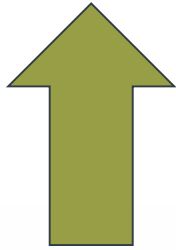# Post-operative mortality, missed care & registered nurse staffing in nine countries: a cross-sectional study

RCN International Research Conference
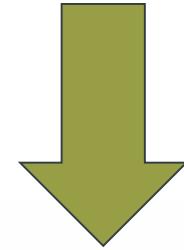Birmingham 16 April 2018

Jane Ball

Luk Bruyneel, Linda H Aiken, Walter Sermeus, Douglas M Sloane, Anne Marie Rafferty, Rikard Lindqvist, Carol Tishelman & Peter Griffiths

# Background

RN Staffing

Risk of patient death in hospital
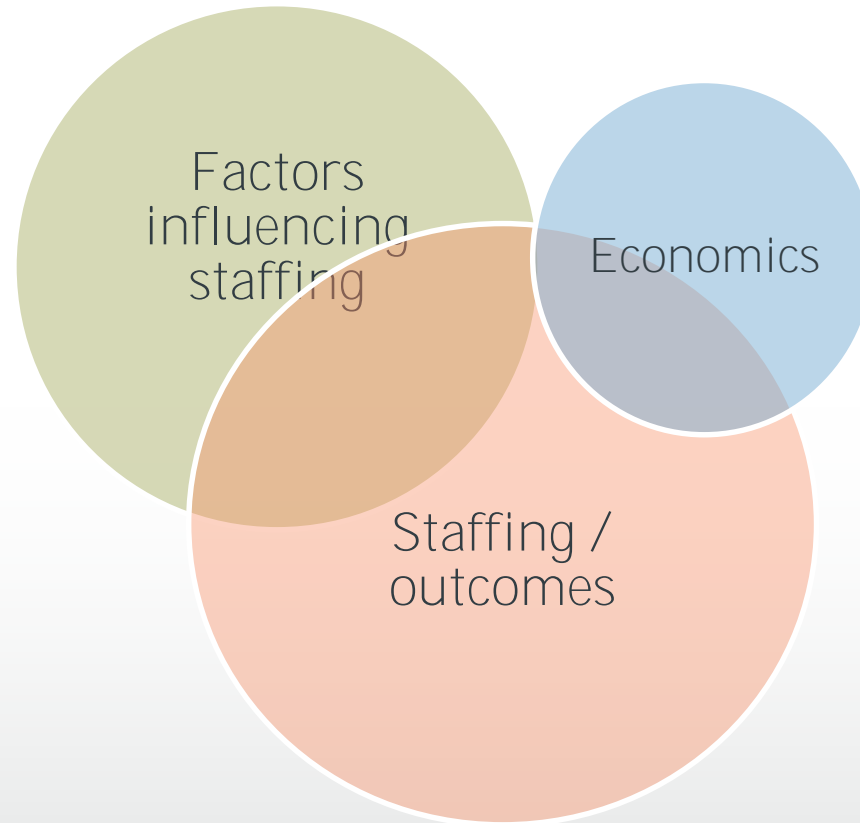
# Systematic review - 2007

➤ 96 studies ➤ meta-analysis of 28

Increased RN staffing associated with lower hospital related mortality

- intensive care units (OR 0.91 CI 0.86–0.96)

- surgical units (OR 0.84; 95% CI, 0.80–0.89)

- medical patients (OR 0.94; 95% CI, 0.94–0.95)

*Kane et al  (2007) Medical Care 45: 12, 1195-1204*

# Review of Evidence - 2014

*Griffiths, Ball, Drennan et al (2014) 'The association between patient safety outcomes & nurse/healthcare assistant skill mix & staffing levels and factors that may influence staffing requirements'.*

# Nurse staffing & patient outcomes

RN Staffing → ? → Patient Outcomes

# Missed care - a mediator?



RN staffing ✓ → 'Missed care' → ? → Mortality
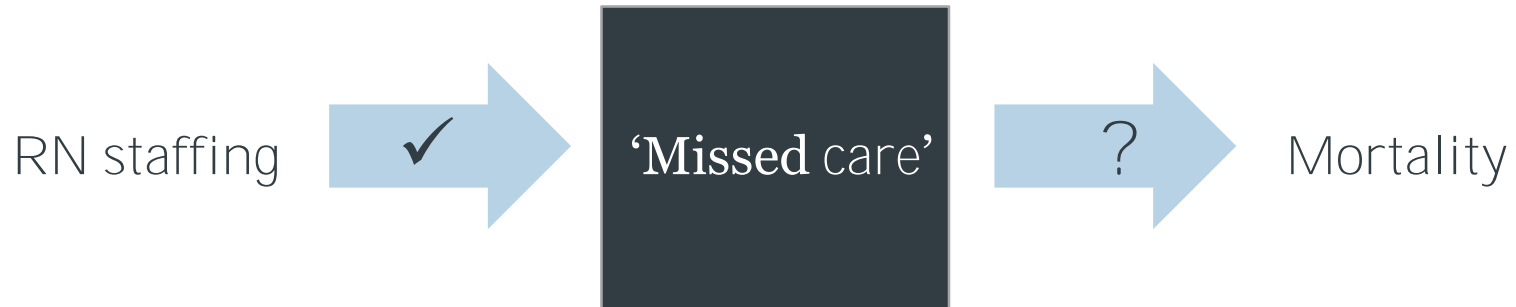
➢ Do hospitals with higher levels of missed care have higher levels of hospital related mortality?

➢ **Does 'missed care' mediate the relationship between RN** staffing and mortality in acute hospitals?

# RN4Cast study





University of Southampton



## Nurse forecasting in Europe (RN4CAST): Rationale, design and methodology

Walter Sermeus, Linda H Aiken, Koen Van den Heede, Anne Marie Rafferty, Peter Griffiths, Maria Teresa Moreno-Casbas, Reinhard Busse, Rikard Lindqvist, Anne P Scott, Luk Bruyneel, Tomasz Brzostek, Juha Kinnunen, Maria Schubert, Lisette Schoonhoven, Dimitrios Zikos and RN4CAST consortium

### Abstract

**Background:** Current human resources planning models in nursing are unreliable and ineffective as they consider volumes, but ignore effects on quality in patient care. The project RN4CAST aims innovative forecasting methods by addressing not only volumes, but quality of nursing staff as well as quality of patient care.

**Methods/Design:** A multi-country, multilevel cross-sectional design is used to obtain important unmeasured factors in forecasting models including how features of hospital work environments impact on nurse recruitment, retention and patient outcomes. In each of the 12 participating European countries, at least 30 general acute

## Nurse staffing and education and hospital mortality in nine European countries: a retrospective observational study

Linda H Aiken, Douglas M Sloane, Luk Bruyneel, Koen Van den Heede, Peter Griffiths, Reinhard Busse, Marianna Diomidous, Juha Kinnunen, Maria Kózka, Emmanuel Lesaffre, Matthew D McHugh, MT Moreno-Casbas, Anne Marie Rafferty, Rene Schwendimann, P Anne Scott, Carol Tishelman, Theo van Achterberg, Walter Sermeus, for the RN4CAST consortium*

SERMEUS, W., AIKEN, L. H., VAN DEN HEEDE, K., RAFFERTY, A. M., GRIFFITHS, P., MORENO-CASBAS, M. T., BUSSE, R., LINDQVIST, R., SCOTT, A. P. & BRUYNEEL, L. 2011. Nurse forecasting in Europe (RN4CAST): rationale, design and methodology. *BMC nursing, 10*, **6.**

## Sample

- 9 Countries: Belgium, England, Finland, Ireland, the Netherlands, Norway, Spain, Sweden, Switzerland

- 300 general acute hospitals

- 422,730 patients who had undergone a common surgical procedure

## Analysis

a) Generalized estimation models (model 1-3)

b) Bayesian model to test for a mediating effect (model 4)

*All models adjusted for hospital characteristics (bed size, teaching status, and technology), practice environment, patient characteristics (age, sex, admission type, type of surgery, and comorbidities present on admission).*

# Data Sources

**Nurse Survey**
**26,516**
**Registered Nurses (RNs)**
Medical /Surgical wards

**Patient data**
**422,730**
**Surgical patients**
- Patient characteristics
- Mortality

**General Acute Hospital characteristics**

# RN4Cast nurse survey

- Work environment & job satisfaction

- Quality & safety

- Your most recent shift

- About you

- Where you work

# Nurse staffing levels

**C8** On your most recent shift how many patients in total were on your unit/ward?

Number of patients: ......... [        ]

- Patients per RN

- Patients per other nursing support staff

- Skill-mix – RNs as % of total nursing staff

**C9** Counting yourself, how many registered nurses in total provided direct patient care on your unit/ward during the most recent shift you worked?

Number of registered nurses: ............................. [        ]

**C10** How many other nursing care staff in total provided direct patient care on your unit/ward during the most recent shift you worked?

Number of other nursing care staff: ......................... [        ]

# Care left undone

**C12 On your most recent shift, which of the following activities were necessary but left undone because you lacked the time to complete them? Please tick all that apply.**

| | |
|---|---|
| Adequate patient surveillance .......................... ☐ 01 | Administer medications on time .......................... ☐ 08 |
| Skin care........................................................... ☐ 02 | Prepare patients and families for discharge ....... ☐ 09 |
| Oral hygiene ..................................................... ☐ 03 | Adequately document nursing care.................... ☐ 10 |
| Pain management.............................................. ☐ 04 | Develop or update nursing care plans/care pathways .......................................................... ☐ 11 |
| Comfort/talk with patients ................................ ☐ 05 | |
| Educating patients and family ........................... ☐ 06 | Planning care ................................................... ☐ 12 |
| Treatments and procedures............................... ☐ 07 | Frequent changing of patient position ............... ☐ 13 |

- Any aspect of care undone (binary)

- Number of items of care undone

- Percentage of items undone (13 = 100%)

Adapted from: Schubert, M., et al., *Rationing of nursing care and its relationship to patient outcomes: the Swiss extension of the International Hospital Outcomes Study.* International Journal for Quality in Health Care, 2008. **20**(4): p. 227-237.

# Case mix adjusted mortality

Predicted likelihood of death calculated based on patient risk factors. Administrative data on discharge:

- Admission type (emergency or elective)

- Diagnosis

- Length of stay (<30 days)

- Patient age & sex

- Comorbidities

| | 30-day inpatient mortality (following common surgery) | | | |
|---|---|---|---|---|
| | Odds ratio | Lower 2·5% CI | Upper 2·5% CI | p-value |
| **Model 1** | | | | |
| **Nurse staffing** | 1·068 | 1·031 | 1·106 | 0·0002 |
| **Nurse education** | 0·929 | 0·886 | 0·973 | 0·0019 |
| | | | | |
| **Model 2** | | | | |
| **Missed care** | 1·159 | 1·039 | 1·294 | 0·0084 |
| | | | | |
| **Model 3** | | | | |
| **Missed care** | 1·125 | 1·006 | 1·258 | 0·0392 |
| **Nurse staffing** | 1·056 | 1·018 | 1·095 | 0·0036 |
| **Nurse education** | 0·928 | 0·885 | 0·972 | 0·0018 |

# Key findings

- An increase in a nurses' workload by one patient was associated with a 7% (OR 1.068)  increase in the odds of a patient dying (as per Aiken 2014, Lancet)

- **A 10% increase in the percent of missed nursing care was  associated with 16% (OR 1·159) increase in the odds of a patient dying**

| | 30-day Inpatient mortality | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Estimate | Posterior SD | Lower 2·5% CI | Upper 2·5% CI | Estimate | Posterior SD | Lower 2·5% CI | Upper 2·5% CI |
| Model 4 | | | | | | | | |
| Missed care | 0·050 | 0·023 | 0·005 | 0·093 | -- | -- | -- | -- |
| Nurse staffing | 0·013 | 0·010 | -0.006 | 0·032 | 0.100 | 0.016 | 0.070 | 0.133 |
| Indirect effect | 0·005 | 0·002 | 0·000 | 0·010 | -- | -- | -- | -- |

*SD = Standard Deviation CI = Credibility Interval (Bayesian estimator).*

# Implications for Policy & Practice

- Reinforces need for careful planning to ensure RN staffing adequate for *safe* & *complete* care

- Specificity – increase utility for application to practice

- Care left undone as an indicator of staffing adequacy/insufficiency

# Limitations

- Cross-sectional design

- Self report measures (staffing, care left undone)

- **Absence of mortality ≠ quality (other outcomes?)**

- Limitations of quantitative methods – the what, not the how or why

# Conclusion

- Higher RN staffing levels associated with lower risk of fatal harm to patients

- Care left undone sits on a causal pathway

- The correlation between RN staffing and mortality is likely to be causal.

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# Thank you!

Any questions?

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