Time to antibiotic in paediatric patients with fever in setting of neutropenia

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Background

Immunocompromised cancer patients are at elevated risk of infections.[1] The major contributing factors that predispose cancer patients to immunodeficiency include the underlying disease and related management.[2] Febrile neutropenia is a common and life-threatening complication in paediatric cancer patients on chemotherapy.[3, 4] It is characterised by fever (temperature ≥101 F or ≥100.4 F for at least one hour).[5] The bacterial infection caused by immuno-suppression is the vital cause of mortality and morbidity in cancer patients.[6] Morbidities and mortalities correlated with this situation can be minimised if the clinicians initiate antibiotic treatment expeditiously.[3] It has been established that the administration of antibiotics in patients presenting with febrile neutropenia in less than sixty minutes of arrival in the emergency room (EAR) can significantly reduce the rate of mortality and morbidity.[7] This study aimed to ensure timely administration of antibiotics (in less than sixty) in the paediatric oncology patients presenting to the EAR with fever followed by chemotherapy.[8]

Materials and Methods

Baseline data from October 2019 to July 2020 was reviewed. The patients, who had a delay of more than 60 minutes in antibiotic administration, were chosen to understand the causes of process variation. A four-stage approach, the Plan-Do-Check-Act (PDCA) cycle, was undertaken to improve the service and resolve the issues faced.[9] The PDCA was aimed to mitigate the identified reasons of process variation, i.e. i)delays in patient assessment, ii)delays in antibiotic prescription, iii)delays in dispensing, iv)transportation of prepared medicine, and v)delays in administration. The team proposed multiple strategies to reduce the process variation, including but not limited to the amendment of hospital electronic system (HIS)-medication module, defined timelines for each service, dose-banding, and educating the relevant staff members to ensure timely communication. Statistical analysis, interrupted time series (ITS) analysis, was performed on two cohorts (pre-intervention and post-intervention phases) to study the effectiveness of interventions. The R-software was used to conduct the analyses.

Results

The statistical process control chart suggested that the variation of the processes reduced significantly in the post-intervention period. The results showed that initially, the average time to antibiotic was 64.6 minutes/month (Figure 1). In the pre-intervention period, there was no significant change in antibiotic administration. The administration time decreased significantly by 12.9 minutes/month in the post-intervention period. However, no significant month-to-month change was observed in the average antibiotic administration time (P-value for the time after the intervention was 0.1839). The Durbin-Watson statistic for the model was 1.744 (P-value=0.2), indicating no autocorrelation.

Conclusion

This study highlights the benefits of using the PDCA for improving the quality of care in a healthcare setup. The changes such as amendment of HIS module, defined timelines for each service, dose banding, and relevant staff member education helped improve and sustain timely administration of antibiotics in the emergency room setting.
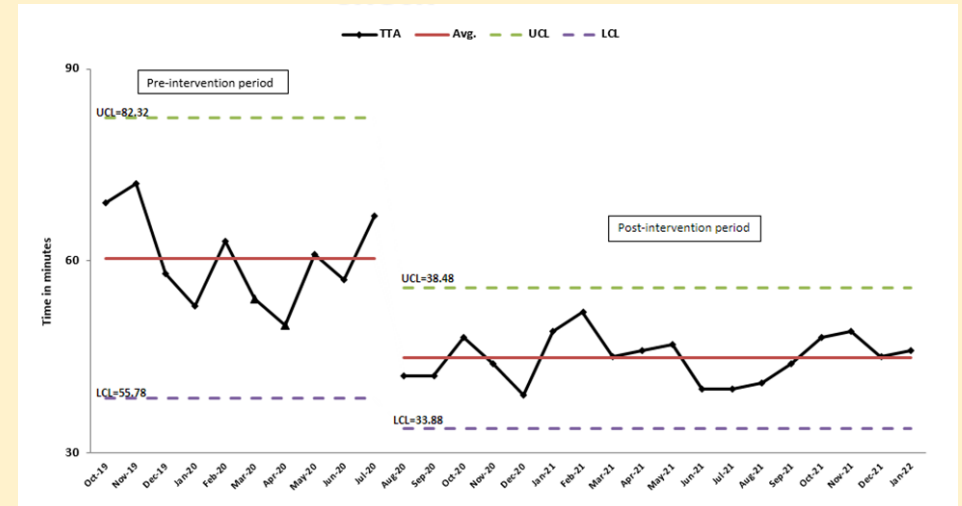

Figure 1:
Average time to antibiotics in paediatric patients with febrile neutropenia from October 2019 till January 2022.

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