

Interdisciplinary  
Nursing Quality  
Research Initiative

Robert Wood Johnson Foundation 

## A Multifaceted Approach to Reducing Medication Errors

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## Medication Errors!



3

**Med. errors cause 7,000 inpatient deaths per year**

**Average inpatient subjected to one med. error per day**

**Costs \$2 billion per year**

**Wide variation across hospitals**

IOM Report (2006)  
"Preventing Medication  
Errors"

4

### Phases

- Prescribing
- Transcribing
- Dispensing
- Administration

### Types:

- Wrong Medication
- Wrong Method
- Wrong Dose
- Wrong Timing
- Wrongly continued
- Wrongly omitted
- Known allergy

**Approximately 50 percent of errors intercepted**

**Of these, 87 percent were intercepted by nurses**

- Cullen et al., 2001; Leape et al., 1995

## What are the factors that impact the “nursing safety net” in intercepting medication errors?



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## Our 14 Hospital Partners!!!!

### Research Questions:

**Phase I—What do nurses “do” to catch errors?**

**Phase II—What are effects of: Nursing care processes, practice environment (NWI-PES), R.N. hours/ppd, and technology on med. errors?**

**Phase III—What are the costs associated with med. errors?**

## Phase I: Qualitative

### Identification of nurses' medication safety processes:

**10 hospitals**

**50 staff R.N.s interviewed**

### Demographics of Sample Ethnic/Racial Distribution ( $n = 50$ )

<b>Asian</b>	<b>12.2%</b>
<b>Filipino</b>	<b>12.2%</b>
<b>Hispanic</b>	<b>2.4%</b>
<b>White</b>	<b>70.7%</b>
<b>Other</b>	<b>2.4%</b>

Demographics of Sample Highest Nursing Education  
(n = 50)

**Diploma 26.8%**

**A.D.N. 31.7%**

**B.S.N. 39.0%**

**M.S.N. 2.4%**

13

Demographics of Sample  
Age  
(n = 50)

**Age ranged from 23 to 60 years old**

**48.8% aged 40 or younger**

**Average age = 42.3 (10.9)**

14

**Independent MAR/Order Reconciliation**

**Full Assessment**

**Question Rationale—Determine Why Medication Ordered**

**Discuss with Physicians/Make Rounds**

**Educate Patients & Families**

**Advocate to Ensure Timeliness**

**Ask M.D.s to Rewrite Orders/Standard Abbreviations**

**1. Independent Order/MAR  
Reconciliation**

**“Check the dosage on the MAR, and  
then I would go  
back to the chart to see that  
everything matched up.”**

**2. Full Assessment:  
Has the patient changed?**

“I just kind of, I take a total overview of everything about the patient so that I know exactly what is going on.”

**3. Question Rationale:  
Why was this med. ordered?**

“Other things to catch errors would be like your familiarity with the patient, and then the patient got a new medication, you would question why is this patient on this medication.

You would call the doctor and you will ask the doctor why is this patient on this medication. The doctor will give you an explanation, but you want to make sure that it is what the doctor really wants.”

#### 4. Discuss/Make Rounds with M.D.

**“I try to make rounds with the physician, because you need to know what is going on. It is easier on you by being informed.”**

#### 5. Educate Patients & Families: Last line of defense

**“Because they have been taught what it is for, so they will let you know.”**

## 6. Advocate to Ensure Timeliness

**“Problem with missing drugs—it can take as long as an hour, with multiple calls.”**

## 7. Ask M.D. to Rewrite/Clarify Orders/Abbreviations **What does this mean?**

**“So we have to deal with the handwriting issues. That’s really primary figuring out what did the doctor really want and that’s a number one issue.”**

**“I have no hesitation in calling the doctor and saying I cannot read your penmanship. You have it double checked.”**

**Interruptions**

**Poor nursing/pharmacy system interface**

## **Interruptions**

**“... the lack of focusing due to interruptions. If you are not focused, you are going to make mistakes.”**

**“Whoever it is causing the interruptions play a big part in medication errors.”**

**“Interruptions are sources of potential errors”**

## **Poor Nursing/Pharmacy Interface**

**“However, a lot of time the pharmacy tech would switch the drawer without opening them, so those meds go downstairs anyway. I’m still missing those meds. So sometimes we take them out ... and put them someplace else. But they don’t want us to hide the meds, but sometimes it’s the only way.”**

## Phase II

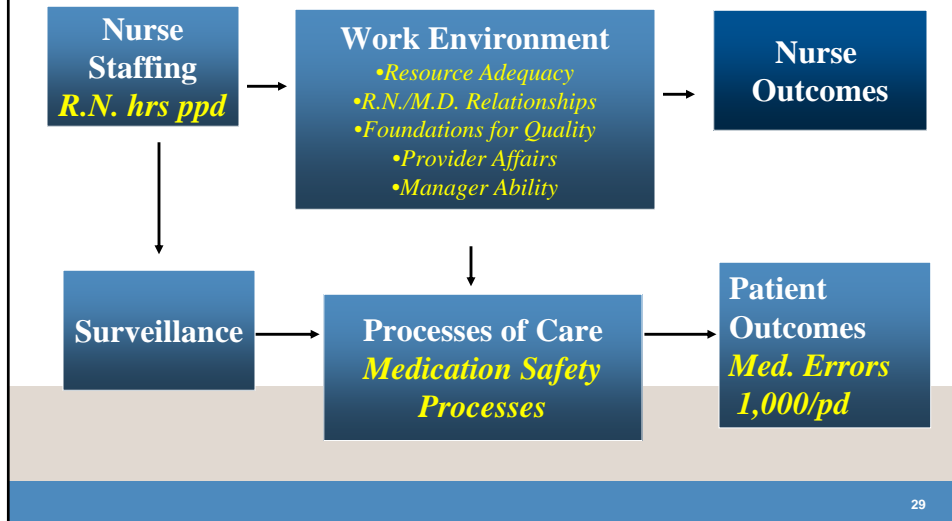
### Research Questions:

**Phase II—What are effects of: Nursing care processes, practice environment (NWI-PES), RN hours/ppd, and technology on med. errors?**

## Nursing Organization and Outcomes Model

(Aiken, Clarke, & Sloane, 2002, *International Journal for Quality in Health Care*, 14(1), 5-13)

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### A Multifaceted Approach to Reducing Medication Errors

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**Sample: 14 hospitals; 83 med./surg. units**

#### Data Sources:

- Survey of 712 R.N.s ( avg. of 8 per unit; 96% RR)
- Pharmacist survey (technology use 83 units)
- Administrative data (q month; 8 months)
  - R.N. hours per patient/day by unit
  - Documented med. errors per 1,000/pt. days by unit

30

**Measures:**

- **Nonintercepted med. errors per 1,000 pdays**—administrative data
- **R.N. hours ppd**—administrative data

- **NWI-PES**—nurse survey
- **Nursing Med Safety Process Scale**—nurse survey
- **Technology Penetration Scale**—pharmacist survey

**Analysis:**

- **Unit level**
- **Robust procedures (HLM/GEE) to account for clustering**

**Education**

- B.S.N. 44.0%
- A.D. 39.2%
- Diploma 13.1%
- M.S.N. or > 3.8%

**Age**

- Range 22 to 67
- Mean = 38.80 (10.35)

**Shift**

- 63.6% days
- 31.1% nights

**Years Experience**

- < 1 to 42
- Mean = 11.71 (10.14)

**69 units (83%) response rate = 100%**

**9 units (11%) response rate = 80%–88%**

**4 units (4.8%) response rate = 60%–66%**

**1 unit (1.2%) response rate = 50%**

**Average response rate per unit = 95.9%**

**Average # of R.N. respondents per unit = 8.3**

**Findings: Nurses' Med. Safety Processes on Med. Errors**

- ***Question Rationale—Determine Why Med. Ordered***
- ***Educate Patients & Families***
- ***Ask M.D.s to Rewrite/Clarify Handwriting***
- ***Independent MAR/Order Reconciliation***

• **Unadjusted Estimate**  
**-0.14,  $p = .0506$**

**Adjusted for Technology**  
**-0.15,  $p = .0493$**

<b>Predictors of R.N.s' Medication Safety Processes!</b>		
	<b>Unadjusted</b>	<b>Adjusted</b>
<b><u>1. Total Practice Environment</u></b>	<b>1.42, <math>p = .000</math></b>	<b>1.32, <math>p = .000</math></b>
Foundations for Quality	1.66, $p = .000$	
Relationships with M.D.s	1.42, $p = .000$	
Participation in Decisions	1.15, $p = .000$	
Adequate Staffing	0.81, $p = .013$	
Supportive Manager	0.90, $p = .001$	
<b><u>2. R.N. Hours PPD</u></b>	<b>0.21, <math>p = .016</math></b>	<b>0.17, <math>p = .013</math></b>

35

<b>A Multifaceted Approach to Reducing Medication Errors</b>		
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<b>Effect of CPOE on Med. Errors</b>		
<b><u>Unadjusted Estimate</u></b>	<b><u>Adjusted for Processes</u></b>	
<b>-0.34, <math>p = 0.040</math></b>	<b>- 0.33, <math>p = 0.048</math></b>	

36

• **Aim #3**

**To estimate the excess hospital costs attributable to medication errors during hospitalization**

- **Participating hospitals**
  - Hospital A with 176 beds
  - Hospital B with 417 beds
- **Study patients**
  - **Case:** Patients who had at least one voluntary medication error report while they were in the medical or surgical units of the study hospitals
  - **Control:** Patients who did not have any voluntary medication error reports while they were in the medical or surgical units of the study hospitals
- **Data sources**
  - Hospital-specific voluntary reports on medication error
  - Hospital's UB-92 claims submitted to the payers
- **Study perspective**
  - Payers' point of view

- Descriptive analysis
- Excess hospital costs attributable to medication errors
  - Oaxaca decomposition method after matching cases with controls by propensity scores
    - Case patients were matched with control patients using propensity scores within blocks of hospital, age, and sex.
    - The incremental effects of medication errors were estimated using GLM with log-link function and gamma distribution.
    - Estimated the differences in hospital costs attributable to:
      - Covariates: Length of hospital stay
      - Endowments: Medication errors.
  - All costs were converted to 2008 U.S. dollars using inpatient hospital services price indices.

	ME	No ME	Difference	
			Mean	95% CI
<b>Partial Oaxaca Decomposition Method with Generalized Linear Model<sup>1</sup></b>				
Mean Cost	N = 470 \$93,179	N = 470 \$86,206		
Cost Attributable to Endowments (ME)			\$6,973	(\$6,138–\$7,808)
<b>Scores<sup>2</sup></b>				
Mean	N = 409 \$85,579	N = 409 \$44,603	\$40,975	(\$31,731–\$50,220)
Cost Attributable to Covariates			\$34,361	(\$25,106–\$43,616)
Cost Attributable to Endowments (ME)			\$6,614	(\$1,616–\$11,612)

1. Costs were estimated using generalized linear model after adjusting for age, sex, hospital, length of stay, and Charlson's comorbidity index.

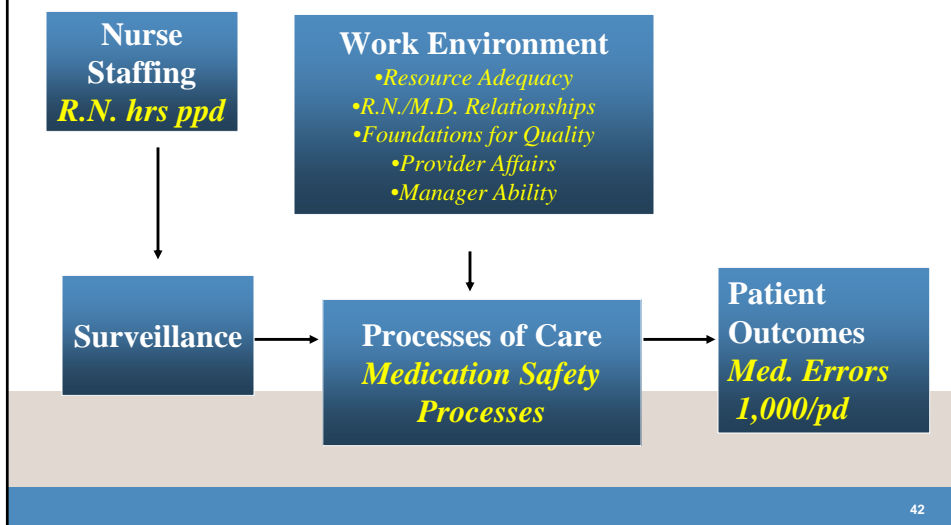
2. Propensity scores were calculated after adjusting for race, admission type, Charlson comorbidity index, and numbers of ICD9 codes within blocks of age, hospital, and gender.

### Conclusions:

- Med. errors are costly (> \$6,000)
- Better R.N. med. safety processes and CPOE associated with fewer nonintercepted med. errors
- Supportive Nursing Practice Environment and higher R.N. staffing enhance R.N.s' med. safety processes

### Nursing Organization and Outcomes Model

(Aiken, Clarke, & Sloane, 2002, *International Journal for Quality in Health Care*, 14(1), 5-13)



**Questions?**

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