

Integrating Contextual Factors into Root Cause Analysis – A Data Mining Approach

Yuanyuan Feng, Marjorie Morales, Mary-Grace Reed, Ruth Fisher, Sharen Henry, Winifred Apraku, Ying Ma, Doramarie Arocha, Salman Moti, Julie Trivedi

UT Southwestern Medical Center

Motivation

Formulating actionable plans to improve the quality of care requires not only the identification of failures, but also the understanding of the context around the problems. This context helps decision-makers to further define the extent of the actions.

The commonly used correlation matrix highlights individual contextual factors' impacts, yet requires a great amount of effort for decision-makers to associate these factors together and come up with an integrated story of what happened.

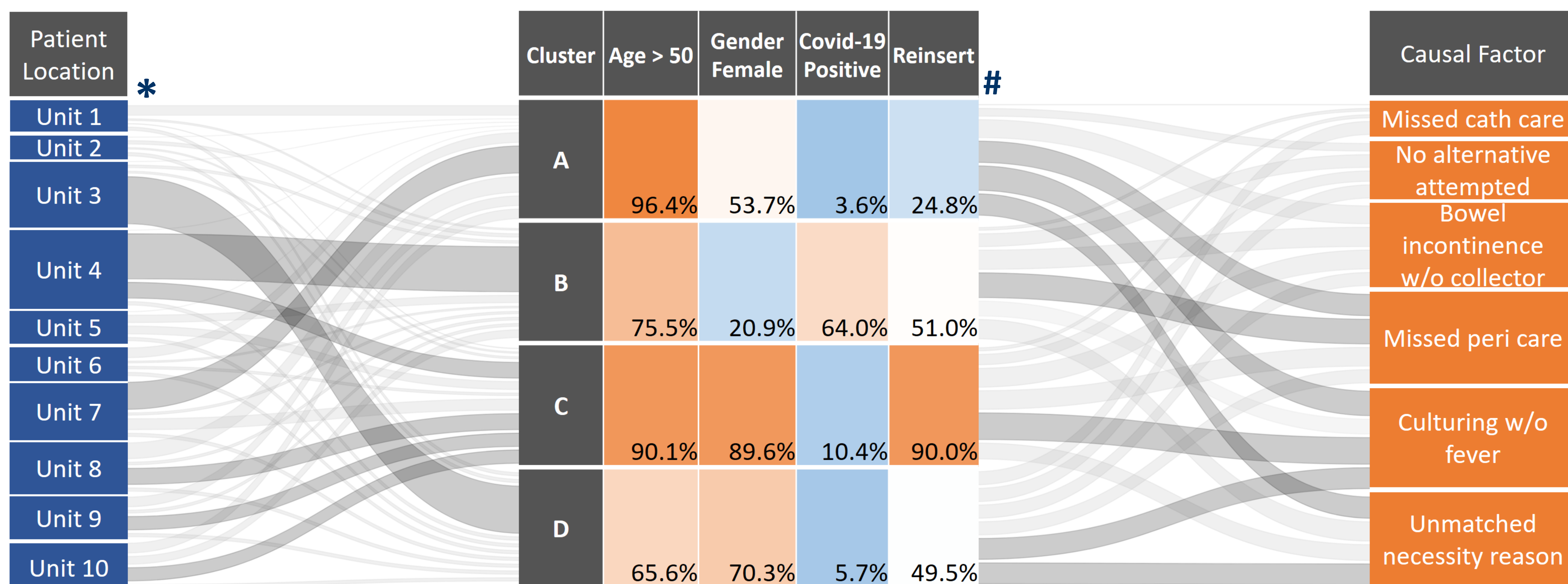
Objective

The objective of this work is to associate the contextual factors with the causal factors to provide a holistic picture of the main causes for decision-makers to formulate action plans.

CAUTI Project

It is a continuous effort at our hospital to reduce the incidence of the catheter-associated urinary tract infections (CAUTI) event. Our CAUTI team conducted root cause analysis to monitor and improve the treatment and care processes on patients with indwelling urethral catheters. This work is based on the results of the most recent root cause analysis on CAUTI events.

Results



- The middle table shows the attribute probabilities in each cluster

- The size of links among patient locations, clusters and causal factors was scaled based on the attribute probabilities

*: Highlighted links indicate a high probability for a dimension in an attribute belonging to a cluster.

#: Color scale is based on the probabilities (orange = 100%, blue=0%)

Methods

Causal Factors

- Urine culturing w/o fever
- Missed perineal care
- Unmatched medical necessity reason
- Bowel incontinence w/o fecal collector
- No alternative attempted
- Missed catheter care

Contextual Factors

- Age
- Gender
- Patient Location
- COVID-19 test results
- Catheter reinsertion
- Number of causal factors identified

Expectation-maximization (EM) Clustering

- 78 combinations of 7 factors among 37 CAUTI events
- Association was identified by the dimensions with higher probabilities in each attribute for each cluster

Conclusion

- The contextual factors specify the problems, enabling us to target at certain patient groups in the steps of our practice processes
- Building upon the initial root cause analysis, we demonstrated feasibility to weaving different contextual factors into the causal reasoning in EM clustering, to provide a holistic description of what happened