Measuring Emergency Department Nursing Workload in Real Time

Edwin L. Clopton, BS
Jennifer R. Granata, FNP-C, MSN, CEN, CPEN, CNML

Southern Maine Health Care
Biddeford, Maine
Question

What is the nursing work load in the Emergency Department?
Nursing workload has been studied systematically since the 1970s.

Related ED studies, beginning around 2000, concentrate on crowding.

Crowding ≠ workload—related, but not the same.

Apparently real-time modeling of ED nursing workload *per se* has not been addressed.
Setting

29-bed Level III Emergency Department, ~40,000 patient visits/year

Staff:
- 1-4 physicians
- Charge nurse and 3-7 staff nurses
- Unit secretary and 1-3 technicians

5-bed low-acuity “Fast Track” and 4-bed acute psych areas not included in study (net 20 beds)
Objective

“Dashboard display” indicating nursing workload in the Emergency Department (ED) in real time
Objective

Develop a formula that uses data from the electronic tracker system to drive the graphic workload indicator
Data Collected

- Patient census, age, gender, triage acuity (5-level ESI, Emergency Severity Index)
- Number of nurses on duty
- Order volume (cumulative and last 60 minutes):
  - radiology
  - ECG
  - lab
  - respiratory therapy
- Number of crisis (behavioral/psych) patients
- Number of arrivals via ambulance and law enforcement
- Number of departures from the ED
Data Collected

Nursing orders and tasks were *not* included because they are difficult to count *automatically*:

- order-entry system creates redundant orders
- many incidental tasks are not charted consistently, promptly, or at all

A sample of manually tallied nursing orders correlated fairly well (~0.84) with lab, ECG, radiology, and RT order volumes
Considerations

Will not be fully implemented with current software (Meditech Client Server) since a major change (to Epic) is coming some day.

Qualifies as a Quality Improvement (QI) initiative, so it is exempt from seeking IRB approval.
Convenience sample of 69 one-hour survey periods evenly distributed over times of day, days of week, and magnitude of workload (n = 1005 patient visits)

<table>
<thead>
<tr>
<th>Time Period</th>
<th>0000-0300</th>
<th>0300-0600</th>
<th>0600-0900</th>
<th>0900-1200</th>
<th>1200-1500</th>
<th>1500-1800</th>
<th>1800-2100</th>
<th>2100-2400</th>
<th>Collected</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weekend</strong></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>(Sat, Sun)</td>
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<td></td>
<td>2</td>
</tr>
<tr>
<td><strong>Near Weekend</strong></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>(Mon, Fri)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td><strong>Midweek</strong></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>24</td>
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<tr>
<td>(Tue, Wed, Thu)</td>
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<td>7</td>
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<tr>
<td><strong>Total</strong></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>69</td>
</tr>
</tbody>
</table>
Data Collection Process

Collect numerical data during and/or after each survey period

Administer validation surveys within 15-20 minutes of the end of each survey period
Validation

Challenge: no uniform definition or measure of either crowding or workload

Financial charges for nursing care?

Provider perception of their own workload
- All nurses on duty?
- Charge nurse
Workload: The portion of the available capacity to perform work that is required to satisfy the present demand for work.

Choose one number to characterize workload in the ED for the past 60 minutes:

<table>
<thead>
<tr>
<th></th>
<th>None or Very Light</th>
<th>ED resources greatly exceeded demand. Required patient care and other tasks (if any) performed promptly with ample time to spare.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Light</td>
<td>ED resources somewhat exceeded demand. Required patient care and other tasks performed promptly with some time to spare.</td>
</tr>
<tr>
<td>3</td>
<td>Moderate</td>
<td>ED resources approximately equal to demand. Required patient care and other tasks performed promptly with little or no time to spare. Few or no tasks deferred. Longest time INWR is brief.</td>
</tr>
<tr>
<td>4</td>
<td>Heavy</td>
<td>Demand somewhat exceeded ED resources. Some tasks deferred in order to perform more urgent tasks. Tasks are pending part of the time. Longest time INWR generally ≤ 60 minutes.</td>
</tr>
<tr>
<td>5</td>
<td>Overwhelming</td>
<td>Demand greatly exceeded ED resources. Many tasks deferred to perform more urgent tasks; tasks are pending most or all of the time. Longest time INWR &gt; 60 minutes.</td>
</tr>
</tbody>
</table>
Data Analysis

For each survey period, examine descriptive statistics (measures of frequency and central tendency)

Compute overall correlation coefficients for each parameter vs. provider-perceived workloads (WLS)
Data Analysis

Parameter

WLS

thumbs up

thumbs down

thumbs up
Model Development

Ideally, identify sets of parameters that:

- correlate well with WLS
- correlate not so well with each other

Using an iterative trial-and-evaluation process, develop a formula based on the available input data that maximizes correlation with WLS.

Test each formula with new data.
Findings

Strongest predictors of WLS:

- Triage acuity \((r^2 = 0.70)\)
- Patient census \((r^2 = 0.65)\)
- Radiology order volume \((r^2 = 0.55)\)
- ECG order volume \((r^2 = 0.51)\)

Best model so far correlates at \(r = 0.90\) with WLS \((r^2 = 0.81)\)
Calculated vs. Reported WLS

- WLS
- FX
- Linear (WLS)
- Linear (FX)
Parameter/RN does not correlate as well with WLS as parameter alone.

Cannot incorporate certain work-intense factors such as code blue, conscious sedation, behavioral restraint.
Limitations

• So far tested at only one site
• Based on a small data sample
• Surely not mathematically optimal
Dashboard display of ED workload should be useful to one or more of:

- ED management and staff
- other hospital units and departments*
- patients and visitors in waiting room via video display
- general public at home via Internet
- hospital administration
- researchers
Implications

*Method should be applicable to other nursing units:

- Same data collection method and validation survey
- Model formulas would have to be custom developed for each application
- May be possible with experience to develop heuristics to facilitate and standardize model development
Questions & Discussion?

CURRENT WORKLOAD

- Zzzz...
- Nicely Busy
- Totally Nuts
Thank You!

Selected References