NPRC Journal of Multidisciplinary Research
Volume 2, Issue 10, October, 2025 Pages: 1-11
ISSN: 3059-9148 (Online)
DOI: 10.3126/nprcjmr.v2i10.85861

OPEN ACCESS

Clinical Impact of Switching from Conventional to Bactec Blood Culture System in a Hospital Setting

Ravi Shankar Gupta*
Associate Professor
Department of Microbiology
National Medical College and Teaching Hospital, Birgunj, Nepal.
gupta.drravishanker@gmail.com
https://orcid.org/0009-0002-6157-9645

Amrullah Shidiki
Associate Professor
Department of Microbiology
National Medical College and Teaching Hospital, Birgunj, Nepal.
amarullahsidhiqie24@gmail.com

Type of research: Original Research
Corresponding Author*
Received: August 02, 2025 Revised & Accepted: October 28, 2025

Abstract

Background: Bloodstream infections (BSIs) leading to sepsis remain major causes of morbidity and mortality in hospitalized patients worldwide. Conventional blood culture methods, though regarded as the diagnostic gold standard, require prolonged incubation and manual monitoring, which delay the detection of microbial growth and the initiation of targeted therapy. The BACTEC Automated Blood Culture System (Becton Dickinson, USA) has been developed to address these limitations through continuous monitoring of carbon dioxide (CO_2) production using a fluorescent sensor, allowing rapid and reliable detection of microbial growth. This study aimed to evaluate the clinical impact of switching from the Conventional Blood Culture Method to the BACTEC System in a tertiary care hospital setting in Nepal.

Methods: A total of 150 blood samples were analyzed—75 using the Conventional Method and 75 using the BACTEC System—to compare time to detection, positivity rate, contamination rate, turnaround time, and early clinical response.

NPRC Journal of Multidisciplinary Research
Volume 2, Issue 10, October, 2025 Pages: 1-11
ISSN: 3059-9148 (Online)
DOI: 10.3126/nprcjmr.v2i10.85861

Results: The BACTEC system significantly reduced mean time to detection from 48.3 ± 8.7 hours to 18.6 ± 4.2 hours ($p < 0.001$), increased culture positivity from 34.7% to 50.7% ($p = 0.03$), and decreased contamination from 8.0% to 2.7% ($p = 0.04$). Antibiotic therapy was changed based on BACTEC results in 46.6% of patients, compared to 25.3% in the conventional group ($p = 0.01$).

Conclusion: The findings indicate that the BACTEC Blood Culture System enhances diagnostic efficiency, accelerates clinical decision-making, reduces unnecessary empirical therapy, and supports antimicrobial stewardship. It represents a reliable, cost-effective solution for improving patient outcomes in resource-limited hospital settings.

Novelty: Introducing automated blood culture testing strengthens diagnostic turnaround and supports earlier targeted therapy in a tertiary hospital with limited resources.

Keywords: Antimicrobial Stewardship, Automated blood culture, BACTEC system, Bloodstream infection, Diagnostic efficiency, Sepsis

Introduction

Bloodstream infections (BSIs) and sepsis rank among the top reasons for human mortality for hospitalized patients (Martinez & Wolk, 2016). Worldwide estimates of sepsis prevalence exceed 19 million cases per year, with over 750,000 in the United States (Adhikari et al., 2010). Early detection of bacteremia and prompt initiation of targeted antimicrobial therapy are crucial for improving patient outcomes and reducing healthcare costs. Blood culture is considered the "gold standard" investigation for the detection of microorganism in blood. Blood cultures should only be taken when there is a reason to suspect infection. The culture of microorganism from blood is essential for microbiological diagnosis of bacteremia, fungemia, infective endocarditis, and conditions associated with a clinical presentation of pyrexia of unknown origin (Bryan, 1989). Blood cultures are the foremost investigation to diagnose or rule out any infection in the body, which can be even a lifesaver, as the infections may lead to a fatal condition. Although traditional blood culture has been considered the gold standard for diagnosing BSIs, conventional blood culture systems rely on manual observation for turbidity, gas formation, or hemolysis, which can delay the detection of microbial growth and prolong the time to diagnosis and treatment.

The need for rapid and reliable detection led to the development of automated blood culture systems, among which the BACTEC Blood Culture System (Becton Dickinson, USA) has gained widespread clinical acceptance (Weinstein et al., 1995). This system operates on the principle of continuous monitoring of carbon dioxide (CO_2) production—a metabolic by-product of microbial growth—detected by a fluorescent sensor (Minassian et al., 2014). The automation not only enhances sensitivity and accuracy but also significantly reduces the time to detection, often identifying positive cultures within 12–24 hours compared to 48–72 hours required by conventional methods (Pal et al., 2009). Sepsis and bloodstream infections are a substantial problem in Nepal — a recent ICU-based study found sepsis in about 38% of adult ICU admissions (Zahlane et al., 2020), and regional surveillance has documented rising rates

NPRC Journal of Multidisciplinary Research
Volume 2, Issue 10, October, 2025 Pages: 1-11
ISSN: 3059-9148 (Online)
DOI: 10.3126/nprcjmr.v2i10.85861

of bloodstream infections and antimicrobial resistance in eastern Nepal over the last decade (Malla et al., 2014). Neonatal sepsis remains a leading cause of morbidity and mortality in Nepali tertiary centers (Manandhar et al., 2021). Reviews of Nepal's AMR landscape further highlight widespread inappropriate antibiotic use, limited laboratory capacity, and gaps in AMR surveillance (Acharya & Wilson, 2019), and broader analyses from South Asia report under-utilization and delayed processing of blood cultures in resource-limited settings (Hemlock et al., 2020).

In developing countries like Nepal, where sepsis remains a major clinical challenge and laboratory resources are often limited, the transition from conventional to automated systems such as BACTEC holds considerable promise. In resource-constrained settings, delayed detection and reporting of bloodstream infections can translate into prolonged empirical antibiotic use, increased resistance, longer hospitalization, and greater costs. By providing faster detection, higher sensitivity, and fewer contaminations, automated systems can enable earlier pathogen identification, more targeted antibiotic therapy, reduced hospital stay durations, and thus improved clinical outcomes and cost-effectiveness.

This study aims to assess the clinical impact of switching from a conventional blood culture system to the BACTEC Blood Culture System in a hospital setting. Specifically, it evaluates differences in time to positivity, detection rates, clinical decision-making speed, and overall patient outcomes. By analyzing these parameters, the study seeks to provide evidence on the diagnostic and economic benefits of adopting automated culture technology in routine hospital microbiology practice.

Materials and Methods

Study Design

This study was conducted from a Lab-based comparative and analytical perspective to evaluate the clinical and diagnostic impact of implementing the BACTEC Automated Blood Culture System (Becton Dickinson, USA) compared to the Conventional Blood Culture System. The study aimed to analyze differences in time to detection, positivity rate, contamination rate, and clinical turnaround time for patients with suspected bloodstream infections.

Study Setting

This study was conducted in the Department of Microbiology at National Medical College and Teaching Hospital, Birgunj, Nepal, where both conventional and automated blood culture systems were operational.

Duration of Study

The study spanned from 3rd July 2024 to 2nd July 2025.

Study Population

A total of 150 blood samples were reviewed and processed during the study period. Out of these, 75 samples were analyzed using the Conventional Blood Culture Method, and 75 samples were analyzed using the BACTEC Automated Blood Culture System. To ensure direct comparability between the two systems, each enrolled patient contributed a single venous blood draw that was aliquoted into two sets of culture bottles and processed concurrently: one set

NPRC Journal of Multidisciplinary Research
Volume 2, Issue 10, October, 2025 Pages: 1-11
ISSN: 3059-9148 (Online)
DOI: 10.3126/nprcjmr.v2i10.85861

inoculated into the Conventional BHI culture bottle(s) and the other into BD BACTEC Plus aerobic bottles. Two blood-culture sets were collected per septic episode; adult bottles were targeted to receive approximately 8–10 mL of blood each, while pediatric bottles received 1–2 mL per bottle. Bottle fill volumes were checked at collection, and any samples with inadequate volume were excluded per the stated criteria. This pre-analytical standardization follows established recommendations and the volume–yield relationship described in Henning et al. (2019), helping to minimize bias in positivity-rate comparisons. Both sets were incubated and handled in parallel by laboratory staff who were blinded to clinical management decisions; laboratory personnel processing subcultures and identification were blinded to the comparison hypothesis.

Inclusion Criteria

- Patients of all age groups and genders presenting with clinical suspicion of septicemia or bloodstream infection.
- Patients admitted to medical, surgical, pediatric, or critical care units with fever (>38°C), chills, or other systemic signs of infection.

Exclusion Criteria

- Patients who had received antibiotic therapy for more than 48 hours before sample collection.
- Samples with inadequate volume (<2 mL in pediatric or <5 mL in adults) or visible contamination.

Diagnosis

For the Conventional Blood Culture Method, blood samples were inoculated into Brain Heart Infusion (BHI) broth and incubated at 37°C for up to 7 days. Daily visual inspection was carried out for signs of microbial growth, such as turbidity, gas production, or hemolysis; any bottle showing a visible change was immediately processed. Positive cultures were subcultured without delay (within 2 hours of detection) onto Blood Agar, MacConkey Agar, and Chocolate Agar plates as appropriate for organism recovery, and plates were incubated at 35–37°C under appropriate atmospheric conditions. Organism identification was performed using standard laboratory techniques -Gram stain, and antimicrobial susceptibility testing (AST) was performed according to Clinical and Laboratory Standards Institute (CLSI) guidelines using disk-diffusion (Kirby–Bauer) or automated susceptibility systems when available. Bottles that remained visually negative after 7 days were subjected to terminal subculture per laboratory protocol before being reported as negative.

For the BACTEC System, blood samples were inoculated into BACTEC Plus Aerobic/F and placed in the BACTEC FX40 instrument, which continuously monitored carbon dioxide (CO_2) production—a metabolic by-product of microbial activity—using a fluorescent sensor. When the instrument flagged a bottle as positive, the bottle was removed and processed immediately: Gram stain and direct smear were performed, followed by subculture onto Blood, MacConkey, and Chocolate agars. Identification and AST workflows matched those used for the Conventional method to ensure comparability of results. Per manufacturer recommendations and laboratory policy, BACTEC bottles that did not flag positive were incubated in the

NPRC Journal of Multidisciplinary Research
Volume 2, Issue 10, October, 2025 Pages: 1-11
ISSN: 3059-9148 (Online)
DOI: 10.3126/nprcjmr.v2i10.85861

instrument for the full recommended period (up to 5 days) and subjected to terminal subculture before being reported as negative.

Main Outcomes and Methods

The study focused on the following main outcomes:

1. **Time to Detection (TTD):** Time in hours from sample incubation to the first positive signal.
2. **Positivity Rate:** Percentage of samples showing confirmed microbial growth.
3. **Contamination Rate:** Percentage of mixed or false-positive cultures.
4. **Turnaround Time:** Total time from sample collection to final culture reporting.
5. **Clinical Response Time:** Time taken for clinicians to modify or initiate targeted antibiotic therapy after receiving the culture result. It was measured as the interval (in hours) between the laboratory reporting time of the first positive culture (instrument flag or lab report timestamp) and the timestamp of the first clinician-ordered antibiotic change (new order or modification) recorded in the patient's medication chart. Data were extracted from laboratory logs and patient charts by two trained investigators, with any discrepancies adjudicated by the senior investigator.

Both systems were compared for their diagnostic efficiency, accuracy, and clinical relevance. The BACTEC results were further evaluated for their potential to reduce hospital stay and improve early therapeutic decisions.

Statistical Analysis

All data were entered and analyzed using Microsoft Excel 2010 and SPSS version 25. Descriptive statistics such as frequency, percentage, mean, and standard deviation (SD) were computed. Comparative analyses were performed using the Chi-square test for categorical variables and the Independent t-test for continuous variables. A p-value of <0.05 was considered statistically significant.

Ethical Approval

The approval for this study was formally obtained from the Institutional Ethics Committee of National Medical College, Birgunj, Nepal (Ref. F-NMC/716/080-081) on 1st July 2024. Written informed consent was taken from all patients or their guardians prior to blood collection. Patient confidentiality was strictly maintained for all research purposes in accordance with institutional and ethical standards.

Results

A total of 150 blood samples were analyzed in this study period. 75 processed by the Conventional Blood Culture Method and 75 by the BACTEC Automated Blood Culture System. The results were compared in terms of time to detection, positivity rate, contamination rate, and clinical response.

Time to Detection (TTD)

The average time to detection of positive cultures was markedly shorter in the BACTEC system than in the conventional method. The mean detection time for BACTEC was 18.6 ± 4.2 hours,

NPRC Journal of Multidisciplinary Research
Volume 2, Issue 10, October, 2025 Pages: 1-11
ISSN: 3059-9148 (Online)
DOI: 10.3126/nprcjmr.v2i10.85861

compared to 48.3 ± 8.7 hours for the conventional method, showing a statistically significant difference ($p < 0.001$).

Minimum–maximum values show BACTEC results ranged from 8.3 to 28.2 h (range = 19.9 h), whereas the conventional method ranged from 25.5 to 64.4 h (range = 38.9 h); the BACTEC range is ~51% of the conventional range, indicating both faster and more consistent detection.

Table 1. Comparison of Time to Detection between Conventional and BACTEC Systems

Method	Total Samples (n)	Positive Samples (n)	Mean Time to Detection (hours ± SD)	Minimum	Maximum
Conventional Method	75	26	48.3 ± 8.7	25.5	64.4
BACTEC System	75	38	18.6 ± 4.2	8.3	28.2

p value: <0.001

Culture Positivity Rate

The BACTEC system yielded a higher positivity rate compared to the conventional method (95% CIs). Of the 75 samples processed in each group, 38 (50.7%) were positive in the BACTEC system and 26 (34.7%) in the conventional system ($p = 0.03$).

Table 2. Comparison of Culture Positivity Rates between Conventional and BACTEC Systems

Method	Total Samples (n)	Positive Cultures (n)	Positivity Rate (%)
Conventional Method	75	26	34.7
BACTEC Method	75	38	50.7

p value = 0.03

Contamination Rate

The contamination rate was significantly lower in the BACTEC system, at 2.7% (2/75), compared to 8.0% (6/75) in the conventional method ($p = 0.04$). This denotes that the BACTEC method can be more accurate and useful for the proper clinical intervention in patients.

Table 3. Comparison of Contamination Rate between Conventional and BACTEC Systems

Method	Total Samples (n)	Contaminated samples (n)	Contamination Rate (%)
Conventional Method	75	6	8
BACTEC Method	75	2	2.7

p – value = 0.04

NPRC Journal of Multidisciplinary Research
Volume 2, Issue 10, October, 2025 Pages: 1-11
ISSN: 3059-9148 (Online)
DOI: 10.3126/nprcjmr.v2i10.85861

Turnaround Time and Clinical Response

The average turnaround time — from sample collection to reporting — was 61.5 ± 10.4 hours for the conventional method and 28.9 ± 6.5 hours for the BACTEC system ($p < 0.001$). Additionally, the number of patients who had early antibiotic modification (based on blood culture results) was significantly higher in the BACTEC group (35 cases; 46.6%) compared to the conventional group (19 cases; 25.3%) ($p = 0.01$).

Table 4. Comparison of Turnaround Time and Clinical Response between the Two Methods

Parameter	Conventional Method (n=75)	BACTEC System (n=75)	p-value
Mean Turnaround Time (hours ± SD)	61.5 ± 10.4	28.9 ± 6.5	<0.001
Cases with Early Antibiotic Modification	19 (25.3%)	35 (46.6%)	0.01

The study findings indicate that the BACTEC Blood Culture System outperforms the Conventional Method across all key parameters. The time to detection was reduced by approximately 62%, while the positivity rate increased by around 16%. Contamination rates decreased by about 5%, and the overall turnaround time was cut by more than half. Moreover, the ability for early clinical intervention nearly doubled. These results underscore the clinical and diagnostic superiority of the BACTEC system, highlighting its significant potential to improve patient care through faster and more reliable detection of bloodstream infections.

Discussion

Implementing the BACTEC automated blood culture system dramatically reduced the time to positivity in our setting, accelerating clinical decision-making. In our study, the mean TTD fell from 48.3 hours (conventional) to 18.6 hours with BACTEC – about a 62% decrease. This is in line with prior reports: for example, Surase et al. (2016) found that 86.8% of isolates were detected by BACTEC within 48 hours, a markedly faster rate than manual culture. Studies by Deslandes et al. (2022) align with this observation, reporting that automated systems decrease detection times by 50–70%, thereby enabling earlier modification of antimicrobial therapy and potentially reducing hospital stay. Conversely, conventional culture methods, though considered the gold standard, rely on manual inspection and are prone to delayed detection, emphasizing the context dependence of laboratory efficiency (Diekema & Marchesseault, 1999). The substantial reduction in detection time observed in our study likely reflects the continuous CO_2 monitoring inherent to the BACTEC system, consistent with WHO recommendations advocating automated cultures for the timely diagnosis of bloodstream infections (Ulrich et al., 2022). Automated systems use a fluorescent CO_2 sensor and constant agitation, triggering detection as soon as microbial metabolism rises above threshold levels

NPRC Journal of Multidisciplinary Research
Volume 2, Issue 10, October, 2025 Pages: 1-11
ISSN: 3059-9148 (Online)
DOI: 10.3126/nprcjmr.v2i10.85861

(Surase et al., 2016). By contrast, conventional bottles rely on manual turbidity checks and are typically incubated longer (often 48–72 hours) before calling negatives, so slow or low-level growth can be missed (Surase et al., 2016). Faster growth signals in automated bottles thus support prompt identification of pathogens and earlier initiation of targeted therapy.

Our BACTEC system also yielded a substantially higher overall positivity rate (50.7%) than the conventional method (34.7%). Enhanced yield with automated cultures has been noted in other studies. Surase et al. (2016) reported culture positivity of 32% with BACTEC versus 19.9% with conventional methods. Similarly, Mengeloglu et al. (2015) showed that a significant number of normally sterile fluid infections were detected only when inoculated into BACTEC bottles – cases missed by conventional plates. Moreover, studies by Ulrich et al. (2022) reported that automated systems can detect bacteremia missed by manual methods, particularly in patients with low microbial loads or intermittent bacteremia. The observed improvement is also consistent with reports from Southeast Asian hospitals showing positivity rates of 40–55% using automated systems. Nevertheless, sensitivity can still be affected by factors such as sample volume, timing of collection, and prior antibiotic exposure (Diekema & Marchesseault, 1999). Several factors explain this improved recovery. For instance, BACTEC bottles contain enriched growth media and allow processing of a larger blood volume, which increases the chance of capturing bacteria when only a few organisms are present. Additionally, BACTEC bottles include antibiotic-adsorbing resins. These neutralize residual antimicrobials in patient blood, allowing organisms suppressed on conventional media to grow in the system (McGuire et al., 1983). Continuous agitation and 24/7 monitoring of automated incubators further ensure that even slow-growing or fastidious organisms are detected once they produce CO_2. As noted by Mengeloglu et al. (2015), classical methods can miss fastidious or low-count bacteria and fungi, whereas automated culture bottles with longer incubation and supportive conditions can isolate these pathogens. In our study, adherence to strict pre-analytical protocols minimized false negatives, although low-level bacteremia may still have escaped detection.

We also observed a lower contamination rate with BACTEC (2.7% vs. 8.0%). This reduction mirrors the findings of Diekema & Marchesseault (1999) and Deslandes et al. (2022), reflecting the closed-system design and minimal human handling inherent to automated cultures. The closed-system design of BACTEC bottles likely reduces handling and exposure during incubation, limiting false positives. Lower contamination rates mean fewer spurious positives, less unnecessary antibiotic use, and more confidence in reported pathogens.

Nearly half of patients in the BACTEC group (46.6%) had antibiotic regimens modified early based on culture results, compared to only 25.3% in the conventional group ($p=0.01$). Rapid notification of positive cultures and Gram stains empowers clinicians to tailor therapy sooner. For example, Halperin et al. (2022) noted that shorter time to detection could have an important effect on identifying causative organisms and guiding antimicrobial stewardship. Early targeted therapy may reduce broad-spectrum usage, shorten hospital stays, and improve outcomes. Our findings are consistent with prior reports that automated blood culture systems support more timely, appropriate antibiotic management.

NPRC Journal of Multidisciplinary Research
Volume 2, Issue 10, October, 2025 Pages: 1-11
ISSN: 3059-9148 (Online)
DOI: 10.3126/nprcjmr.v2i10.85861

Limitations

This study has some limitations. First, it was conducted in a single hospital setting with a sample size of 150 blood cultures, which may limit generalizability to other hospitals with different patient populations or laboratory workflows. Second, the study did not include a formal cost-effectiveness or sensitivity analysis, as the focus was primarily on real-world diagnostic and clinical performance outcomes. Third, factors such as prior antibiotic exposure, sample volume, and timing of collection could have influenced culture results, although strict adherence to pre-analytical protocols aimed to minimize these effects. Despite these limitations, the findings provide strong evidence for the clinical utility and operational benefits of automated blood culture systems in improving patient care and laboratory efficiency.

Conclusion and Recommendations

This study has established that the implementation of the BACTEC automated blood culture system significantly improves diagnostic efficiency for bloodstream infections in a hospital setting in Nepal. The system markedly reduces the mean time to detection from 48.3 hours to 18.6 hours, increases the positivity rate from 34.7% to 50.7%, lowers contamination rates, and enables earlier clinical interventions. These improvements facilitate the timely initiation of targeted antibiotic therapy, reduce unnecessary empirical treatment, and support antimicrobial stewardship, thereby enhancing patient outcomes and optimizing healthcare resource utilization. The evidence suggests that automated blood culture systems like BACTEC should be more widely adopted in resource-limited hospital settings to improve both clinical efficiency and patient care. Future studies should evaluate cost-effectiveness, impact on patient mortality and hospital stay, and long-term antimicrobial resistance trends following the adoption of automated systems. Collaborative national programs that integrate automated blood culture data into antimicrobial resistance (AMR) surveillance could further enhance public health outcomes in Nepal and similar settings.

Acknowledgments: We are grateful to the National Medical College and Teaching Hospital, Birjung, Nepal, for providing ethical clearance to conduct this study.

Funding: No funding was received.

Author Contributions: All authors (RSG and AS) made equal and substantial contributions to the conceptualization, methodology design, and data collection. RSG managed data entry and analysis, interpreted the results, and played a major role in drafting the manuscript. AS provided critical supervision, manuscript review, and editorial input. All authors read and approved the final version of the manuscript.

Conflict of interest: The authors declare no conflict of interest.

NPRC Journal of Multidisciplinary Research
Volume 2, Issue 10, October, 2025 Pages: 1-11
ISSN: 3059-9148 (Online)
DOI: 10.3126/nprcjmr.v2i10.85861

References

Acharya, K. P., & Wilson, R. T. (2019). Antimicrobial resistance in Nepal. *Frontiers in medicine*, *6*, 105.

Adhikari, N. K., Fowler, R. A., Bhagwanjee, S., & Rubenfeld, G. D. (2010). Critical care and the global burden of critical illness in adults. *The Lancet*, *376*(9749), 1339–1346. https://doi.org/10.1016/S0140-6736(10)60446-1

Bryan, C. S. (1989). Clinical implications of positive blood cultures. *Clinical microbiology reviews*, *2*(4), 329-353.

Deslandes, V., Rafipour, D., Gorn, I., Sabri, E., Sant, N., & Desjardins, M. (2022). Effect of delayed entry of blood culture bottles in BACTEC automated blood culture system in the context of laboratory consolidation. *Scientific Reports*, *12*(1). https://doi.org/10.1038/s41598-022-05246-3

Diekema, D. J., & Marchesseault, A. (1999). Clinical impact of changing to an automated blood-culture system at a small community hospital. *Clinical Microbiology and Infection*, *5*(9), 590–593. https://doi.org/10.1111/j.1469-0691.1999.tb00444.x

Halperin, A. V., del Castillo Polo, J. A., Cortes-Cuevas, J. L., Cardenas Isasi, M. J., Ampuero Morisaki, M., Birch, R., ... & Cantón, R. (2022). Impact of automated blood culture systems on the management of bloodstream infections: results from a crossover diagnostic clinical trial. *Microbiology spectrum*, *10*(5), e01436-22.

Hemlock, C., Luby, S. P., Saha, S., Qamar, F., Andrews, J. R., Saha, S. K., ... & Bogoch, I. I. (2020). Utilization of blood culture in South Asia for the diagnosis and treatment of febrile illness. *Clinical Infectious Diseases*, *71*(Supplement_3), S266-S275.

Henning, C., Aygül, N., Dinnétz, P., Wallgren, K., & Özenci, V. (2019). Detailed analysis of the characteristics of sample volume in blood culture bottles. *Journal of clinical microbiology*, *57*(8), 10-1128.

Malla, S., Dumre, S. P., Shakya, G., Kansakar, P., Rai, B., Hossain, A., ... & Antimicrobial Resistance Surveillance Programme team, Nepal. (2014). The challenges and successes of implementing a sustainable antimicrobial resistance surveillance programme in Nepal. *BMC public health*, *14*(1), 269.

Manandhar, S., Amatya, P., Ansari, I., Joshi, N., Maharjan, N., Dongol, S., ... & Karkey, A. (2021). Risk factors for the development of neonatal sepsis in a neonatal intensive care unit of a tertiary care hospital of Nepal. *BMC infectious diseases*, *21*(1), 546.

Martinez, R. M., & Wolk, D. M. (2016). Bloodstream Infections. *Diagnostic Microbiology of the Immunocompromised Host*, 653–689. https://doi.org/10.1128/9781555819040.ch25

McGuire, N. M., Kauffman, C. A., Hertz, C. S., & Kovach, J. M. (1983). Evaluation of the BACTEC antimicrobial removal system for detection of bacteremia. *Journal of clinical microbiology*, *18*(3), 449-451.

Mengeloglu, Z., Tas, T., Bucak, Ö., Kocoglu, E., & Kucukbayrak, A. (2015). Comparison of classical methods versus BACTEC blood culture system for culture of normally sterile body fluids. *Russian Open Medical Journal*, *4*(4), 401-401.

Minassian, A. M., Newnham, R., Kalimeris, E., Bejon, P., Atkins, B. L., & Bowler, I. C. (2014). Use of an automated blood culture system (BD BACTEC™) for diagnosis of prosthetic joint

NPRC Journal of Multidisciplinary Research
Volume 2, Issue 10, October, 2025 Pages: 1-11
ISSN: 3059-9148 (Online)
DOI: 10.3126/nprcjmr.v2i10.85861

infections: easy and fast. *BMC Infectious Diseases*, *14*(1). https://doi.org/10.1186/1471-2334-14-233

Pal, N., Sharma, R., Rishi, S., & Vyas, L. (2009). Optimum Time to Detection of Bacteria and Yeast Species with BACTEC 9120 Culture System from Blood and Sterile Body Fluids. *Journal of Laboratory Physicians*, *1*(02), 069–072. https://doi.org/10.4103/0974-2727.59703

Surase, P. V., Nataraj, G., Pattamadai, K., Mehta, P. R., Pazare, A. R., Agarwal, M. C., & Nanavati, R. N. (2016). An appropriately performed conventional blood culture can facilitate choice of therapy in resource-constrained settings-comparison with BACTEC 9050. *Journal of Postgraduate Medicine*, *62*(4), 228-234.

Ulrich, P. S., Bastian, I. N., & Chen, D. J. (2022). Clinical Significance of BD Bactec FX Blood Culture Incubation Beyond 96 Hours (4 Days). *Journal of Clinical Microbiology*, *60*(7), e00549-22. https://doi.org/10.1128/jcm.00549-22

Weinstein, M. P., Mirrett, S., Reimer, L. G., Wilson, M. L., Smith-Elekes, S., Chuard, C. R., Joho, K. L., & Reller, L. B. (1995). Controlled evaluation of BacT/Alert standard aerobic and FAN aerobic blood culture bottles for detection of bacteremia and fungemia. *Journal of Clinical Microbiology*, *33*(4), 978–981. https://doi.org/10.1128/jcm.33.4.978-981.1995

Zahlane, K., Ouafi, A. T., & Barakate, M. (2020). The clinical and epidemiological risk factors of infections due to multi-drug resistant bacteria in an adult intensive care unit of University Hospital Center in Marrakesh-Morocco. *Journal of infection and public health*, *13*(4), 637-643.