Association of Catheter Associated Urinary Tract Infection with the Practice Environment at the Unit Level

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Dissertation University of Kansas
Disclosures

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Background

Patient Outcomes – Importance in Acute Care

• Financial Impact in the USA
  ▪ Centers for Medicare & Medicaid – Reimbursement
  ▪ Public Reporting

• Hospital Acquired Conditions (HAC)
  – Falls with Injury
  – Pressure Ulcers
  – Nosocomial Infections
Nosocomial Infections

- **Five Preventable**
  - Ventilator Associated Pneumonia (VAP)
  - Surgical Site Infection (SSI)
  - Clostridium Difficile Infection (CDI)
  - Central Line Bloodstream Infection (CLBSI)
  - Catheter Associated Urinary Tract Infection (CAUTI)

- **Estimated Cost in USA** $9.8 billion (95%CI, $8.3-$11.5 billion) in 2012 dollars*

*Zimlichman et al. (2013)
Catheter Associated Urinary Tract Inf. (CAUTI)

- Most frequent nosocomial infection
- 13,000 deaths associated with UTI (CDC, 2010)
- 75% of UTIs- associated with a urinary catheter (CDC, n.d.)
- 17% of bacteremias have a urinary source
- Prevention supported by:
  - Decreased use
  - Standardized care
- Association between nurse staffing and UTI
  (Aiken, Sloane, & Wu, 2012)
Practice Environment & Outcomes

• 1983 Original Study, Magnet Hospitals  (McClure & Hinshaw Eds., 2002)
  – Identified characteristics of good practice environments

• Nurse-to-patient staffing level major factor in prevention of HACs (Multiple investigators)
  – Practice environment affects outcomes associated with staffing levels (Aiken et al., 2011)
Practice Environment & Outcomes

• Healthy work environment
  • Important to nurse satisfaction
  • Patient outcomes Magnet® vs non-Magnet® hospitals (Aiken & Colleagues, 2000; Kramer & Colleagues, 2011)

• Leiter & Laschinger (2006) Posited *Nurse Worklife Model*
  • Practice Environment associated w/burnout & personal accomplishment
Gap in the Literature

Studies to date of NWLM:
- Aggregated Individual-level nurse survey data
- Nurse perception of adverse patient outcomes

Other studies of outcomes related to the practice environment:
- Hospital-level using administrative data
- Hospital-level adverse event rates

Gap: Evaluation of the association of unit level measures of practice environment with measured clinical outcomes.
Design

- Correlational path analysis:
  - Structural Equation Modelling (SEM) NWLM of Job Enjoyment fit to the data

- Secondary Analysis
  - National Database for Nursing Quality Indicators (NDNQI)® 2012 RN Satisfaction Survey Data Reporting Practice Environment Scale (PES) and Job Enjoyment Scale (JES)
  - Unit types: medical, surgical, combined medical-surgical
Measures

– Job Enjoyment Scale (JES) –
  • Seven item scale
  • Likert-type responses from strongly disagree (1) to strongly agree (6) ($\alpha = .97$)

– Practice Environment Scales (PES) –
  • Five Subscales ($\alpha = .87 - 90$)
  • 3-10 items
  • Likert-type responses, strongly disagree (1) to strongly agree (4)
Measures (cont’d)

- **CAUTI (USA-National Healthcare Safety Network definition)**
  - Raw data from 2012 were annualized to calculate rates
  - Rate - Total number of reported CAUTIs / total number of catheter days x 1000.
## Practice Environment Scale

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th># Items</th>
<th>α</th>
</tr>
</thead>
<tbody>
<tr>
<td>PES-Collegial RN-MD Relations</td>
<td>Presence of collaborative working relationship (RN-MD Collaboration)</td>
<td>3</td>
<td>.87</td>
</tr>
<tr>
<td>PES-Nurse Participation in Hospital Affairs</td>
<td>Policy development and decisions about practice (Policy Involvement)</td>
<td>9</td>
<td>.90</td>
</tr>
<tr>
<td>PES-Staffing and resource adequacy</td>
<td>Staffing level is adequate to provide the care needed (Staffing Adequacy)</td>
<td>4</td>
<td>.88</td>
</tr>
<tr>
<td>PES-Nurse manager ability, leadership, and support</td>
<td>Nursing manager viewed as a leader who provides strong support (Strong Leadership)</td>
<td>5</td>
<td>.90</td>
</tr>
<tr>
<td>---</td>
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<td>---</td>
<td>---</td>
</tr>
<tr>
<td>PES-Nursing Foundations for Quality Care</td>
<td>Nursing practice is supported by high standards, professional nursing philosophy, education, expectation of competency, and measurement of quality (Nursing Model of Care)</td>
<td>10</td>
<td>.88</td>
</tr>
</tbody>
</table>
### Job Enjoyment Scale Items (1-6 Scale)

<table>
<thead>
<tr>
<th>Stem: Nurses with whom I work would say that they:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Are fairly well satisfied with their jobs.</td>
</tr>
<tr>
<td>2. Would not consider taking another job</td>
</tr>
<tr>
<td>3.* Have to force themselves to come to work much of the time.</td>
</tr>
<tr>
<td>4. Are enthusiastic about their work almost every day.</td>
</tr>
<tr>
<td>5. Like their jobs better than the average worker does.</td>
</tr>
<tr>
<td>6.* Feel that each day on their job will never end.</td>
</tr>
<tr>
<td>7. Find real enjoyment in their work.</td>
</tr>
</tbody>
</table>

*Reverse scored so that a higher score = higher Job Enjoyment.*
Data Analysis

– Descriptive statistics & ANOVA (SPSS version 18)

– SEM – correlational path analysis
  • Mplus Software version 7 to test the hypothesized \textit{a priori} NWLM-JE

– Incremental fit indices
  • Comparative Fit Index (CFI) - Acceptable range: > .90
  • Root Mean Square Error of Approximation (RMSEA) - Acceptable range: < .08
  • Standardized Root Mean Square Residual (SRMR) < .08

(Hooper, Couglan & Mullen, 2008)
National Database for Nursing Quality Indicators

2012 RN Satisfaction Data and Quality Outcomes data

- **Study Aim**
  - Confirm structure of the modified NWLM of Job Enjoyment from previous study of unit level 2011 data set
  - Evaluate the relationship of elements of the nurse practice environment with CAUTI
Study Assumptions

- Unit level data with at least 40% response rate accurately reflect the score for the unit (Kramer et al., 2009)

- CAUTI rates sufficient to determine the pathways for association of the NWLM-JE with CAUTI rate at the unit level.
Hypothesized Nurse Worklife Model of Job Enjoyment & CAUTI rates

Key: CAUTI = Catheter Acquired Urinary Tract Infection; ---- Paths added to original NWLM from 2011 Study

All paths to JES (+) association

- Nurse Manager Ability, Leadership & Support
- Staffing & Resource Adequacy
- Collegial RN-MD Relationships
- Participation in Hospital Affairs
- Nursing Foundation for Quality Care
- Job Enjoyment Scale (JES)
- CAUTI Rates

Practice

Environment
## Results: Hospital & Unit Type Characteristics (N=1,106)

<table>
<thead>
<tr>
<th>Bed Size</th>
<th>%</th>
<th>Unit Types</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 100</td>
<td>8.1</td>
<td>Medical</td>
<td>33.9</td>
</tr>
<tr>
<td>100-199</td>
<td>18.8</td>
<td>Surgical</td>
<td>25.2</td>
</tr>
<tr>
<td>200-299</td>
<td>22.3</td>
<td>Medical-Surgical</td>
<td>40.5</td>
</tr>
<tr>
<td>300-399</td>
<td>16.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>400-499</td>
<td>14.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>500+*</td>
<td>20.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### RN Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Range</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>50-100</td>
<td>92</td>
</tr>
<tr>
<td>White</td>
<td>0-100</td>
<td>67</td>
</tr>
<tr>
<td>BSN or higher</td>
<td>0-100</td>
<td>56</td>
</tr>
<tr>
<td>Certification</td>
<td>0-100</td>
<td>16</td>
</tr>
</tbody>
</table>

ANOVA indicated a significant difference on CAUTI rate for Academic Medical Center status & Hospital bed size > 500
Results:

• PES subscales moderately to highly correlated ($r = .53$ to $0.88$); reliabilities $range = .94$ to $0.97$

• CFA for subscales-$CFI = .91$-1.0 with the exception of Participation in Hospital Affairs ($CFI = .85$)

• Job Enjoyment Scale similar across all unit types
  $[M = 3.71 \ (SD=.58) \ to \ 3.78 \ (SD=.58)]$
Results (cont’d)

• CAUTI Rate
  – Medical  \( M = 1.91 \) (\( SD=2.7 \))
  – Surgical  \( M = 1.54 \) (\( SD=2.1 \))
  – Medical-Surgical  \( M = 1.91 \) (\( SD=2.5 \))

• Model Fit Indices:
  – \( CFI = .995 \)
  – \( RMSEA= 0.04 \) (95% CI = .028-.056)
  – \( SRMR=0.02 \)
Results of Modified NWLM with CAUTI Rates

Key: PES = Practice Environment Scale; CAUTI = Catheter Associated Urinary Tract Infection

Coefficients depicted in the model are standardized; \( a p < .05; \) \( b p < .01; \) \( c p < .001 \)

\[ .60^c \] PES-Nurse Manager Ability, Leadership & Support → \[ .53^c \] PES-Staffing & Resource Adequacy

\[ .06^a \] PES-Collégial RN-MD Relationships → \[ .26^c \] PES-Staffing & Resource Adequacy

\[ .60^c \] PES-Participation in Hospital Affairs → \[ .66^c \] PES-Nursing Foundation for Quality Care

\[ .23^c \] PES-Staffing & Resource Adequacy → \[ .32^c \] Job Enjoyment Scale

\[ .21^c \] PES-Staffing & Resource Adequacy → \[ .08^b \] CAUTI Rates

\[ .13^c \] Academic Medical Ctr → \[ .07^b \] Bed Size > 500

\[ .08^b \] Job Enjoyment Scale → \[ .08^b \] CAUTI Rates
1 point Change in Job Enjoyment associated with change in CAUTI Rate of .08, \( p \leq .01 \)
Significance

- Modified NWLM of Job Enjoyment paths from previous study supported
- Significant negative association of CAUTI rate with Practice Environment through Job Enjoyment at the unit level
- Positive association of academic medical centers and hospitals with > 500 beds
- Impact of the practice environment on CAUTI aligns with work at the hospital level by Aiken
- Pervasive impact of nurse manager in NWLM aligns research on importance of first-line nurse leadership
Limitations:

- Sample may not be representative of hospital populations across the U.S.
- Under representation of rural & smaller hospitals
- Higher proportion of Magnet® designated hospitals in the NDNQI ® database.
- Units with poor practice environments may be under represented due to lack of a 40% response rate.
- Cross-sectional data limits inference of causality
Strengths

- Large national sample from all census divisions
- Well-defined valid and reliable measures for variables
- Measured clinical outcome
Questions?