

FREQUENCY OF POSITIVE BLOOD CULTURES AND PATHOGEN DISTRIBUTION AMONG FEBRILE PATIENTS ADMITTED TO NORTHWEST GENERAL HOSPITAL, PESHAWARGul Rukhsar¹, Wafa Khan², Zainab Kamal², Wiqar Ahmad³, Sanam Fida¹, Medrar Ullah Khan⁴**How to cite this article**

Rukhsar G, Khan W, Kamal Z, Ahmad W, Fida S, Khan MU. Frequency of Positive Blood Cultures and Pathogen Distribution Among Febrile Patients Admitted to Northwest General Hospital, Peshawar. J Gandhara Med Dent Sci. 2026;13(4):30-35. <http://doi.org/10.37762/jgmids.13-4.867>

Date of Submission: 12-02-2026**Date Revised:** 15-09-2026**Date Acceptance:** 16-09-2026

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ABSTRACT**OBJECTIVES**

To determine the frequency of positive blood cultures, describe the distribution of clinically significant pathogens, and compare selected clinical outcomes according to blood-culture status among febrile adult inpatients at Northwest General Hospital, Peshawar.

METHODOLOGY

This prospective observational cohort study enrolled 129 consecutive febrile patients aged 18-90 years admitted to the Department of General Medicine from January to June 2025. Two blood-culture sets were collected using aseptic technique and processed in an automated culture system. Positive bottles underwent Gram staining, subculture, and organism identification by matrix-assisted laser desorption ionisation time-of-flight mass spectrometry. Patients were followed until discharge or in-hospital death. Data were analysed using SPSS version 25, with appropriate non-parametric and exact tests; $p < 0.05$ was considered significant.

RESULTS

Blood cultures were positive in 50/129 patients (38.8%). Enterobacteriaceae accounted for 48.0% of positive cultures, Gram-positive cocci for 40.0%, and non-fermenting Gram-negative rods for 12.0%. *Staphylococcus aureus* was the most frequent species (22.0%). Carbapenems (31.0%) and cephalosporins (27.9%) were the most frequently prescribed antimicrobial classes. Culture-positive patients were less often male (48.0% vs 70.9%; $p = 0.015$), had lower median diastolic blood pressure (70 vs 80 mmHg; $p = 0.004$), and longer median hospital stay (4 vs 3 days; $p = 0.043$). Mortality was higher among culture-positive patients (20.0% vs 10.1%), although not statistically significant ($p = 0.126$).

CONCLUSION

Bloodstream infection was frequent among febrile inpatients, with substantial Gram-negative and Gram-positive pathogen burdens. The findings support timely blood-culture sampling, careful interpretation, and strengthened antimicrobial stewardship. Local surveillance of pathogen distribution and resistance should guide empiric therapy and institutional antibiotic prescribing in this hospital population.

KEYWORDS: Fever, Blood Culture, Bloodstream Infection, Bacteremia, Antimicrobial Stewardship, Enterobacteriaceae, Mortality

INTRODUCTION

Fever is a common occurrence among hospitalised patients, accounting for 2 to 29% of all hospital admissions, and is frequently used as a clinical justification for blood culture.¹ Blood culture is the current established method for diagnosing suspected cases of bacteremia. When bacteremia is suspected, most high-income countries regularly obtain blood cultures (BC) from febrile patients (FP).² The reported prevalence of positive BC among hospitalised FP ranges from 5 to 15%.^{3,4} However, due to insufficient or lacking laboratory capacity, doctors can opt to treat patients with antibiotics empirically. In resource-constrained settings, especially in South Asia, BC are a

rapidly growing resource that can inform appropriate treatment and encourage antimicrobial stewardship.^{5,6}

Given the World Health Organisation's global action plan to combat antimicrobial resistance (AMR) and the knowledge of how AMR impacts the attainment of Sustainable Development Goals, a better understanding of the relationship between prescribed antimicrobials, blood culture use, and clinician decision-making can help direct interventions to address AMR.^{7,8} Clinical decisions, such as choosing the right antibiotic if necessary, can be guided by antimicrobial susceptibility information obtained from BC. 2 BC were underutilised among FP in low- and middle-income countries (LMICs) and among patients who were ultimately found to be bacteremic, according to an earlier study.⁹

BC for febrile cases when bacteremia is suspected may not be ordered in many LMICs for a number of reasons, such as the assay's low sensitivity, high cost, and the lengthy time it takes to obtain results. These factors may deter clinicians from ordering cultures in settings like outpatient departments, where many patients may not return or be reachable for follow-up.¹⁰ False positive BC are linked to inappropriate antibiotic use, greater downstream testing, higher healthcare costs, and longer hospital stays. One investigation on BC of febrile patients found that 3.1% of the BC were true positive, with an 8.5% diagnostic yield. The most frequently isolated pathogens were *Staphylococcus aureus* (22.0%), Enterobacterales (17.8%), coagulase-negative *Staphylococcus* spp. (16.3%), enterococci (10.2%), and *Candida* spp. (7.0%).¹ This study aims to evaluate the diagnostic yield of BC among FP admitted to Northwest General Hospital. While blood-culturing practices vary across clinical roles and experience levels, the non-clinical factors influencing culture decisions remain underexplored. Given the importance of BC in identifying pathogens and guiding appropriate treatment, this research seeks to determine the frequency of positive cultures and identify the isolated pathogens. The findings will support evidence-based practices, improve patient outcomes, and enhance antibiotic stewardship and resource utilisation.

METHODOLOGY

This prospective observational cohort study was conducted in the Department of General Medicine, Northwest General Hospital & Research Centre, Peshawar, from January to June 2025. Consecutive patients meeting the eligibility criteria were enrolled at hospital admission and followed until discharge or in-hospital death. The study was conducted after institutional ethical clearance, and written informed consent was obtained from all participants before enrollment. Confidentiality was maintained through coded study records. The sample size was calculated using an anticipated blood-culture positivity of 3.1%, a 95% confidence level, and an absolute precision of 3%, yielding a target close to the final enrollment of 129 patients. Adults of either sex aged 18-90 years with documented fever at admission were eligible. Fever was defined as an oral temperature of at least 38.0°C or a rectal temperature of at least 38.3°C. Patients who had received systemic antibiotics within the preceding 48 hours, patients with major immunocompromising conditions such as HIV infection, chemotherapy, organ transplantation or neutropenia, and patients with localised infections for which blood culture was not routinely indicated were excluded. Baseline data were recorded on a structured proforma. They included age, sex, body mass index, residence, educational

attainment, occupation, socioeconomic status, comorbid conditions, admission temperature, heart rate, respiratory rate, systolic and diastolic blood pressure, duration of febrile illness, presenting symptoms, and hospital length of stay. Hospital outcome was categorised as discharge after clinical improvement or in-hospital death. Because outcome status was determined from the index admission record, complete in-hospital outcome data were available for all enrolled participants. Blood cultures were obtained at enrollment and, when clinically feasible, before the first in-hospital dose of antimicrobial therapy. Trained nursing staff performed venipuncture after chlorhexidine skin antisepsis. Two culture sets were collected from separate venipuncture sites, with each set containing one aerobic and one anaerobic bottle. Approximately 8-10 mL of blood was inoculated into each bottle, providing an intended total culture volume of approximately 32-40 mL per patient. The two sets were collected approximately 20-30 minutes apart and transported promptly to the microbiology laboratory. Blood-culture bottles were incubated in an automated blood-culture system and monitored for microbial growth for up to five days. Bottles flagged as positive underwent Gram staining and subculture. Organism identification was performed using matrix-assisted laser desorption/ionisation time-of-flight mass spectrometry (MALDI-TOF MS). Isolates were interpreted as clinically significant bloodstream infection or probable contamination according to organism identity, the number of positive bottles or sets, repeat cultures when available, and the clinical picture. Coagulase-negative staphylococci, *Corynebacterium* species, *Bacillus* species other than *B. anthracis*, and other typical skin flora were considered probable contaminants when isolated from only one bottle or set without supporting clinical or microbiological evidence. A clinically relevant pathogen, repeated isolation of the same organism, or concordant microbiological and clinical findings supported classification as true bloodstream infection. Polymicrobial cultures were counted as one culture-positive episode while each clinically significant organism was recorded for pathogen distribution. Antimicrobial prescriptions during the admission were grouped by antibiotic class. Because individual patients could receive more than one agent, antimicrobial percentages were not mutually exclusive and therefore did not sum to 100%. The study did not have sufficiently detailed time-stamped prescribing data to separate empiric treatment from subsequent culture-directed therapy reliably; accordingly, antibiotic use was described rather than interpreted as a measure of appropriateness. Data were analysed using IBM SPSS Statistics version 25. All tests were two-sided, and $p < 0.05$ was considered statistically significant.

RESULTS

A total of 129 febrile inpatients were included. The median age was 57 years (IQR 32-70), and 80 (62.0%) participants were male. The median body mass index was 24.6 kg/m² (IQR 21.8-27.1). Diabetes mellitus was documented in 68 (52.7%) patients and hypertension in 57 (44.2%). At presentation, median temperature was 100.5°F (IQR 100-101), median heart rate was 94 beats/min, and median systolic and diastolic blood pressures were 120 and 76 mmHg. Length of hospital stay (days, median (IQR): 3 (2-6). Regarding antibiotic prescriptions, carbapenems were the most frequently prescribed antimicrobial class (40, 31.0%), followed by cephalosporins (36, 27.9%) and fluoroquinolones (20, 15.5%). Penicillins and no antibiotic were each prescribed to 19 (14.7%) patients, while glycyliclins and macrolides were prescribed to 11 (8.5%) patients each. Other prescribed antimicrobial classes included glycopeptides (9, 7.0%), lipopeptides (8, 6.2%), peptides (8, 6.2%), oxazolidinones (6, 4.7%), and aminoglycosides (2, 1.6%). Patients could receive more than one antimicrobial agent. Among the 50 patients with positive blood cultures, 10 (20.0%) died, while 40 (80.0%) improved and were discharged (Table 4). In comparison, when the entire cohort of 129 febrile patients was considered, 18 (14.0%) died, and 111 (86.0%) improved and were discharged. Of the 79 patients with no growth/not identified, 8 (10.1%) died, and 71 (89.9%) improved and were discharged. The duration of hospital stay ranged from 0 to 15 days, with a mean duration of 5.23 ± 7.75 days and a median of 4 days.

Table 1: Baseline Characteristics of the Study Participants (n=129)

	Variable	n (%age)
Gender	Male	80 (62.0)
	Female	49 (38.0)
Socioeconomic status	Lower-middle	55 (42.6)
	Upper-middle	59 (45.7)
	High	15 (11.6)
Comorbid	Diabetes mellitus	68 (52.7)
	Hypertension	57 (44.2)
	Typhoid	12 (9.3)

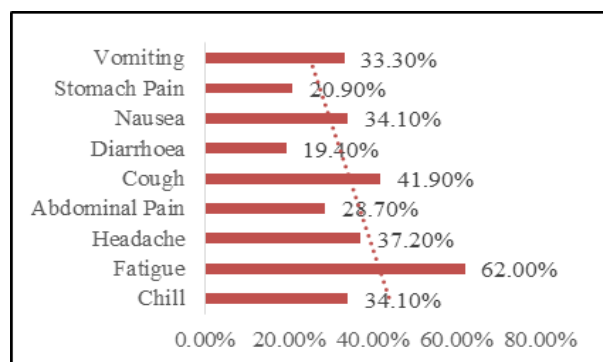


Figure 1: Presenting Symptoms of Patients

Table 2: Frequency of Positive Blood Cultures, Microbial Isolates, and Antibiotics Prescribed

Variable		n (%age)
Blood culture status	Positive blood culture	50 (38.8)
	No growth/not identified	79 (61.2)
Microbial isolates among entire cohort (n=129)	Non-fermenting Gram-negative rods	6 (4.7)
	Gram-positive cocci	20 (15.5)
	Enterobacteriaceae	24 (18.6)
Microbial isolates among culture-positive patients (n=50)	Non-fermenting Gram-negative rods	6 (12.0)
	Gram-positive cocci	20 (40.0)
	Enterobacteriaceae	24 (48.0)

Note: Percentages for microbial isolates in the first section use the entire study cohort (n=129) as the denominator, whereas percentages under "microbial isolates among culture-positive patients" use n=50 as the denominator.

Table 3: Species-Level Distribution of Microorganisms Isolated from Positive Blood Cultures

Organism identified	N	% of positive cultures (n=50)	% of total sample (n=129)
Staphylococcus aureus	11	22	8.5
Staphylococcus epidermidis	7	14	5.4
Escherichia coli	6	12	4.7
Enterobacter spp.	7	14	5.4
Providencia spp.	6	12	4.7
Salmonella typhi	4	8	3.1
Acinetobacter spp.	2	4	1.6
Pseudomonas aeruginosa	1	2	0.8
Pseudomonas spp.	1	2	0.8
Klebsiella spp.	1	2	0.8
Enterococcus spp.	2	4	1.6
Pantoea spp.	2	4	1.6

Table 4: Association Between Blood Culture Isolate and Hospital Outcome Among Culture-Positive Patients

Blood culture isolate	Mortality	Improved/discharged	Total	RR (95% CI)	p-value
	n (%age)				
Non-fermenting Gram-negative rods	2 (33.3)	4 (66.7)	6 (100.0)	1.83 (0.50 – 6.68)	0.116
Gram-positive cocci	6 (30.0)	14 (70.0)	20 (100.0)	2.25 (0.73 – 6.98)	
Enterobacteriaceae	2 (8.3)	22 (91.7)	24 (100.0)	0.27 (0.06 – 1.15)	
Total	10 (20.0)	40 (80.0)	50 (100.0)	--	

Note: Mortality (%) is calculated within each organism category. RR compares the mortality risk for each organism category with all other culture-positive organism categories combined. Overall comparison was performed using the Fisher-Freeman-Halton exact test.

Table 5: Comparison of Demographic, Clinical Characteristics, Comorbidities, and Outcomes According to Blood-Culture Status

Variable	Culture-positive (n=50)	Culture-negative (n=79)	p-value
Age, years, median (IQR)	57 (33.3)	56 (39.0)	0.494
Male sex, n (%)	24 (48.0)	56 (70.9)	0.015
Temperature, °F, median (IQR)	101.0 (1.0)	100.0 (1.0)	0.309
Heart rate, beats/min, median (IQR)	99.5 (40.0)	93.0 (15.5)	0.111
Systolic BP, mmHg, median (IQR)	120 (30.0)	120 (18.0)	0.102
Diastolic BP, mmHg, median (IQR)	70 (23.8)	80 (11.0)	0.004
Diabetes mellitus, n (%)	23 (46.0)	45 (57.7)	0.209
Hypertension, n (%)	22 (44.0)	35 (44.3)	1.000
Hospital stay length, days, median (IQR)	4 (6.5)	3 (3.0)	0.043
Mortality, n (%)	10 (20.0)	8 (10.1)	0.126

Note: Continuous variables were compared using the Mann–Whitney U test. Categorical variables were compared using Fisher's exact test.

DISCUSSION

In this study, the frequency of positive BC among FP was 38.8%, which exceeds the positivity rates reported in the literature. A study conducted in Nepal reports a blood culture positivity rate among FP from 5% to 28.5% in elderly patients with other studies reporting rates of 12.77% in Bangladesh 24.2% in Ethiopia and 24.44% in pediatric febrile neutropenic patients in Bali.^{11,12,13,14} A study at Khyber Teaching Hospital, Peshawar, reported a lower positivity rate of 9% among patients with non-focal pyrexia.¹⁵ The blood-culture positivity rate in our study was 38.8%, which was higher than that reported in several comparable studies. This relatively high positivity rate may reflect differences in patient selection, disease severity, blood-volume collection, microbiological methods, and local epidemiology. Because blood-culture contamination can also influence reported positivity rates, potential contaminants were assessed using microbiological and clinical criteria. Therefore, the observed positivity rate should be interpreted in the context of the study setting and culture interpretation procedures. The predominance of Gram-negative organisms, particularly *Enterobacteriaceae* (18.6%), in our study aligns with global findings. Different studies similarly reported Gram-negative rods, especially *Escherichia coli*, *Klebsiella spp.*, and *Pseudomonas spp.*, as the most frequent pathogens.^{14,16} This consistent predominance emphasises the clinical importance of Gram-negative bacteremia, especially considering its association with higher mortality in neutropenic and critically ill patients.^{17,18} Our findings also showed a substantial proportion of Gram-positive cocci (15.5%), including likely *Staphylococcus aureus* or coagulase-negative *Staphylococci*, paralleling results from Ethiopian and Bangladeshi studies.¹⁹ In terms of the use of antibiotics,

the most commonly prescribed class was carbapenems (31%), cephalosporins (27.9%), and fluoroquinolones (15.5). This prescription trend indicates an anchoring towards a general-purpose empiric treatment, presumably due to the severity of the clinical condition and apprehension of resistant pathogens. But these trends are concerning with regard to global antimicrobial resistance (AMR). Examples in literature: In the literature, 79 per cent of antibiotics used pre-hospital were in the WHO "Watch" category, and this is alarming due to the inappropriate use of empiric antibiotics.²⁰ Among patients with positive blood cultures, the mortality rate was 20.0% (10/50). Organism-specific mortality was highest among patients with non-fermenting Gram-negative rods (33.3%, 2/6), followed by Gram-positive cocci (30.0%, 6/20) and Enterobacteriaceae (8.3%, 2/24). Although mortality was numerically higher among patients with non-fermenting Gram-negative rods and Gram-positive cocci, the overall association between organism category and hospital outcome was not statistically significant on exact testing ($p = 0.116$). Therefore, these findings should be interpreted as descriptive rather than evidence of a statistically significant organism-specific mortality difference. Our observation of numerically higher mortality among patients with Gram-positive cocci should be interpreted cautiously because the difference was not statistically significant and the number of patients in the individual organism categories was small. Previous studies have reported differences in mortality according to bloodstream pathogen characteristics.^{21,22,23} However, direct comparison with our findings is limited by differences in patient populations, clinical severity, and study design.

LIMITATIONS

This was a single-centre study with a relatively small sample size, which limits generalizability and statistical precision. Patients who had received antibiotics within the preceding 48 hours and several immunocompromised populations were excluded; consequently, the findings should not be extrapolated to all febrile medical inpatients. Detailed antimicrobial susceptibility data, infection source, severity scores, time to positivity, and time-stamped antimicrobial changes were not available for complete analysis. Although contamination was assessed using clinical and microbiological criteria, some isolates such as coagulase-negative staphylococci remain difficult to classify without complete device and repeat-culture information. The study measured in-hospital outcomes only and did not include post-discharge mortality or readmission. Multivariable modelling was not

undertaken, so observed group differences may be influenced by unmeasured confounding. Future multicentre studies should integrate antimicrobial susceptibility, antibiotic timing, stewardship interventions, source of infection, severity adjustment, and longer follow-up.

CONCLUSIONS

Positive blood cultures were common among febrile inpatients at Northwest General Hospital, with Enterobacteriaceae and Gram-positive cocci accounting for most clinically significant isolates. Culture-positive patients had longer hospital stays and numerically higher mortality, although the mortality difference was not statistically significant. Frequent use of carbapenems and cephalosporins reinforces the need to connect high-quality blood-culture practice with local resistance surveillance and antimicrobial-stewardship programmes.

CONFLICT OF INTEREST: None

FUNDING SOURCES: None

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Zainab Kamal - Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Supervision; Final Approval

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The authors accept responsibility for all aspects of the work and will ensure that any concerns regarding the accuracy or integrity of any part are properly investigated and resolved.



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