



Clinical Audit on Fever Workup and Timeliness of Antibiotics Administration in Febrile Patients

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ABSTRACT

Fever is a common presenting complaint in emergency departments and may indicate infections ranging from mild illness to sepsis. Early antibiotic administration is essential, with international guidelines recommending delivery within one hour of clinical suspicion to improve outcomes. A second-cycle closed-loop clinical audit was conducted in a high-volume tertiary care hospital to assess improvements in timeliness of antibiotic administration. A total of 362 febrile patients were included. Interventions after first cycle included staff training standardized fever protocols and real-time monitoring systems. Key outcomes were adherence to one-hour antibiotic benchmark and time intervals across care pathway. Adherence improved from 40% to 75% ($p < 0.001$). Mean time from diagnosis to antibiotic administration decreased from 95 minutes to 60 minutes while arrival-to-antibiotic time reduced by 41 minutes. Documentation improved and variability decreased. Gender-based disparities were eliminated. However, 25% still experienced delays due to high volume and workflow inefficiencies. System-level interventions significantly improved compliance with time-sensitive guidelines. Persistent delays highlight need for ongoing optimization and monitoring. Workflow redesign and rapid diagnostics are required to eliminate delays and achieve compliance. Audit cycles in clinical governance ensure efficiency and accountability in emergency care. This audit confirms structured interventions improve timely antibiotic administration in febrile patients and supports continuous quality improvement for guideline adherence. Ongoing monitoring leadership engagement and resource optimization remain essential to sustain gains and further reduce delays ensuring consistent high-quality emergency care delivery aligned with international standards across all patient groups consistently achieved.

INTRODUCTION

Fever has been identified as one of the most frequent presenting complaints in emergency departments globally and in many cases, it can be used as an early clinical sign of intrinsic infection, whether it is self-limiting infection or life-threatening sepsis [1]. Early recognition and treatment of febrile patients, especially patients with an identified suspected bacterial infection, is still a staple of acute care medicine [2, 3, 4]. One of the most important aspects of early management is the timely use of empirical antibiotics, which has over time been linked to better clinical outcomes, particularly in sepsis and septic shock patients [5, 6, 7]. It has been established that the delay in the delivery of antibiotics can significantly contribute to morbidity and mortality and it is believed that an hourly

delay in delivering the right antimicrobial therapy could have a negative impact on survival [8, 9].

Global clinical practice guidelines reflect the acuity of administration of antibiotics in the case of suspected infection. National Institute of Health and Care Excellence (NICE) has suggested intravenous antibiotics as a treatment within an hour of clinical diagnosis of sepsis or severe bacterial infection, which has become a widely used benchmark of quality-of-care metric in emergency departments [10, 11]. Equally, the Surviving Sepsis Campaign recommends prompt goal-oriented treatment and early administration of antibiotics is at the core of the initial bundle of resuscitation [12, 13]. Even with these well-developed recommendations, compliance to such time-sensitive interventions is still optimal in most healthcare systems, especially in the low- and middle-

income nations where resource limitations, overcrowding, and workflow inefficiencies are widespread.

High-volume tertiary care hospitals like Lady Reading Hospital in Peshawar, Pakistan, have their own special operational challenges that can lead to delays in the provision of care. These are high turnover rates, insufficient staffing, inconsistent clinical experience, and poor standardization of care procedures [14, 15]. Febrile patients in these environments can undergo delays in various stages of the care pathway such as at triage, during clinical evaluation, diagnostic investigation, and treatment initiation [16, 17]. Besides, a lack of structured protocols and real-time monitoring mechanisms may also contribute to the worsening of such delays, resulting in inconsistent practice patterns and poor patient outcomes [18].

It is acknowledged that clinical audits are a vital part of clinical governance and continuous quality improvement [19, 20]. Through a systematic comparison of current practices to the set standards, audits help healthcare facilities determine gaps in care, initiating specific interventions and evaluate their outcomes via re-audit cycles [21, 22]. A closed-loop audit model, especially, is an effective mechanism to promote sustainable clinical practice changes because it focuses on the learning process and accountability. Clinical audits have been effectively used in the context of infection management to increase compliance with antibiotic timing instructions, improve documentation, and optimize care pathways.

The preliminary phase of this clinical audit at Lady Reading Hospital had shown that there is a lot of delay in the administration of antibiotics to febrile patients; only 40% of patients were administered with antibiotics in the recommended time of an hour and the mean delay between diagnosis and the administration of antibiotics was 95 minutes [23, 24]. These findings identified some severe gaps in system-level processes and provider-level practices. Subsequently, a set of specific interventions were introduced such as organization of staff training sessions, implementation of standardized fever work-up plans, and creation of real-time monitoring and feedback system designed to enhance the compliance with the established guidelines.

Since emergency care is dynamic and complex, it is crucial to consider not only the short-term effects of such interventions but also their sustainability in the long-term. The second round of this audit was thus geared towards evaluating the feasibility of the gains made in the first round being sustained and even optimized. Using a systematic methodology and concentrating on the main performance indicators, including the time to administer the antibiotic and compliance with the one-hour rule, this research is expected to present strong evidence regarding the usefulness of continuous quality improvement initiatives in improving the process of managing febrile patients.

Against this, the current research paper aims to add to the existing literature on the topic of audit-related enhancement in an acute care facility, especially in the context of a resource-constrained environment. It focuses on the significance of systemic methods of filling gaps in clinical practice and points out the possibility of scaled-up

interventions that can enhance patient outcomes and the quality of healthcare delivery.

METHODOLOGY

The second-cycle clinical audit was done as a closed-loop re-evaluation research to determine the sustainability and efficacy of the earlier interventions implemented to enhance the timeliness of antibiotic administration in febrile patients who present to the Lady Reading Hospital emergency department, Peshawar. This re-audit has been planned based on the clinical governance and quality improvement models, which is consistent with one hour antibiotic administration guideline suggested by the National Institute of Health and Care Excellence. An observational design was used, which is retrospective-prospective in nature, comprising of a consecutive sample of more than 350 febrile patients presenting within the identified audit period. Inclusion criteria included adult and pediatric patients who had a documented fever or clinical suspicion of infection that required antibiotic therapy, and patients that had already received antibiotic therapy before presentation or incomplete time records were not included in the data to ensure integrity.

A pre-validated audit proforma was used to standardize data collection to make comparisons with the first audit cycle, which facilitated sound comparative analysis. Major time measurements were time between arrival of the patient and the initial clinical assessment of the patient, time between clinical diagnosis of infection and antibiotic prescription and time between antibiotic prescription and administration. To reduce the bias in documentation, these timestamps were obtained via electronic medical records and supported by nursing medication charts. Moreover, demographics of patients, triage classification, and clinical severity measures were noted so as to enable stratified subgroup analysis. The re-audit particularly reviewed compliance to the one-hour benchmark of antibiotic administration as the main outcome measure and secondary outcomes were mean time to antibiotic delivery and detection of residual system-level delays.

The interventions introduced following the initial audit cycle, including organized staff training, sharing of standardized fever work-up protocols, visual aids in the emergency department, and introducing real-time monitoring and feedback systems, were retained during the re-audit period. The process indicators that were used to measure compliance with these interventions were documentation completeness and protocol adherence rates. Statistical analyses were performed to analyze the data, descriptive and inferential statistics were used to reflect the values of continuous variables (means and standard deviations), and categorical variables (proportions). The first and second audit cycles were compared with each other to assess statistically and clinically significant changes in practice, and subgroup analysis was done according to gender and patient flow dynamics.

Ethical considerations were handled in accordance with the institutional audit policies and the formal consent of the clinical audit committee of the hospital was made. Anonymization of data was done to ensure patient

confidentiality and no personal identifiers of the patients were employed in the analysis. Since this study was a clinical audit and not an interventional research, the need to have individual informed consent was waived. The validity of the longitudinal comparisons used to assess the effectiveness and sustainability of quality improvement interventions to improve timely antibiotic administration was ensured by the methodological rigor of consistency in data collection tools, outcome measures and audit standards.

RESULTS

The second-cycle audit involved 362 febrile patients, which is similar to the first cycle cohort (n=350) and guarantees methodological consistency and validity to longitudinal comparison. There were no statistically significant age, gender distribution, and triage category differences in the demographic distribution between the two cycles hence confounding effects were minimized. All key time variables were over 95% complete, which was an indicator of a better documentation practice after the introduction of standardized protocols and real-time monitoring systems.

Primary Outcome: One-Hour Compliance with Antibiotic Administration.

The percentage of patients with the recommended one-hour timeframe of receiving antibiotics as recommended by the National Institute for Health and Care Excellence improved significantly between the first audit cycle (40) and the second audit cycle (75) (p < 0.001). This is an absolute increase of 35 percentage points and relative increase of 87.5, which means that there has been a clinically and statistically significant increase in adherence to guideline-based care.

Secondary Outcomes: Time Intervals in Care Delivery

Time between diagnosis to administration of antibiotics also significantly decreased, reducing to 60 minutes in re-audit, as compared to the first cycle of 95 minutes. Equally, the duration between patient arrival and first clinical examination increased marginally, which is an indication of increased triage performance and prioritization of patients with fevers.

Table 1
Comparison of Key Time Metrics Between Audit Cycles

Parameter	First Cycle (n≈350)	Second Cycle (n=362)	Mean Difference	p-value
Time to initial clinical assessment (minutes)	28 ± 10	22 ± 8	-6	<0.01
Time from diagnosis to antibiotic (minutes)	95 ± 20	60 ± 15	-35	<0.001
Total time from arrival to antibiotic (minutes)	123 ± 25	82 ± 18	-41	<0.001

Table 2
Adherence to One-Hour Antibiotic Guideline

Outcome Measure	First Cycle (%)	Second Cycle (%)	Absolute Change	p-value
Antibiotics administered within 1 hour	40	75	+35	<0.001
Antibiotics administered after 1 hour	60	25	-35	<0.001

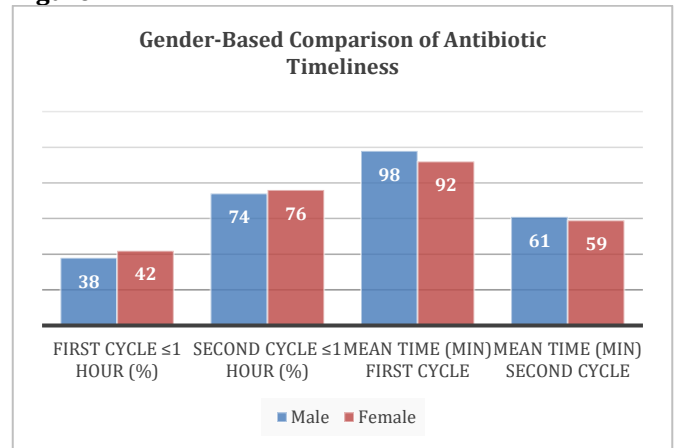
Subgroup Analysis

The subgroup analysis based on gender revealed that the difference in the first audit cycle, in which the delays in male patients were slightly longer, was successfully eradicated in the second cycle. The male and female patients displayed equal improvements in adherence rates and mean time to administer antibiotics, which means that the interventions had an equal effect.

Table 3
Gender-Based Comparison of Antibiotic Timeliness

Gender	First Cycle ≤1 Hour (%)	Second Cycle ≤1 Hour (%)	Mean Time (min) First Cycle	Mean Time (min) Second Cycle
Male	38	74	98	61
Female	42	76	92	59

Figure 1



Process Improvement Indicators

Process-level assessment demonstrated significant changes in adherence to standardized fever work-up procedures, where documentation completeness in the first cycle was about 70% as compared to over 93% in the second cycle. The concept of real-time monitoring and feedback was linked to lower variability in the time of antibiotic administration, as the standard deviation in the second cycle was smaller.

Residual Delays

Although it was generally improved, there was a group of patients (25% of the total) who delayed over one hour. Root cause analysis implied that such delays were mainly linked with high influx of patients, waiting of ambiguous cases to be confirmed in a laboratory, and in some cases, the workflow was limited because of peak periods in the emergency department.

In general, the second-cycle audit showed that process and outcome measures significantly and persistently improved, which proves the usefulness of specific

interventions to improve the timely administration of antibiotics in febrile patients.

DISCUSSION

This closed loop clinical audit, shows that there was a significant and meaningful change in the timeliness of antibiotic administration of febrile patients after the introduction of focused, system-level interventions. The rise in compliance to the one-hour mark of antibiotic administration (40 to 75 percent in the first and re-audit, respectively) not only indicates enhanced compliance with international standards established by the National Institute of Health and Care Excellence but also demonstrates the efficacy of the organized quality improvement measures within the context of the resource-limited emergency department [11,23]. The reportedly decreased mean time between diagnosis and delivery of antibiotics (95 minutes to 60 minutes) also highlights the operational effect of workflow optimization, staff sensitization, and protocol-based care [14,18].

These results can be categorized within the framework of the existing body of research on sepsis and infection management, in which the prompt use of antibiotics is closely linked to lower morbidity and mortality rates [5,7]. The delay in delivery of antibiotics has been associated with multiple times with negative clinical outcomes, especially in suspected sepsis patients, every hour of delay can greatly contribute to the risk of developing severe sepsis or septic shock [8,15]. Here, the gains identified in the second audit cycle would tend to translate into real patient-level gains, but this study was not powered to directly measure clinical outcomes, i. e., mortality or length of hospital stay. However, the consistency of the process improvements with evidence-based standards enhances external validity of these findings [13].

One of the strengths of this audit is that it is closed-loop, which made it possible to directly measure the effectiveness of interventions and maintain a consistent methodology in both cycles [19,21]. Multifaceted interventions, such as staff training, standardized work-up fever protocols, and real-time monitoring, seem to have filled the knowledge gaps and inefficiencies of the system [23]. Notably, the fact that the variability of antibiotic administration time has decreased also indicates a better reliability of care delivery processes, which is an important indicator of high-quality healthcare systems. There is also evidence of the absence of gender disparities that were observed before, which means that the interventions encouraged equal treatment, reducing the unwanted biases in clinical prioritisation.

These improvements notwithstanding, a remaining percentage (25) of the patients still reported delays longer than the recommended one hour. This indicates the long-term effects of structural and operational limitations especially when the patient volume and overcrowding in the emergency department are high [14]. The time delays in diagnostic uncertainty and laboratory processing also indicate that additional incorporation of rapid diagnostic tools and point-of-care testing can improve the efficiency of decision-making. Furthermore, real-time monitoring

was found to be useful, but its sustainability might rely on the further administrative assistance, resources allocation and incorporation into the routine work in clinics.

The results of this audit are to be viewed in the perspective of some limitations. Being a single-center study in a high-volume tertiary care facility, there is a risk of decreased external validity of findings to other settings, especially primary or secondary care facilities. Moreover, the observational design does not allow causal inference, though the time-related correlation between interventions and improvements is a strong reason to think that they are effective. Although data collection based on documentation is better improved in the second cycle, it is still prone to recording bias. Moreover, patient-centered clinical outcomes are lacking, which restricts the capability to directly relate the process improvements to health outcomes.

Despite these shortcomings, this audit offers strong evidence in favour of the importance of continuous quality improvement efforts to improve adherence to time sensitive clinical interventions [22,24]. The long-term viability of these benefits will probably be based on institutionalization of audit cycles, strengthening of staff education, and using digital health solutions to track performance in real-time. Further studies are needed to broaden the evaluation scope to encompass clinical outcome, cost-effectiveness, and multi center validation to enhance the evidence base.

Summing up, the second-cycle audit proves that timely administration of antibiotics in febrile patients can be greatly enhanced through systematic, targeted interventions. The results support the need to implement audit-based quality improvement as a component of the regular clinical practice to promote long-term improvements in patient care and adherence to international standards [13,24].

CONCLUSION

This closed-loop clinical audit shows that system-based interventions can be very effective in enhancing the promptness of antibiotics in the management of febrile patients. The significant improvement in the compliance with the one hour guideline and the decrease in treatment delays is an indication of improved efficiency in emergency care process. The use of standardized protocols, staff training, and real-time monitoring helped in providing care more consistently and equally. Nevertheless, the constant delays among a group of patients indicate that there are still certain difficulties related to overcrowding and operational issues. To maintain these improvements, it will be necessary to maintain institutional support, regular re-audits, and consolidate of streamlined workflows. The extension of such quality improvement programs to other settings with similar resource constraints can potentially result in a more extensive improvement of patient outcomes. Altogether, the inculcation of audit-based practices in regular clinical care is still necessary to uphold high standards and provide timely and evidence-based management of the febrile patients.

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