultures must be weighed against more costly and clinically useful tests such as skin lesion samples, urine and joint fluid cultures, and more direct tests like cerebrospinal fluid Gram stain and culture [4].

Despite insufficient studies on the ordering of BCs in adult EDs, the few publications that have been published generally state that these tests are over-ordered, frequently result in a low impact on patient management, and frequently have a high false-positive rate [2-4].

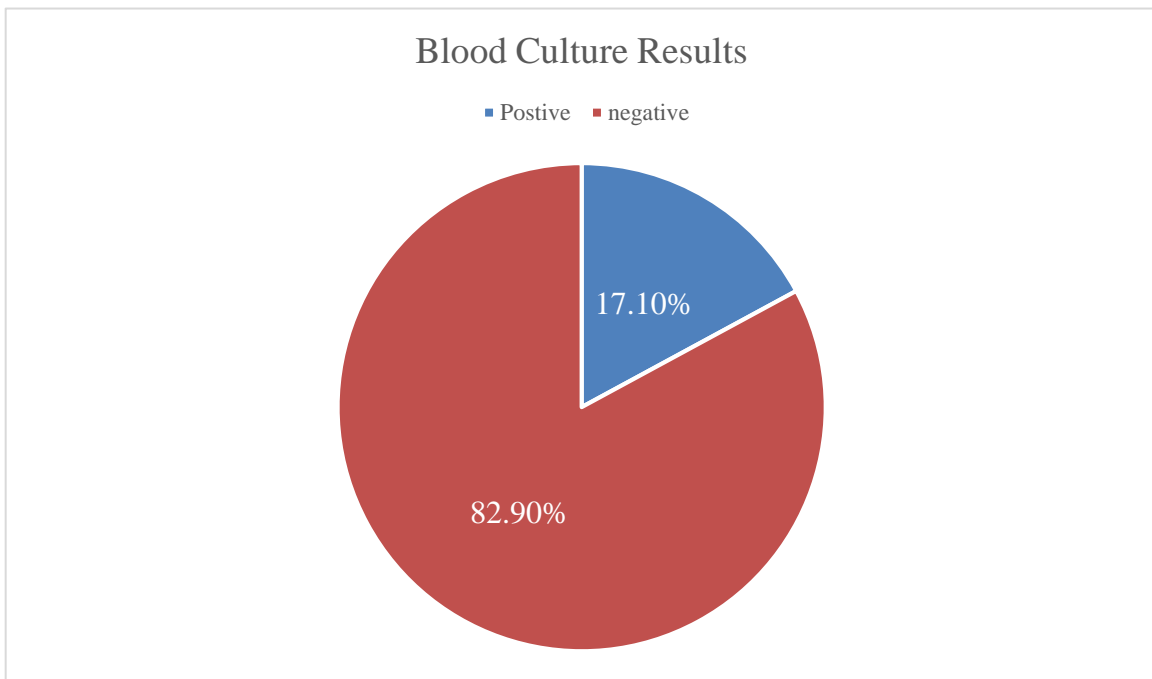


Figure 1. Prevalence of positive blood cultures among the collected samples in the studied centre.

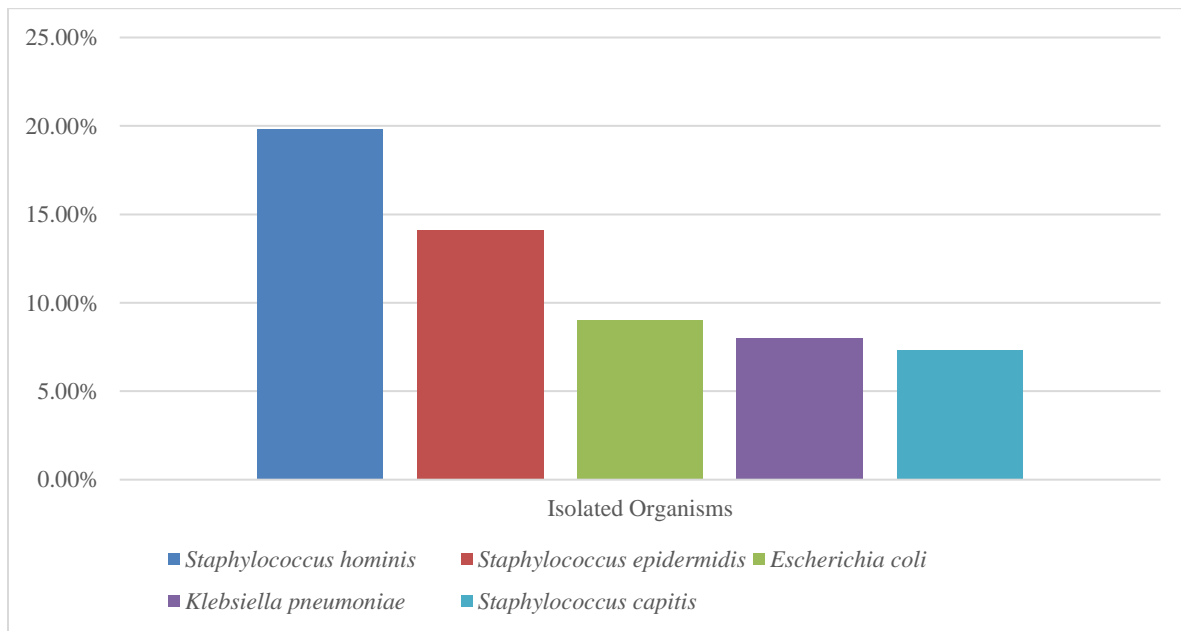


Figure 2. The most commonly isolated organisms from blood cultures in a tertiary hospital in Taif, Saudi Arabia

In contrast, our study found that the confirmed prevalence of positive BCs is sufficient reason to order BCs for every sepsis-suspected patient. The prevalence could be attributed to several factors, such as the physician's gestalt, or the ED system and structure.

Additional studies, mostly from paediatric EDs, have focused on the circumstances in which BCs are most unlikely to be helpful. Their results suggest that BCs should not be collected from patients with urinary tract infections, cellulitis, or community-acquired pneumonia, because they showed that in such patients, the collection of BCs is not helpful in changing their management", or "the collection of BCs has no effect on their management [3, 5- 6]. On the other hand, it is interesting to note that in our study, BCs were most frequently ordered for these three groups, whose symptoms included fever, neurological symptoms and respiratory symptoms. In cases of sepsis, meningitis, osteomyelitis, septic arthritis, endocarditis, peritonitis, pneumonia associated with severe sepsis/HCAP, and fever of unknown cause, BCs are recommended [8–15,16]. Furthermore, blood cultures should typically be ordered in the ED for any patient who is critically unwell or has a high chance of developing continuous bacteraemia [1].

A study conducted on a paediatric population reported that all 10 patients with a confirmed pathogen on BC had the same organism cultured from mid-stream urine [6], while Ramos et al. [3] observed that BCs changed treatment most often when the diagnosis was not a urinary tract infection. Given these results, it is difficult to defend the continued collection of BCs in this circumstance.

In our study, the most common pathogens in the positive BCs were *Staphylococcus hominis*, *Staphylococcus epidermidis*, *Escherichia coli*, *Klebsiella pneumoniae*, *Staphylococcus capitis*, and *Staphylococcus aureus*. MRSA and *Pseudomonas aeruginosa* were also isolated. In the literature, BCs that contain *Staphylococcus aureus*, *Streptococcus pneumoniae*, group A streptococci, *Haemophilus influenzae*, *Pseudomonas aeruginosa*, and *Candida* species typically result in a true positive [17, 18].

Meanwhile, the growth of Viridans streptococci and enterococci in cultures may represent either real pathogens or contamination. There is a greater chance that many BCs collected from different lines will be truly positive [19, 20,21]; this method can raise the proportion of accurately positive blood cultures.

Our study has several limitations. This was a retrospective chart review-based study, and systematic bias in data retrieval cannot be avoided in such research. Furthermore, we are a tertiary referral centre for adult patients only, with a high level of acuity and a high mean age (66 years). This means that, compared with many community hospitals, our patient group is different. Our patients' true-positive BC rates are probably greater than those in the ED of other hospitals, because they are older, have more comorbid conditions, and are sicker overall. This is a confounding factor that may affect the results of our study.

V. CONCLUSION

The prevalence of positive blood cultures in the ED of our tertiary hospital was high in comparison with the literature review. The most commonly isolated organisms were *Staphylococcus hominis*, *Staphylococcus epidermidis*, *Escherichia coli*, and *Klebsiella pneumoniae*. Sensitivity was highest to vancomycin, followed by levofloxacin.

VI. REFERENCES

1. Goto M, Al-Hasan MN. Overall burden of bloodstream infection and nosocomial bloodstream infection in North America and Europe. *Clin Microbiol Infect.* 2013;19(6):501-9. Doi: 10.1111/1469-0691.12195.
2. Sturmman KM, Bopp J, Molinari D, Akhtar S, Murphy J. Blood cultures in adult patients released from an urban emergency department: a 15-month experience. *Acad Emerg Med.* 1996; 3:768–775.
3. Ramos JM, Masiá M, Elía M, Gutiérrez F, Royo G, Bonilla F, Padilla S, Martín-Hidalgo A. Epidemiological and clinical characteristics of occult bacteremia in an adult emergency department in Spain: influence of blood culture results on changes in initial diagnosis and empiric antibiotic

treatment. *Eur J Clin Microbiol Infect Dis*. 2004 Dec;23(12):881-7. Doi: 10.1007/s10096-004-1235-0. PMID: 15599649.

4. Kelly AM. Clinical impact of blood cultures taken in the emergency department. *J Accid Emerg Med*. 1998; 15:254–256.

5. Segal GS, Chamberlain JM. Resource utilization and contaminated blood cultures in children at risk for occult bacteremia. *Arch Pediatr Adolesc Med*. 2000; 154:469–473.

6. Pitetti RD, Choi S. Utility of blood cultures in febrile children with UTI. *Am J Emerg Med*. 2002; 20:271–274.

7. Sadow KB, Chamberlain JM. Blood cultures in the evaluation of children with cellulitis. *Pediatrics* 1998; 101:E4.

8. Coburn B, Morris AM, Tomlinson G, Det-sky AS. Does this adult patient with suspected bacteremia require blood cultures? *JAMA* 2012;308:502–11.

9. Stevens DL, Bisno AL, Chambers HF, Dellinger EP, Goldstein EJ, Gorbach SL, Hirschmann JV, Kaplan SL, Montoya JG, Wade JC; Infectious Diseases Society of America. Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Diseases Society of America. *Clin Infect Dis*. 2014 Jul 15;59(2):e10-52. Doi: 10.1093/cid/ciu444. Erratum in: *Clin Infect Dis*. 2015 May 1;60(9):1448. Dosage error in article text. PMID: 24973422.

10. Mandell LA, Wunderink RG, Anzueto A, Bartlett JG, Campbell GD, Dean NC, Dowell SF, File TM Jr, Musher DM, Niederman MS, Torres A, Whitney CG; Infectious Diseases Society of America; American Thoracic Society. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. *Clin Infect Dis*. 2007 Mar 1;44 Suppl 2:S27-72. Doi: 10.1086/511159. PMID: 17278083; PMCID: PMC7107997.

11. Nicolle LE, Bradley S, Colgan R, Rice JC, Schaeffer A, Hooton TM. Infectious Diseases Society of America guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults.

Clin Infect Dis. 2005;40:643–54.

12. Gupta K, Hooton TM, Naber KG, Wullt B, Colgan R, Miller LG, Moran GJ, Nicolle LE, Raz R, Schaeffer AJ, Soper DE; Infectious Diseases Society of America; European Society for Microbiology and Infectious Diseases. International clinical practice guidelines for the treatment of acute un-complicated cystitis and pyelonephritis in women: A 2010 update by the Infectious Diseases Society of America and the European Society for Microbiology and Infectious Diseases. *Clin Infect Dis*. 2011 Mar 1;52(5):e103-20. doi: 10.1093/cid/ciq257. PMID: 21292654.

13. Hooton TM, Bradley SF, Cardenas DD, Colgan R, Geerlings SE, Rice JC, Saint S, Schaeffer AJ, Tambayh PA, Tenke P, Nicolle LE; Infectious Diseases Society of America. Diagnosis, prevention, and treatment of catheter-associated urinary tract infection in adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America. *Clin Infect Dis*. 2010 Mar 1;50(5):625-63. doi: 10.1086/650482. PMID: 20175247.

14. Dellinger RP, Levy MM, Rhodes A, Annane D, Gerlach H, Opal SM, Sevransky JE, Sprung CL, Douglas IS, Jaeschke R, Osborn TM, Nunnally ME, Townsend SR, Reinhart K, Kleinpell RM, Angus DC, Deutschman CS, Machado FR, Rubenfeld GD, Webb SA, Beale RJ, Vincent JL, Moreno R; Surviving Sepsis Campaign Guidelines Committee including the Pediatric Subgroup. Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock: 2012. *Crit Care Med*. 2013 Feb;41(2):580-637. doi: 10.1097/CCM.0b013e31827e83af. PMID: 23353941.

15. Solomkin JS, Mazuski JE, Bradley JS, Rodvold KA, Goldstein EJ, Baron EJ, O'Neill PJ, Chow AW, Dellinger EP, Eachempati SR, Gorbach S, Hilfiker M, May AK, Nathens AB, Sawyer RG, Bartlett JG. Diagnosis and management of complicated intra-abdominal infection in adults and children: guidelines by the Surgical Infection Society and the Infectious Diseases Society of America. *Surg Infect (Larchmt)*. 2010 Feb;11(1):79-109. doi: 10.1089/sur.2009.9930. PMID: 20163262.

16. Shapiro NI, Wolfe RE, Wright SB, Moore R,

Bates DW. Who needs a blood culture? A prospectively derived and validated prediction rule. *J Emerg Med* 2008;35:255–64.

17. Martín-Gutiérrez G, Martín-Pérez C, Gutiérrez-Pizarraya A, Lepe JA, Cisneros JM, Aznar J. Time to positivity of blood cultures in patients with bloodstream infections: A useful prognostic tool. *Enferm Infecc Microbiol Clin*. 2017 Dec;35(10):638-644. English, Spanish. doi: 10.1016/j.eimc.2016.10.003. Epub 2016 Dec 2. PMID: 27916290.

18. Pien BC, Sundaram P, Raoof N, Costa SF, Mirrett S, Woods CW, Reller LB, Weinstein MP. The clinical and prognostic importance of positive blood cultures in adults. *Am J Med*. 2010 Sep;123(9):819-28. doi: 10.1016/j.amjmed.2010.03.021. PMID: 20800151.

19. Strand CL, Wajsbort RR, Sturmman K. Effect of iodophor vs iodine tincture skin preparation on blood culture contamination rate. *JAMA* 1993;269:1004–6

20. Mirrett S, Weinstein MP, Reimer LG, Wilson ML, Reller LB. Relevance of the number of positive bottles in determining clinical significance of coagulase-negative staphylococci in blood cultures. *J Clin Microbiol*. 2001 Sep;39(9):3279-81. doi: 10.1128/JCM.39.9.3279-3281.2001. PMID: 11526163; PMCID: PMC88331.

21. Weinstein MP. Current blood culture methods and systems: clinical concepts, technology, and interpretation of results. *Clin Infect Dis*. 1996;23:40–6.