How Nurse-to-Patient Ratios Affect Patient Outcomes

Nurse-to-Patient Ratios: Research and Reality

Boston, Massachusetts

March 30, 2005

Minor changes have been made to presentation following conference

Jack Needleman

UCLA School of Public Health

Variability of Nurse Staffing
Needleman/Buerhaus, 1997 Sample

Staffing Measure	Mean	Low 1st Q	High 3rd Q
RN hours/ patient day	7.8	6.6	9.4
LPN hours/ patient day	1.2	0.5	1.6
Aide hours/ patient day	2.4	1.6	3.1
Licensed hours/ patient day	9.0	7.5	10.4
RN share of licensed	87%	84%	90%
Aide share of total	21%	11%	33%

Patients per Nurse, Pennsylvania, 1999

Number of Patients per Nurse	Hospitals	Patients
Sample size	168	232,342
Four or less	12%	18%
Five	38%	48%
Six	24%	21%
Seven	17%	9%
Eight or more	8%	4%

Source: Aiken, et al., JAMA 2002

Outcomes Associated with Nursing
Research studies looking at specific outcomes

| | RN percent of staff | | RN hours/day | |
	Assoc	No Assoc	Assoc	No Asssoc
Mortality	1	1	8	6
Failure to Rescue	1	1	2	1
Length of Stay	3		8	
Pneumonia	3		5	1
Urinary Tract Infection	4		4	
Post Op Infection	2		2	
Nosocomial Infection			3	
Sepsis		1	4	2

Outcomes Associated with Nursing
Research studies looking at specific outcomes

	RN percent of staff		RN hours/day	
	Assoc	No Assoc	Assoc	No Asssoc
Pressure Ulcers	4	1	3	2
Deep Vein Thrombosis		1	1	1
Upper GI Bleeding	1		1	
Shock/Cardiac Arrest	1		1	
Medication Errors	2		2	
Falls	3		2	
Pain Management	1		1	
Patient Satisfaction	2	1	1	
Patient Complaints	1		1	

Limitations to Identifying Optimal Ratios

- **Cross study limitations in methods**
  - Often hospital, not unit, staffing
  - Different measures of outcomes
- **Staff skill mix**
  - RN/LPN
  - Experience
  - Education
- **Patient mix**
  - Nursing acuity
  - Risk of adverse outcomes
- **Nursing environment**
  - Nursing model/philosophy
  - Physical layout of units
- **Presence/use of auxiliary staff**
  - Phlebotomists, transport, aides

Quantifying the Effects of Nursing

- Needleman/Buerhaus, NEJM, 2002
    - 799 hospitals from 11 states, 1997
    - ¼ US acute discharges

Sample: Low and High Staffed Hospitals
Needleman/Buerhaus

	Low	High
Hospitals	399	400
Beds	201	252
Census	126	149
Licensed hours per day	7.5	10.4
Aide hours per day	2.3	2.6
RN as % Licensed	84%	90%

Comparison of Outcome Rates in Low and High Staffed Hospitals

Needleman/Buerhaus

	Low Staffed Hospitals	High Staffed Hospitals	Diff
Length of Stay	5.5	4.6	-16%
UTI	6.2%	5.8%	-6%
Pneumonia	2.3%	2.0%	-13%
UGI Bleeding	1.1%	0.9%	-18%
Shock/Cardiac	0.6%	0.5%	-17%
Failure (Surgery)	22.6%	19.7%	-13%

Outcomes Associated with Nursing
Needleman/Buerhaus simulation results
Based on analysis of results across 10 alternative models

Outcome	Impact of High RN Staffing	Impact of High Staffing in all Nursing Categories
LOS	3-6%	3-12%
Urinary Tract Infection	4-12%	4-25%
Pneumonia	3-8%	2-17%
Upper GI Bleed	5%	3-10%
Shock	6-10%	7-13%
Failure to Rescue (Surg)	4-6%	2-12%

Business case for nursing

- **Simulation from Needleman/Buerhaus 2003**
- **Three options:**
  - Raise RN/LPN ratio to 75th percentile level (where below)
  - Raise Licensed hours to 75th percentile level (where below)
  - Do both
- **Estimate**
  - Cost of increased nursing
  - Reduced days, adverse events associated with higher staffing
  - Cost offset associated with reduced days and events
  - Avoided deaths & net cost of avoided deaths

Business case for nursing

- **Limitations**
  - **Use 1997 costs and staffing**
    - Analysis with data updated to 2002 under review
    - Staffing (RN/LPN & hours per day) had not changed significantly between 1997 and 2002
  - **Limited number of outcomes**
    - Only those with strongest evidence in Needleman/Buerhaus
    - Excludes outcomes found in other studies to be nurse-sensitive
    - Therefore, lower bound estimate of savings and upper bound estimate of cost per avoided death

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Simulation of Moving Nursing to 75th Percentile
Estimates for 1997 based on Needleman/Buerhaus 2002

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	Raise RN Proportion	Raise Licensed Hours	Both
Total Cost	$679 Million	$6.3 Billion	$7.1 Billion

Avoided Days and Outcomes Associated with Raising Nursing to 75th Percentile
Estimates for 1997 based on Needleman/Buerhaus 2002

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	Raise RN Proportion	Raise Licensed Hours	Both
Avoided Days	411,529	672,701	1,084,230
Urinary Tract Infection	37,451	3,834	41,128
Pneumonia	10,804	1,261	12,027
UGI Bleeding	3,808	3,793	7,516
Shock or Cardiac Arrest	2,671	496	3,147
Failure to Rescue (Surgical)	325	548	865
TOTAL Avoided Outcomes	54,733	9,384	63,818
Avoided Deaths	4,591	1,655	6,205

Cost Savings of Avoided Outcomes and Net Cost of Increasing Nurse Staffing to 75Th Percentile

Estimates for 1997 based on Needleman/Buerhaus 2002

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	Raise RN Proportion	Raise Licensed Hours	Both
Cost Savings due to avoided days and adverse events	$842 Million	$1.4 Billion	$2.2 Billion
Net cost after subtracting cost of increased nursing	**($163 Million)**	**$4.9 Billion**	**$4.9 Billion**
Net Cost as % of Hospital Exp	**-0.1%**	**1.6%**	**1.5%**
Cost per avoided death	Less than zero	$3 Million	$790 Thousand

Concluding Thoughts

- **Nursing's association with a wide range of outcomes is well established in the research literature, although in some cases only for specific hospitalized populations (e.g., ICU, surgical)**
  - Conclusions consistent with theory and experience
  - Limitations in data availability, quality limit capacity to demonstrate association in analysis
- **Research demonstrates importance of both staffing mix/skill and hours per patient**
- **Research does not establish optimal ratio**
  - Outcomes and optimal staffing influenced by patient mix and acuity, nurses skill mix, work environment and auxiliary personnel
- **Simulation of partial impacts of nursing demonstrates a strong business case for nursing**