The Importance of Vigilance in Promoting Patients’ Safety in Nurse Anesthesia Practice

**Presenter**

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Disclosure

No conflict of Interest to report
Objectives

Upon completion of this lecture

1. Learners will be able to discuss the relationship between mental workload, fatigue, years of experience, and providers' vigilance.

2. Learners will be able to evaluate factors that could affect provider’s vigilance during patient care.

3. Learners will be able to list factors affecting perceived provider’s vigilance during patient care.

4. Learners will be able to apply simulation experience to increase situational awareness during anesthetic management.
Overview

- Introduction
  - Vigilance?
- Background
- Problem Statement
- Significance
- Research Question
- Theoretical Framework
- Methodology and Design
- Data Analysis/ Results
- Major Findings
- Limitation, Implications and Future Studies
- Questions
Patient safety issues have become major topics to help prevent, avoid, and/or decrease harm or injury to patients as defined by the Institute of Medicine (IOM).

Medical error is the 3rd leading cause of death in the U.S. (Makary, 2016).

In anesthesia, about 2211 deaths were recorded Btw 1999-2005 in the U.S.

The most valuable aspect of every anesthetic procedure is the human performance part of the anesthesia and its link to patient safety (Rall, Gaba, Howard, & Dieckmann, 2010).
Vigilance denotes the ability of a healthcare provider to maintain a high level of mental concentration or alertness over prolonged periods of time when performing a task (Warm, Parasuraman, & Matthews, 2008).

What is Vigilance decrement?
- Decline in performance is denoted reduction in vigilance decrement (~45 minutes-1hr)
Patient safety issues are still on the rise in healthcare. In 2000 IOM report “to Err is Human” indicated that as many as 98,000 people die in the hospital every year.

In 2013, an updated study indicated that a minimum of 210,000 people die from preventable medical errors every year in the clinical settings (James, 2013).

Many studies have indicated that when accidents occur, they are often related to lack of vigilance on the part of human operators in semi-automated systems (Molloy & Parasuraman 1996).
In healthcare, when providers’ level of vigilance decreases over time during vigilance tasks, it could lead to unnecessary medical errors, leading to patient safety issues in the clinical setting (Thomson et al., 2015).

Vigilance inferences are perceived from patient outcomes.

The inability to avert a preventable patients’ negative outcome, leading to a failure to rescue, is often perceived as lack of vigilance (Clarke & Aiken, 2003).
There are many factors that can affect anesthesia–errors related to human performance:

- Mental workload,
- Fatigue,
- Years of experience, &
- **Vigilance** (contributory factors for errors during surgery)

Yet there is little known about the relationship among these factors that could help predict a CRNA’s level of vigilance.
Significance

Who does vigilance affects?
• All healthcare providers
• Patients >210,000 die per year
• Family
• All healthcare sectors as seen in insurance claims

Cost of vigilance decrement
• ~$1.5 billion/ year

Widespread of decreased vigilance
• Out of all surgical errors, vigilance errors contribute to about 63%
• Minor and major outcomes possible
Research Questions

- **Research Question 1**
  - What is the relationship between mental workload, fatigue, and the perceived level of vigilance among CRNAs?

- **Research Question 2**
  - Which factors (mental workload and/or fatigue) best predict CRNAs’ perceived level of vigilance after controlling for years of experience?

- **Research Question 3**
  - What is the relationship between years of experience and the perceived level of vigilance among CRNAs?
398 articles were reviewed
• 108 articles met the criteria for examining the factors—mental workload, fatigue, and years of experience—affecting provider’s perceived level of vigilance during vigilance tasks. In all these articles,
• 87 research articles and 21 non-empirical articles. Of these 87 research articles, 21 were systematic reviews, 36 were randomized controlled trials, and 30 were correlational design articles.

The articles selection were based on:
• Those related to the concept of vigilance
• Mental workload
• Fatigue
• Years of experience
• Prior research in other fields
• Based on the instruments
• Anesthesia practice esp. CRNA and MDA practices
• Types of errors in surgical suites
Factors affecting CRNAs’ level of vigilance

- Automatic and Deliberative nursing
- Years of experience
- CRNA’s level of vigilance
- Mental workload
- Fatigue
- Patient safety
Vigilance

- **Vigilance**
  - **Definition**: Maintaining constant attention over time regardless of stimulus while maintaining the same standard performance.
    - Assessed by either prolonged response time or lack of ability to detect signal or both using the PVT instrument (Helton & Russell, 2015).

- Decline in performance is denoted reduction in vigilance or vigilance decrement.

- Vigilance is central to nursing care and patients’ outcome (Meyer & Lavin, 2005)

- Vigilance involves hard mental workload

- Vigilance tasks are resource demanding and stressful (making errors due to human practice an important one ~ factors that can affect provider’s level of vigilance during routine anesthesia care)
PSYCHOMOTOR VIGILANCE TEST

To properly run a PVT test, hold the iOS device in landscape mode in both hands while hovering your thumbs over the screen. When you see the count up
A Quick PVT TEST

- Download the NASA PVT app from app store
- From the screen, let’s do the demo PVT test (Unregistered).
Mental Workload

- **Mental workload**
  - **Definition:** Amount of information processing capacity of a provider during required tasks
    - *Measured using the perceived NASA-TLX scale. This is a subjective measure of MWL by the participant*

- Vigilance tasks lead to informational processing capacity depletion and are challenging to the available resources.

- Increased MWL can lead to high turnover & nurses' shortages

- Mental workload varies during anesthesia care, esp during induction of anesthesia

- When MWL is above provider's capacity, life threatening situation occurs

- Shift work ~ increased MWL

- Download the NASA Task Load Index app (app version) (21 questions)
NASA Task Load Index

Hart and Staveland’s NASA Task Load Index (TLX) method assesses workload on five 7-point scales. Increments of high, medium and low estimates for each point result in 21 gradations on the scales.

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<tr>
<th>Scale</th>
<th>Description</th>
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<tr>
<td>Mental Demand</td>
<td>How mentally demanding was the task?</td>
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<td>Physical Demand</td>
<td>How physically demanding was the task?</td>
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<td>Temporal Demand</td>
<td>How hurried or rushed was the pace of the task?</td>
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<td>Performance</td>
<td>How successful were you in accomplishing what you were asked to do?</td>
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<td>Effort</td>
<td>How hard did you have to work to accomplish your level of performance?</td>
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<td>Frustration</td>
<td>How insecure, discouraged, irritated, stressed, and annoyed were you?</td>
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<th>Scale</th>
<th>Very Low</th>
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Fatigue

- **Definition:** As the state of reduced mental or physical capacity resulting from lack of sleep or incr MWL, &/or unbalanced circadian cycle that can impair alertness.
  - Measured using Samn Perelli subjective fatigue scale
- Fatigue can lead to complete breakdown
- Blamed for errors leading to adverse outcomes such as:
  - Clinical practice
  - Aviation
  - Military
  - Transportation
- Common among shift workers~ Ex: Nurses and other healthcare workers)
- Fatigue-related effects could compromise alertness and paying attention to subtle changes in patient care.
When you are asked to “Rate your average mental fatigue (1–7), fill in the number that is your best estimate of your average mental fatigue across the work period”.
Use this scale:
2. Very lively. Responsive, but not at peak.
3. Okay. Somewhat fresh.
4. A little tired. Less than fresh.
7. Completely exhausted. Unable to function effectively. Ready to drop.
Years of Experience

- **Years of Experience**
  - **Definition:** Number of years of practicing anesthesia administration by the CRNA
    - Measured by number of years providing anesthesia by the CRNA

- Does longer years of clinical practice = better practice and vigilance?
Theoretical Framework: Orlando’s Deliberative Nursing Process

- **Theoretical Framework**
  - Orlando’s (1961) theory of deliberative nursing process-Middle Range Theory

- **Concepts and Non-relational Propositions**
  - Patients’ behavior (need for help and improvement) – Assessment: For example: PONV, hunger, Vital signs
  - Nurses’ reactions (perception, thoughts, and feelings) – Planning
  - Nurses’ activity (automatic nursing process and deliberative nursing process activities, sequence and requirements) – Action (Fawcett & DeSanto-Madeya, 2013).

- *Every nursing situation involves the patients’ behavior, the nurses’ reaction to that behavior, and the nurses’ actions intended for the patients’ advantages.*
Application of Orlando’s Theory in this Study

APPENDIX A
Orlando’s Theory of Deliberative Nursing Process

Function of professional CRNA

Patient’s presenting behavior (verbal or nonverbal cues)

Antecedents of Vigilance decrement
1. Mental workload
2. Fatigue
3. Years of experience

Deliberative responses through pt.’s validation

Validates problems, assesses, recognizes, implements, and evaluates plan

CRNA’s immediate reaction (perception, intuition, feelings, situation awareness)

Consequences of vigilance decrement:
1. Patient outcomes
2. Provider’s feeling of guilt
3. Recognition for good outcome
4. Hypervigilance (individual & organization)

Implement standard nursing process

Product of nursing process:
1. Safe anesthetic care during surgery

Averts potential negative outcomes as a result of increased mental workload and increased fatigue

Embraces patients’ safety outcomes and prevent future safety issues.

Automate responses without pt.’s validation.

Observes, recognizes, assesses, implements, acts appropriately and evaluates.
Design
- A quantitative correlational design

Rationale
- What is happening here?
- According to Dickoff and James (1968), the research questions for the study are factor-relating questions.

A correlational design Helped:
- Evaluate the strength of the relationship between mental workload, fatigue, years of experience, and vigilance.
- Help establish the direction of the relationship between the independent and dependent variables.
However, no conclusion can be made regarding causality between the dependent and the independent variables using the correlational design.

Sample: 98 CRNAs participated (Estimated size 82 from power analysis)

Demographic and SP data collected in pre-op area after consent was obtained from participant

TLX and PVT data were collected outside OR immediately after induction of anesthesia by participant while another CRNA assumed patient care for safety
DATA ANALYSIS AND RESULTS

- SPSS 25 Stat software utilized
  - Normality, Linearity and Homoscedasticity ✓

- Descriptive Statistics
  - The majority (n= 55, 56%) had between 0 and 10 years of experience with the next largest group being 11-15 years of experience (n=21, 21.4%)
  - There were more females (n= 62; 63.3%) than males (n=36; 36.7%)

- Mean and SD
  - Mental workload has a mean of 49.83 (high)
  - Level of vigilance has a mean of .03 (low)
  - Fatigue has a mean of 2.29 (low)
  - Years of experience has a mean of 2.72 (low)
Table 3 shows the mean and standard deviations for the Years of Experience, Gender, & Level of Education.
Results

Research Question 1
- What is the relationship between mental workload, fatigue, and perceived level of vigilance among CRNAs?

Finding
- Significant correlations were found between perceived Level of Vigilance and Years of Experience ($r=-0.216$, $p=0.033$), and between Fatigue and Mental Workload ($r=0.211$, $p=0.037$).
Results

Research Question 2
➢ Which factors (mental workload and/or fatigue) best predict the CRNA’s perceived level of vigilance after controlling for years of experience?

Findings
❖ The study shows that mental workload is more likely to help predict CRNA’s perceived level of vigilance, after controlling for years of experience.
Results

- **Research Question 3**
  - What is the relationship between years of experience and the perceived level of vigilance among CRNAs?

- **Findings**
  - Significant correlations were found between perceived Level of Vigilance and Years of Experience ($r=-0.216$, $p=0.033$).
Inclusive and Exclusive Criteria

- Limited to practicing anesthesia providers in surgical suites in the northeast Tri-State region of the United States—Pennsylvania, Delaware, and New Jersey
- The study excludes emergency and/or unstable patients

The American Society of Anesthesiology [ASA] (2014) patient status 1 to 3 were included in the study to eliminate safety issues among unstable patients.
Implications

- Increased MWL could affect CRNAs Vigilance
- Use of other objectives and subjective instruments in assessing vigilance in anesthesia practice
- Inclusion of hands-on simulation practices into yearly continuing education to help ascertain appropriateness of response
Assess the impact of age on CRNA’s perceived Level of Vigilance

Impact of sleep loss on perceived Level of Vigilance?

Does working long hours have any effect on CRNA’s perceived Level of Vigilance?
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Questions???

Thank you