IMPLEMENTATION OF NON-BATCHED RESPIRATORY VIRUS ASSAY SIGNIFICANTLY IMPACTS PATIENT OUTCOMES IN THE ICU

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ABSTRACT- revised

Background: Nucleic acid amplification and detection of respiratory virus (RV) pathogens is rapid and sensitive, but multiplex methods can be costly. Implementation of molecular methods promotes improvement in turnaround time (TAT) and increased laboratory workflow efficiency; however, few studies assess the impact of rapid results on downstream patient outcomes. The purpose of this study was to assess the impact of rapid multiple RV testing for ICU patient population.

Methods: Geisinger Medical Center (GMC) is a 590 bed quaternary care hospital with an integrated health service organization of 8 hospitals, which serves >2.8 million residents throughout 45 counties in Pennsylvania. The GMC standard is to perform multiplex RV testing for all admissions with respiratory symptoms. Between Nov 1, 2010 and Mar 19, 2012, batch molecular RV testing (pre-intervention) was performed once per day. Between Mar 19, 2012 and Apr 30, 2014, rapid RV testing (BioFire Diagnostics) was performed on a real-time-first (RTF), random access basis (post-intervention) with priority to ICU and ED locations. A quasi-experimental study design was used to compare retrospective categorical and continuous data from pre- and post-intervention cohorts. The following data variables were analyzed using descriptive and comparative statistics in JMP ver. 12.0.1: collect to result time (CTR), 28 day mortality, length of stay (LOS), ICU days, ventilator days, antimicrobial utilization (including viral and bacterial) utilization, laboratory test utilization, and total cost.

Results: Pre- (n=276) and post-intervention (n=460) cohorts showed similar data distributions for age, gender, diagnosis-related group, percent positive results, and treatable viruses detected. The following data variables showed statistical post-intervention improvement (by chi-squared analysis): 28 day survival, LOS, ICU days, ventilator days, antimicrobial utilization, laboratory test utilization, and total cost. The mean CTR was reduced by 35.4 hrs for the post-intervention period and was associated with significantly improved mortality when results are reported in < 7 hrs. Patients with positive RV results (any positive result) displayed a significant reduction in mortality (P < 0.05). A 56% decrease in mortality was also observed for Flu A-positive patients; however, due to sample size the difference was not statistically significant. For patients with negative RV results, mean ICU stay, mean overall LOS, and mean total cost decreased by 3.3 days, 1.9 days, and $8,194, respectively.

Discussion: Rapid molecular results can improve downstream patient and operational outcomes. Although random access molecular methods tend to be more costly than batch molecular assays, improved outcomes in certain populations, such as ICU, may warrant their use. A plan for action, driven by the test result, patient and operational outcomes. Although random access molecular methods promote improvement in turnaround time (TAT), and increased laboratory workflow efficiency; however, few studies assess the impact of rapid results on downstream patient outcomes. The purpose of this study was to assess the impact of rapid multiple RV testing for ICU patient population.

CONCLUSIONS

• The FilmArray is a random access instrument which eliminates the need for batch testing and may significantly reduce CTR time in a variety of healthcare settings.

• At GMC, CTR times greater than 7 hrs can increase 28 day mortality in an ICU setting. Further confirmation in other healthcare settings is warranted.

• Impact to patient outcomes were observed in GMC ICU via significant reductions (P < 0.05) in:
  - ED wait times per pre-admission visit
  - ICU days per ICU visit
  - LOS per ICU visit
  - Antibiotic days per visit
  - Ventilator days per visit
  - 28 day all cause mortality

• Total cost per visit

• Limitations
  - Viruses detected are not equal between the pre- and post-intervention groups.
  - More were detected in post-intervention.
  - DRG severity of illness was fully assessed.
  - Although practical, a quasi-experimental study design has limitations.

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