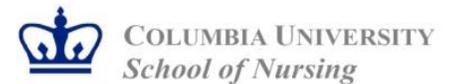


Nurse Staffing and Healthcare Associated Infections

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Funded by NR010822



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<http://cumc.columbia.edu/dept/nursing/chphsr/>

Background

- Healthcare associated infections (HAI) are a serious, but often preventable problem.
- In the US, the Department of Health and Human Services has prioritized HAI as part of the plan to build a safer and more affordable health care system.
- There are financial incentives for hospitals to prevent HAI
 - Medicare has stopped paying for 3 HAIs
 - CMS, as part of value-based purchasing, decreases payments if HAI rates are too high

Background

- Nurses play a critical role in preventing HAI
- Previous research has found substantial, but inconsistent evidence that better staffing is associated with fewer HAIs
- Inconsistent results are related to
 - Measures of staffing at unit or hospital level
 - Lack of individual risk adjustment
 - Variable definitions of HAI inconsistent with the CDC definitions

Purpose

- Addressing the limitations in previous research, this study was designed to:
- Examine the relationship of nurse staffing and HAIs



Methods: Setting

- 3 hospital system
- More than 2,000 beds
- 100,000 patients discharged annually
- Located in large urban US city

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Methods: Data

- 6 years of data (2007 through 2012)
- Multiple electronic data sources
- Nurse staffing data extracted from payroll
- Patient information from 3 data sources
 - Administrative data providing demographic information, admit/discharge dates, diagnoses
 - Clinical data warehouse integrating data from more than 20 electronic sources (e.g., patient location, laboratory results, medication and procedures)
 - Electronic health record including physician orders and nurses notes

Methods: Data cleaning

- Excluded pediatric, labor and delivery, mental health and rehab units
- Excluded surgical patients because follow up data on surgical site infections were not available
- Excluded unit-shifts with extreme staffing levels with patient to nurse ratios
 - > 4 ICUs
 - > 8 med, med/surg
 - > 6 step-downs



Variables: HAI

- Composite measure of HAI
 - Urinary tract infections (UTI), bloodstream infection (BSI) and pneumonia (PNU)
 - Definitions consistent with CDC/NHSN
 - Occurring on or after 3rd day



Variables: Nurse staffing

- Staffing
 - Nurse Support (NS): Licensed practical nurses combined with nurse assistants
 - Registered Nurse (RN)
- Unit/shift level
 - Day (7am -7pm) and nights (7pm – 7am)
 - Nursing hours / patients on unit
- Low staffing
 - Staffing 80% below median for shift
- Patient staffing
 - Low staffing range 0 to 2, with 0 = no low staffing, 2 = both shifts low staffed

Variables: Patient Controls

- Demographics
- Skilled nursing stay prior to admission
- Co-existing conditions (i.e., diabetes, cancer, HIV, and transplantation)
- Comorbidities: Charlson Index
- Medical procedures
- High risk medications



Analysis

- Cox proportional hazards regression
- HAI composite the outcome measure
- Used staffing 2 days prior onset of HAI as time varying covariate
- Model controlled for patient characteristics, unit type, year and patient turnover

Results

- Final Sample
 - 34 units
 - 100,264 patients
 - 448,826 patient days
 - 4,390 (4.34%) HAIs

Results: Patient

- Patients with HAI were more likely to be:
Older and female

And have:

a skilled nursing facility stay, more comorbidities (higher Charlson index), co-existing conditions (with exception of diabetes), ICU stay, medical procedures, indwelling devices and indwelling devices, and receive antibiotics

All p values <.05

Results: Level of Dayshift* Staffing by Unit Type

Variable	ICUs	Medical Units	Med/Surg Units	Step-Down Units
No. of Shifts	27,331	18793	10016	10731
<u>Registered Nurses (RN)</u>				
RN nursing hours/patients (mean (S.D.))	11.5 (6.6)	3.4 (2.2)	2.6 (2.1)	3.8 (1.6)
80% of RN staffing median	8.0	2.2	1.8	2.9
Understaffed shifts by the definition (%)	19.40%	13.20%	11.70%	15.60%
<u>Nursing supporting staff (NS)</u>				
NS nursing hours/patients (mean (S.D.))	2.3 (2.3)	1.8 (1.0)	2.0 (1.3)	1.5 (0.8)
80% of NS staffing median	1.44	1.28	1.44	1.12
Understaffed shifts by the definition (%)	32.40%	20.90%	23.30%	27.80%

*Nightshift followed a similar pattern

Results: Association of nurse staffing and HAIs (n = 448,826)

Variables	Hazard Ratio (95% CI)	P value
RN Understaffing (0 as reference group)		
1	1.00 (0.92, 1.09)	0.98
2	1.15 (1.02, 1.30)	0.024
NS understaffing (0 as reference group)		
1	1.05 (0.97, 1.12)	0.226
2	1.11 (1.01, 1.21)	0.031

Notes: Model is controlled for patient individual risks such as demographics, comorbidity, medical procedures and treatments, unit patient turnover, unit types, and data year.

RN: Registered nurse; NS: Nursing support staff including nursing assistants and a small number of licensed practiced nurses.

Understaffing & skill mix are both calculated by comparing with 80% of median in the unit and shift,

0 = neither day nor night shift was understaffed, 1= one of the shift was understaffed, & 2 = both shifts were understaffed.

Discussion

- HAIs continue to be problematic.
- No association of understaffing 2 days prior with just 1 shift understaffed.
- Strong associations when both day and night shifts were understaffed.
- This is true for both RN and nursing support staff.
 - Patients on units with low RN staffing on both shifts 2 days prior to infection onset were **15%** more likely to have a HAI than those patients on units with adequate staff
 - Patients on units with low NS staffing on both shifts 2 days prior to infection were **11%** more likely to have a HAI than those patients on units with adequate staff

Discussion

- Strengthens existing evidence on nurse staffing and HAIs
- One of only 3 studies that consider infection incubation period.
- The other studies were small sizes, single unit and lacked controls for risk adjustment.

Limitations

- Only 3 urban hospitals
 - However, diverse patient population
- Could not control for specific care processes (e.g., compliance with hand hygiene or aseptic technique with procedure)

Questions

- Contact Pat ps2024@columbia.edu
- Big **THANKS** to Lisa for presenting!