A Novel Use of Bar Code Medication Administration Data to Examine Inpatient Nursing Processes

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Introduction

Researchers have sought inpatient nursing process measures that permit examination of relationships between structural indicators (e.g., nurse staffing levels) and patient outcomes, but such data have been unavailable or impractical to gather on a large scale. We developed a method for analyzing inpatient nurse processes through secondary use of bar code medication administration (BCMA) data. Inpatient nurses engage in a collective timebound effort (“medpass”) to administer medications scheduled at standard times (e.g., 9 am). We assessed variation in the length of time it takes for nursing staff to administer all medications scheduled at these peak times, producing a potential process indicator that can be determined at any hospital that uses BCMA, and which can support structure-process-outcome analyses of inpatient nursing care. Isolating inpatient nurse processes from existing bar code medication administration (BCMA) data offers a pathway to progress in nursing research and quality improvement, through use of large-scale data already being gathered at over 90% of US hospitals.

Methods

Using FY2015 barcode medication administration data from a large, complex, academic, urban VA medical center, we identified the peak time for scheduled medications and times that the medications were given by nursing staff. A mixed-effects model was estimated to examine sources of variability in cumulative delivery time (time from first to last dose given of medications scheduled for the peak time) using daily data. Variations across units, days, and months were accounted for as fixed effects. Per unit number of nurses, number of patients and their interaction were used to assess unit-level workload and resources to meet workload. The effect of number of patients per nurse, a time-varying covariate, was treated as random.

Results

453,310 9am medications were given, representing 33% of daily scheduled medications. The median time of first medication administration was 08:20am (40 minutes prior to scheduled time). The median number of patients receiving medications from a single staff member is 3.0 (mean: 3.2, SD: 1.2). A typical nurse with three patients took 55.16 minutes (intercept; SD 10.26) to deliver all 9am medications. Each additional patient per nurse resulted on average in an additional 14.89 minutes (slope; SD 3.6). Total time per nurse varied by unit (-4 to +7 minutes) and across days of the week compared with Wednesdays (Friday +2.7 minutes; Sunday -2.3 minutes). Month had little impact. Significant unexplained variation over time remained (SD 34 minutes) after accounting for unit, day of the week, month, and individual nurse. Daily within unit median difference between longest and shortest individual staff cumulative time to administer medications was 88 minutes (mean: 85.0, SD: 43.6).

Discussion

Variability across nurses in cumulative delivery time and time per patient may reflect differences in medication workload, non-medication patient needs, unit responsibilities, and nurse ability to manage assigned workload. The scale of BCMA data availability creates new opportunities for robust examination of staffing adequacy, skill progression of nurses over time, and within-unit workload balance. Our team is exploring new avenues for assessing systemic structural factors that influence inpatient nursing processes-of-care and how these impact patient and other important outcomes. Use of BCMA data collected as a part of usual care may allow for use of these assessments beyond research as integral parts of a learning health care system’s efforts to improve inpatient nursing care.