The Nature of Turbulence and Workload: Conceptual and Operational Clarification

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Purpose

The purpose of the original dissertation research was to provide a data-based description of the essential variables and relationship patterns that described workarounds evidenced by intensive care nurses when interacting with computer-based Health Information Technology (HIT)

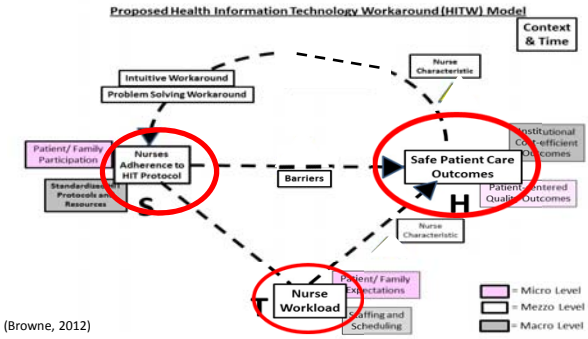
Purpose

This presentation focuses on the specific findings uncovered when we explored the variable relationship patterns between nurse workload, patient safety and the use of Health Information Technology (HIT) at the bedside

Problem

When considering a nurses' work at the bedside, there were many assumptions, but there was no clear specification of workload and it's relationship with HIT, nursing work and patient safety

First Draft of HITW Model



(Browne, 2012)

Background

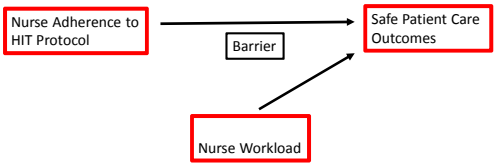
The Health Information Technology Workaround Model (HITW) was first developed using clinical experience, literature, and pilot data to provide a description of registered nurses' use of HIT and the workarounds that they employ

Review of Literature and conceptual framework

The Stinchcombe (1968) causal format was chosen to guide the dissertation. It provided a method for identifying variables and relationships that maintain either adaptive or maladaptive response (Braden, 1986). The model allowed for consideration of multiple levels, a dynamic environment and self –organization: all the characteristics of a complex adaptive system that could not be described in a linear model.

Need for Study: Some Questions

- What are the relevant variables and concepts associated with HIT use and patient safety?
- What are the relational patterns between the nurses' interactions with HIT and patient safety?
- Is there a framework allowing us to pose interventions to support the effective use of HIT and evaluate their impact on patient safety?
- Why are workarounds being performed?



Need for Clarification

What is a HIT Barrier (Problem) and how is that measured?

HIT Problem: "The degree to which a response to an exception in nursing workflow associated with Healthcare Information Technology is representative of a technical or documentation misalignment with practice, requires additional process steps, poses patient safety risk and/or conflicts with a time-critical task". (Browne, 2016)

Barrier scale developed and fully supported in literature: all 12 barrier attributes supported.

Need for Clarification

What is a nurses' workload and how is that measured?
No standards (Baernholdt, Cox & Scully, 2010)

Need for Clarification

How are safe patient care outcomes measured?

Developed from the quantitative and qualitative descriptions and scored on a 0-4 scale.

Measure developed from the SEC (Safety Event Classification) scale. Healthcare Performance Improvement white paper series. (Throop & Stockmeier, 2009)

Insight Gained From Pilot

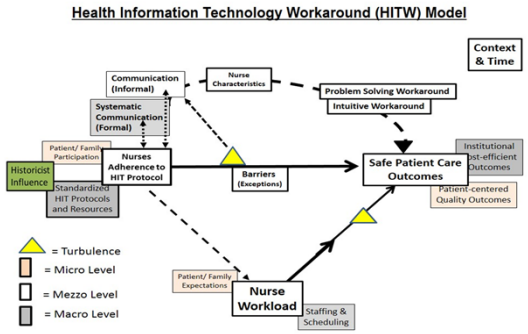
- Tested survey, program, website and management of data
- Local chapter of AACN: approx. 50-60 members, 19 responded
- Open ended questions asked first. Also included a web site evaluation

Why were some workarounds occurring without any type of HIT barrier or workload issue described?

Why?

- It had to do with workflow issues the nurses were encountering, but these behaviors/ types of work were not described by the workload variable or the HIT barrier/ problem variable.
- Based on the work of Jenner , the variable turbulence was developed and was defined as: ***Turbulence:*** **The degree to which the interaction between a nurse and the pace and disruptiveness of change in the environment affects the nurses' ability to practice or provide care.** (Browne, 2016)

Turbulence Added to Model



Methodology

- **Sample:** Active members of AACN. Survey was distributed via their semi-monthly newsletter. Must be a registered nurse using HIT at the bedside
- **Web site:** was built and managed by UTHSCSA
- Confidentiality/ security and rigor: even PI could not modify website or survey results
- **Survey:** ran 6 weeks
- Two open ended narrative questions followed by 46 quantitative questions. None were mandatory.
- Nurses were asked to narratively write about their workaround experience and to describe any other factors occurring at the same time

Demographic Findings

Number: 307 Registered Nurses voluntarily responded

Gender: 87% female & 13% male.

Age: 58% 45 + years old

Education: 50% BSN, 20% ADN, 20% Master's Degree

Expertise midway between a proficient and expert level.

ICU Specialties included adult, pediatric and neonatal.

Patient Acuity: 62% critical, 29% guarded and 9% stable.

Workload reported: 40% Heavy and 58% Moderate

Software representation included: KBMA (Allscripts), Carefusion, Cerner, Epic, Meditech, McKesson, Soarian, eICU, EndoTool and GlucoStabilizer.

Study Findings: Turbulence

***Frequency of Turbulence Attributes* (N= 296)**

Turbulence Attribute	Number of Episodes	Turbulence Attribute	Number of Episodes
Admissions/ Discharges	31	Changes in Acuity	197
Transfers in/ out of Unit	75	Noise	79
Communication Breakdowns	102	Information Overload	43
Equipment & Supply Issues	19	Absence of Secretary	9
Staff Having to Leave Unit	50	Interpersonal Distractions	27
Administrative Demands	102	Preceptee or Student	36
Distractions	157	Interruptions	185
Loss of Information at Handoff	37		

EFA used to identify the underlying factor structure of turbulence measure

Attributes	1	2	3	4	5
Distractions	.802				
Interruptions	.753				
Noise	.563				
Absence of a secretary		.679			
Equipment and supply issues		.589			
Staff having to leave the unit		.545			
Administrative or Regulatory demands		.530			
Communication breakdowns			.728		
Information overload			.683		
Loss of information during hand-off			.590		
Admissions/Discharges				.827	
Transfers into and out of unit				.799	
Responsibility for Preceptee or Student					.774
Interpersonal distractions					.636

Study Findings: Turbulence

- **Turbulence Measure 15 items:**
- Data for analysis was satisfied with a final sample size of 296 (> 12 cases per variable).
- Reliability of the turbulence scale was acceptable (α = .751)
- Items had factor loadings > .5 except changes in acuity. Changes in acuity removed

- The Turbulence 5 factor solution (14 items) explained 54% of variance, representing:
  - **1. Attention diversion**
  - **2. Resources**
  - **3. Communication**
  - **4. ADT (admission/discharge/transfer)**
  - **5. Interpersonal relationships**

Findings: Turbulence, Workload and Safe Patient Care

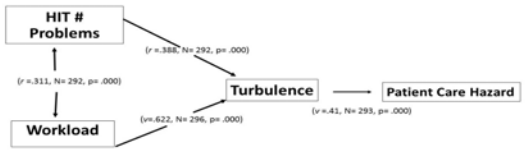
Is workload negatively associated with safe patient care?
*No: chi square and correlation analysis found no relationship

Does context or time pressure negatively impact safe patient care?
* No evidence to support this

Are nurse characteristics associated with pt. safety hazards or workarounds ? * No significant relationships identified

Findings: Turbulence, Workload and Safe Patient Care

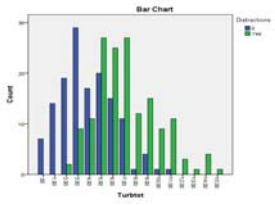
Is there evidence that HIT Problems (barriers) interact with workload, turbulence and workarounds creating feedback loops that moderate safe patient care? Yes!



The evidence supports the notion that workload and the HIT problems may be interacting indirectly with patient safety via turbulence

Findings: Turbulence, Workload and Safe Patient Care

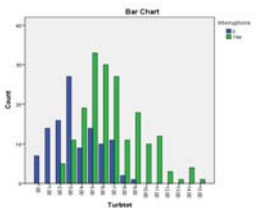
The most frequent/ significant turbulence items were distractions, interruptions, information overload and loss of information. All are identified in literature as associated with safety risk. In this example, no distractions occurred for turbulence scores of 3 or less, scores 5-9, twice as many occurrences of distraction and 11-15 every time



Turbulence Score X Distraction Occurrence

= Distractions did not occur

= Distractions occurred



Turbulence Score X Interruption Occurrence

= Interruptions did not occur

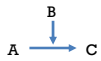
= Interruptions occurred

Turbulence, Workload and Safe Patient Care

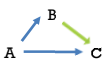
Based on the literature and study findings, it could be hypothesized that nurses encountering turbulence scores of 4 or less may have limited risk of committing a safety error, Scores of 5-9 moderate risk and scores of 10 or greater the highest risk of safety errors.

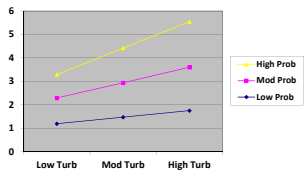
Moderation and Mediation Testing:

Moderation
Under what conditions of B is A significantly associated with C?
OR
Under what turbulence conditions are Patient safety & HIT Problems Significantly associated?

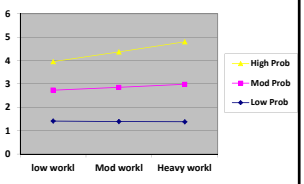


Mediation
What accounts for the impact of A on C?
Or
What accounts for the impact of turbulence on patient safety? (informal communication)





Interaction Plot of Moderation Effect of Turbulence on Number of Problems and Patient Safety Hazard



Interaction Plot of Moderation Effect of Workload on Number of Problems and Patient Safety Hazard

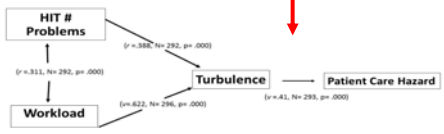
Examination of the interaction plot showed that as problems and turbulence increased, patient hazard risk increased. This analysis showed that the relationship between total problems and patient safety hazard is moderated by high levels of turbulence. In fact, visually, the range of influence of the moderating variable Turbulence is twice the range with high problems/high turbulence. Visually, a low and moderate number of problems appear to also be moderated by high turbulence, but these relationships are not statistically significant.

Turbulence, Workload and Safe Patient Care

Four types of workarounds tested

The relationship between turbulence and patient safety is being partially mediated by workarounds (Informal Communication)

(Browne & Braden, 2012)



Turbulence, Workload and Safe Patient Care

Four types of workarounds tested

The relationship between turbulence and patient safety is being partially mediated by workarounds (Informal Communication)

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Model Summary of Informal Communication Workaround Mediating Turbulence and Patient Safety

Model	R	R Sq	Adjusred R Sq	S.E.	R Sq Change	F Change	df1	df2	Sig F Change
1	.119[a]	.014	.011	.464	.014	4.243	1	294	.040
2	.135[b]	.018	.011	.464	.004	1.163	1	293	**.282**

Note:
a. Predictors: Turbulence Total
b. Predictors: Turbulence Total, Informal Communication

Conclusions

- Clarification of HIT Problem and Turbulence
- Workload not clarified but standard measure used
- HIT problems no direct relationship with safety risk
- Workload no direct relationship with safety risk
- When combined with turbulence, HIT problems and/ or workload do result in increased patient safety risk
- Turbulence acts as a moderating variable between safety risk and total problems
- Workarounds may act as mediators between turbulence and patient safety

Limitations

- Critical care sample only
- Unable to determine “no response” vs. “no receipt”
- Social desirability
- Some variables put restrictions on analysis
- Self reported questionnaires and inability to follow up

Recommendations for Future work & Research

Turbulence may be the key:

- Anchor for future interventions
- This will be the utility of the model: identifying where turbulence appears in nursing workflow and in system level interfaces
- Consider turbulence, workload and patient safety simulation

With Special thanks to:

Dr. Carrie Jo Braden & Dr. Barbara Covington

Questions?

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