A Computation Model
Quantifying Nurse Staffing to Care Needs

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The University of Eastern Finland

• Approx. 15 000 students and 2 800 members of staff
• One of the largest universities in Finland.
• Three campuses: Joensuu, Kuopio, Savonlinna

Finland: 5 425 056 inhabitants
Attractive and Safe Hospital project (At Safe -project)

• Led by professor Katri Vehviläinen-Julkunen
• Funded by the University of Eastern Finland, Innovative Research Initiatives 8/2011-7/2014
• Aims to produce new information relevant to the ongoing reorganization of the health care services
• Diverse research methodology, longitudinal designs
• Health care as a complex system
The presentation: A Computation Model Quantifying Nurse Staffing to Care Needs

1. Background
2. Purpose
3. Frame, Material and Methods
4. Results
5. Discussion
6. Conclusion
7. Future
1 Background

• The computational model for nurse staffing was innovated in the Nurse Staffing Management Development (NSMD) project as part of the B11 project designing a new building to the Kuopio University Hospital (KUH) in Finland

• KUH: provides acute care to one million inhabitants in Eastern Finland: 730 beds, 4200 staff/2800 nurses, 90 000 treated patients, 370 000 outpatient visits, 2 500 deliveries
1 Background

Demography of Finland: Under 15- and over 65 year-olds per 100 working age inhabitants

%  
0-14 years old
Over 65 years old

Year
1 Background

• Well-functioning health care, with reasonable usage of resources with acceptable outcomes is everyone’s focus

• Adequate nurse staffing is associated in health care functions with effectiveness and health-contributing performance

However, there is lack of information of quantifying nurse staffing that is transparent, comparable, and repeatable
2 Purpose

The purpose of the NSMD project was to define nurse staffing needs to carry out units’ scenarios in the new settings moving into the new building in 2015

– With existing or smaller volume of nurses

– Less inpatient care (beds ↓), outpatient care ↑ and day-hospital care ↑

– Utilizing data-based parameters
3 Frame, Material and Method

Metaframe: Complex adaptive systems

Operational frame: Donabedian’s STRUCTURE – PROCESS – OUTCOME (SPO) as an open system

“A good structure leads to fine process and contributes desired outcomes”
3 Frame, Material and Method

<table>
<thead>
<tr>
<th>Structure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing intensity</td>
<td>Information of patients’ care needs (acuity, case mix)</td>
</tr>
<tr>
<td>Nursing work environment intensity</td>
<td>Information of the care settings (DRG, census, secretarial and housekeeping services)</td>
</tr>
<tr>
<td>Nursing resources</td>
<td>Information of nurses (RN %, NHPPD, Nurse/Patient ratio, Part-time and Temporary employees)</td>
</tr>
</tbody>
</table>

Outcome (care results, quality, safety, length of stay, finance, nurse turnover)
3 Frame, Material and Method

Data from hospital information systems

• 15 patient settings (outpatient, operations, ICU, neon-ICU, delivery, dialysis)

• 108,864 patient episodes

• 464 nurses’ administrative information
3 Frame, Material and Method

Total working time:
- 52 weeks/year
- 5 days/week

(5*52 = 260 days/year)

Excluding absences:
- public holidays (10 days in Finland)
- annual leaves, vacations (35 days on average in KUH)
- sick leaves (15 days on average in KUH)
- other leaves (3 days on average in KUH)

One nurse can work
260-63 = 197 days/year

7.65 h * 197 = 1,507.05 hours/year
3 Frame, Material and Method

Patients’ care needs based on registered data of units’ day to day functions
- patient day = 24 h
- outpatient visits = $X \text{ min}/60 \text{ min}$
- operation theater time = $X \text{ min}/60 \text{ min}$
- additional essential activities that require nurse resources

Information of care needs expressed as hours
3 Frame, Material and Method

Basic formula

Care need * (acuity coefficient)

Available working time of nurses

= Computational nurse staffing need ©

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### 3 Frame, Material and Method

Example from the ICU of patient care need with highest acuity

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient days</td>
<td>Volume (year 2011)</td>
<td>Care need HOURS</td>
<td>Coefficient</td>
<td>Requisite nursing HOURS</td>
<td>Computational nurse staffing need</td>
</tr>
<tr>
<td>ICU patient days</td>
<td>1122,4</td>
<td>24</td>
<td>1,5(^1)</td>
<td>40406</td>
<td>26,8</td>
</tr>
</tbody>
</table>

Calculations

\[=B \times C \times D = E / 1507,05\]

1) One and a half nurses take care of one patient
3 Frame, Material and Method

Proportion of computational nurse staffing need to unit’s post

\[
\text{COMPUTATIONAL NURSE STAFFING NEED} = \frac{\text{UNIT’S POSTS (bedside nurses)}}{100}
\]

The ratio provided information on the usage level of nurse resources in care processes

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4 Results

The units’ proportion of nurse staffing needs and posts was 43.7–107.3 %

In all but one unit, there were enough nurses to carry out the units’ scenarios in the new building in 2015

Proportioned ratios:
- between 80–85 %: adequate nurse staffing
- between 85–100 %: a call for developing the processes
4 Results

- **Operation theater**: 59.9%
- **Recovery room**: 43.7%
- **ICU**: 81.7%
- **Dialysis**: 63.1%
- **Neon. ICU**: 105.1%
- **Delivery**: 98.9%

**Proportion of nurse staffing needs and posts (2011)**

**Estimation of the proportion of nurse staffing needs and posts (2015)**
5 Discussion

Transparent, comparable and repeatable way of quantifying nurse staffing, a solid basis for evaluation and decision making.

Under- and over-staffing was indicted

- Were all care processes included?
- Were there processes included that do not need nurse staffing?
- Were the used data valid/reliable?
6 Concluson

The ratios of the computational nurse staffing need and posts do not in themselves change anything.

But they do offer transparent and comparable information for planning, following up, and evaluating nurse staffing to lead change.
7 Future, on process

- The verification and validation acuity coefficient
- Integration to rosters
Thank you!

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http://www.uef.fi/en/hoitot/etusivu

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