# Introduction to Patient Safety Research

Presentation 6 - Understanding Causes: Cross-Sectional Study



Better Knowledge for Safer Care

# 2: Table of Contents

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# 3: Overview

- **Objective**
  - To determine the association between the patient-to-nurse ratio and patient mortality, failure-to-rescue (deaths following complications) among surgical patients, and factors related to nurse retention.

- **Methods**
  - Cross-sectional analyses of linked data from 10,184 staff nurses surveyed, 232,342 hospital patients discharged from April 1998 to November 1999, and administrative data from 168 general hospitals in Pennsylvania.

- **Results**
  - Each additional patient per nurse associated with a 7% increase in both the likelihood of dying within 30 days of admission and of failure-to-rescue.
  - Each additional patient per nurse was associated with a 23% increase in the odds of burnout and a 15% increase in the odds of job dissatisfaction.

- **Conclusions**
  - In hospitals with high patient-to-nurse ratios, surgical patients experience higher risk-adjusted 30-day mortality and failure-to-rescue rates, and nurses are more likely to experience burnout and job dissatisfaction.

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# 4: Introduction: Study Details

- **Full Reference**
  - **Aiken LH, Clarke SP, Sloane DM, Sochalski J, Silber JH. Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. JAMA, 2002: 288:1987-1993**

- **Link to Abstract (HTML)**          **Link to Full Text (PDF)**

**Context** The worsening hospital nurse shortage and recent California legislation mandating minimum hospital patient-to-nurse ratios demand an understanding of how nurse staffing levels affect patient outcomes and nurse retention in hospital practice.

**Objective** To determine the association between the patient-to-nurse ratio and patient mortality, failure-to-rescue (deaths following complications) among surgical patients, and factors related to nurse retention.

**Design, Setting, and Participants** Cross-sectional analyses of linked data from 10184 staff nurses surveyed, 232342 general, orthopedic, and vascular surgery patients discharged from the hospital between April 1, 1998, and November 30, 1999, and administrative data from 168 nonfederal adult general hospitals in Pennsylvania.

**Main Outcome Measures** Risk-adjusted patient mortality and failure-to-rescue within 30 days of admission, and nurse-reported job dissatisfaction and job-related burnout.
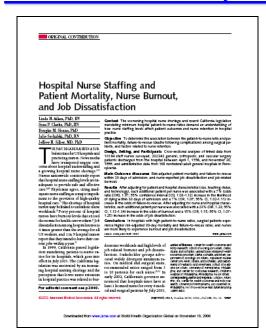
**Results** After adjusting for patient and hospital characteristics (size, teaching status, and technology), each additional patient per nurse was associated with a 7% (odds ratio [OR], 1.07; 95% confidence interval [CI], 1.03-1.12) increase in the likelihood of dying within 30 days of admission and a 7% (OR, 1.07; 95% CI, 1.02-1.11) increase in the odds of failure-to-rescue. After adjusting for nurse and hospital characteristics, each additional patient per nurse was associated with a 23% (OR, 1.23; 95% CI, 1.13-1.34) increase in the odds of burnout and a 15% (OR, 1.15; 95% CI, 1.07-1.25) increase in the odds of job dissatisfaction.

**Conclusions** In hospitals with high patient-to-nurse ratios, surgical patients experience higher risk-adjusted 30-day mortality and failure-to-rescue rates, and nurses are more likely to experience burnout and job dissatisfaction.

JAMA. 2002;288:1987-1993                                    www.jama.com

# 5: Introduction: Patient Safety Research Team

- **Lead researcher – Prof. Linda H. Aiken, PhD, RN**
  - **Director, Centre for Health Outcomes and Policy Research**
  - **University of Pennsylvania in Philadelphia, USA**
  - **Field of expertise: nurse workforce issues and the organizational features of hospitals**
- **Other team members:**
  - **Sean P. Clarke, PhD, RN**
  - **Douglas M. Sloane, PhD**
  - **Julie Sochalski, PhD, RN**
  - **Jeffrey H. Silber, MD, PhD**

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# 6: Background: Opening Points

- **Nurses across the US consistently report that hospital nurse staffing levels are inadequate to provide safe and effective care**
  - Physicians cite inadequate nurse staffing as a major impediment to the provision of high-quality hospital care
- **Shortage of hospital nurses may be linked to unrealistic nurse workloads**
  - Stakeholder groups advocate widely divergent minimum patient-to-nurse ratios
  - In 1999, California passed legislation mandating patient-to-nurse ratios for its hospitals

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# 7: Background: Opening Points (2)

- **Data on the practice environment and quality of care in hospitals should be obtained from registered nurses**
  - Only healthcare workers providing care 24/7
- **Administrative data in the US are typically obtained from two sources:**
  - Data on hospital characteristics from the American Hospital Association Annual Survey (considered the Gold Standard in the US)
  - Patient data from the appropriate states agencies

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# 8: Background: Study Rationale

- **Worsening hospital nurse shortage and California legislation demand an understanding of how nurse staffing levels affect patient outcomes and nurse retention in hospital practice**
    - Aiken research team had been conducting research on magnet hospitals (hospitals known for good nursing care), and on hospitals providing care to AIDS patients for several years prior to this study
    - Research team sought to continue their program of research adapted to a larger state wide scale

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# 9: Background: Setting Up a Research Team

- **Collaborators chosen based on expertise**
  - **Dr. Sloane chosen as senior statistician**
  - **Dr. Silber chosen based on his development of risk adjustment models, and the concept of failure-to-rescue**
- **Funding**
  - **Obtained through a grant submission to the National Institutes of Health/National Institute of Nursing Research**

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# 10: Methods: Study Design

- **Design: cross-sectional study**
  - Information about hospital staffing and organization obtained from nurse surveys
  - Patient outcomes derived from hospital discharge abstracts
  - Hospital characteristics drawn from administrative databases
- **Main outcome measures:**
  - Risk-adjusted patient mortality
  - Failure-to-rescue within 30 days of admission
  - Nurse reported job dissatisfaction and job-related burnout

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# 11: Methods: Study Objectives

- **Objectives:**
  - **To determine the association between the patient-to-nurse ratio and the following:**
    - Patient mortality
    - Failure-to-rescue (deaths within 30 days of admission among surgical patients who experienced complications)
    - Factors related to nurse retention

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# 12: Methods: Study Population and Setting

- **Setting: hospital characteristics**
  - **Data collected on all 210 adult general hospitals in Pennsylvania for the year 1999**
    - Data from1999 American Hospital Association Annual Survey and 1999 Pennsylvania Department of Health Hospital Survey
  - **Out of 210 acute care hospitals 168 were kept in the final sample**
- **Population: patient outcomes**
  - **Patient discharge abstracts for all admissions to non-federal adult acute care hospitals in Pennsylvania from Apr. 1998 to Nov. 1999**
    - Data from Pennsylvania Health Care Cost Containment Council
  - **232,342 patients met inclusion criteria**
    - General surgical, orthopaedic or vascular procedures
    - Ages 20 through 82

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# 13: Results: Study Population and Setting (2)

- **Population: hospital staffing**
  - **Surveys mailed to a random sample of 50% of all nurses registered with the Pennsylvania Board of Nursing**
  - **Response rate to nurse surveys was 52%**
    - Compared favourably with rates seen in other voluntary surveys of health professionals
  - **At least 10 nurse respondents from each hospital**

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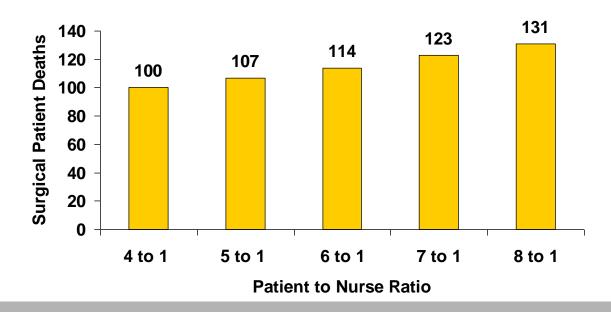
# 14: Methods: Data Collection

- **Hospital nurse staffing measures calculated as the mean patient load across all staff registered nurses across entire hospital**
- **Nurses surveyed about demographic characteristics, work history, workload, job satisfaction and job-related burnout**
  - **Job satisfaction measured on a 4-point scale**
  - **Burnout measured with the Emotional Exhaustion scale of the Maslach Burnout Inventory**
- **Patient discharge abstracts were merged with Pennsylvania vital statistics records to identify:**
  - **Patients who died within 30 days of admission**
  - **30-day patient mortality**
  - **Failure-to-rescue (deaths within 30 days of admission among patients who experienced complications)**

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# 15: Methods: Data Analysis and Interpretation

- **All analyses performed using STATA v7.0 software**
- **Computed descriptive data**
- **Logistic regression models to estimate effects on nurse outcomes and patient outcomes**
  - All logistic regression models estimated using Huber-White procedures to account for clustering
  - Model calibration assessed with the Hosmer-Lemeshow statistic
- **Direct standardization to illustrate the magnitude of the effect of staffing**
  - Estimated probability of death and failure-to-rescue under various patient-to-nurse ratios

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# 16: Results: Key Findings

- Patient-to-nurse ratio ranged from 4:1 to 8:1
- After adjusting for patient and hospital characteristics, each additional patient per nurse was associated with:
  - 7% increase in the likelihood of dying within 30 days of admission
  - 7% increase in the likelihood of failure-to-rescue



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# 17: Results: Key Findings (2)

- **After adjusting for nurse and hospital characteristics, each additional patient per nurse was associated with:**
  - **23% increase in the likelihood of burnout**
  - **15% increase in the likelihood of job dissatisfaction**
- **Of the 232,342 surgical patients:**
  - **4,535 (2.0%) died within 30 days of admission**
  - **53,813 (23.2 %) experienced a major complication**
  - **Failure-to-rescue rate was 8.4% (death following a complication)**

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# 18: Results: Nurse Survey Responses

- **Nurse characteristics**
  - **94% female**
  - **40% with BSN degree of higher**
  - **Mean years of experience - 13.8**
  - **Clinical specialty**
    - 31% - medical/surgical
    - 20% - intensive care
    - 10% - operating/recovery
    - 40% - other
  - **43% reported high emotional exhaustion**
  - **42% reported job dissatisfaction**

# 19: Conclusion: Main Points

- **In hospitals with high patient-to-nurse ratios:**
  - Surgical patients experience higher risk-adjusted 30-day mortality and failure-to-rescue rates
  - Nurses are more likely to experience burnout and job dissatisfaction

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# 20: Conclusion: Discussion

- **Study suggests that, all else being equal, substantial decreases in mortality rates could result from increasing nurse staffing**
  - Based on 4 million similar procedures in US per year, if all patients were treated in hospitals with a 4:1 versus an 8:1 patient-to-nurse ratio, there would be 20,000 fewer deaths per year

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# 21: Conclusion: Study Impact

- **Academic impact**
  - **Findings published in top tier journals including the Journal of the American Medical Association**

- **Policy impact**
  - **Findings have been influential in US states debating the issue of nurse staffing legislation**

- **Practice impact**
  - **Study findings on nurse staffing and patient outcomes have caused many hospital administrators to rethink their staffing strategies and to provide nurses with more appropriate workloads**

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# 22: Conclusion: Practical Considerations

- **Study duration**
  - **Approximately 4 years**
- **Cost**
  - **$1.2 million USD**
- **Additional resources**
  - **Library services, computers and analytic software, secure server for data storage, computer technicians and a secure area for storage of hard copies of surveys and patient data**
- **Required competencies**
  - **Experts in nursing and workforce theory, survey methodology, sampling, data management and complex statistical methods**
- **Ethical approval**
  - **Took about 3-4 weeks to obtain**

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# 23: Author Reflections: Lessons and Advice

- **Similar research can be conducted in both developed and developing countries**
    - **Studies in other countries will have to be modified to suit local data availability**
    - **However, many countries do not have the same availability of data on hospitalized patients**
- **Advice for researchers**
    - *"Develop a collaborative relationship with those experts who can best assist you in developing and executing a research plan.*
    - *Further, consider the possibility of international collaborative efforts."*

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# 24: Author Reflection: Selecting Design

- **Chosen research methods were considered as a reliable and valid way to assess:**
  - **Practice environment of nurses**
  - **Nurse and patient outcomes**
- **Nearly impossible to obtain data from thousands of nurses and millions of patients in any other manner**

# 25: Author Reflections: Overcoming Barriers

- **Challenge**
  - *"The Pennsylvania Hospital Association (PHA) had concerns regarding nurse reports of quality of care in Pennsylvania hospitals, and the possibility of identifying hospitals in research journals."*

- **Solution**
  - *"Dr. Aiken met with a group of executives from the PHA, explained the methodology of our research and that no hospitals are ever identified in our research findings."*

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# 26: Author Reflections: Ideas for Future Research

- **Study considered to be well executed, and only needs to be replicated in other states and countries**
  - **Nurses can be surveyed on the practice environment and the quality of care almost anywhere in the world**
- **Studies should continue to examine work environment of nurses**
  - **Determining those factors that could possibly keep nurses in the workforce**
  - **Improving the practice environment of nurses**
  - **Improving the quality of patient care**

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# 27: Additional References

- Aiken, L. H. and P. A. Patrician. 2000. "Measuring organizational traits of hospitals: the Revised Nursing Work Index." Nursing Research 49(3):146-53.

- Aiken, L. H., S. P. Clarke, and D. M. Sloane. 2000. "Hospital restructuring: does it adversely affect care and outcomes?" Journal of Nursing Administration 30(10):457-65.

- Aiken, L. H., S. P. Clarke, D. M. Sloane, J. A. Sochalski, R. Busse, H. Clarke, P. Giovannetti, J. Hunt, A. M. Rafferty, and J. Shamian. 2001. "Nurses' reports on hospital care in five countries." Health Affairs 20(3):43-53.

- Lake, E. T. 2002. "Development of the practice environment scale of the Nursing Work Index." Research in Nursing & Health 25(3):176-88.

- Aiken, L. H., S. P. Clarke, R. B. Cheung, D. M. Sloane, and J. H. Silber. 2003. "Educational levels of hospital nurses and surgical patient mortality." Journal of the American Medical Association 290(12):1617-23.

# 28: Additional Resources and Tools

- **Practice Environment Scale of the Nursing Work Index**
  - A reliable and valid measure of the nurse work environment
  - Adopted by the National Quality Forum.
- **Maslach Burnout Inventory (MBI)**
  - A reliable and valid measure of job-related burnout.
  - A version of the MBI designed specifically for use in healthcare providers

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