

“Taking the Ball into the Endzone with a Simulation Project: From Conception to Clinical Surveillance”

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Objectives

- Discuss use of clinical data used to develop simulation research and instructional methods
- Review outcome data as a result of a simulation intervention




Outline

- Background of the problem
- Methodology used for developing an ergonomically based simulation intervention for injury prevention
- The clinical connection
- System spread and surveillance
- Policy implications



Area of Focus: Provider Injury

- Injury epidemiology is the “systematic study of preventable injuries”
- Injury deaths: 140,000 annually- 4th-5th leading cause of death overall in the US
 - #1 cause of death for Americans in the age ranges of 1-44(CDC, 2009)
- Injuries can be stratified into ‘true’ accidents vs. those which are potentially preventable
- Occupational injuries are a subset
 - Also can be stratified according to those which are preventable




Robertson LS. Injury epidemiology : research and control strategies. New York: Oxford University Press, 2007

Evidence Base Driving Course

- Nurses (RNs and LPNs) represent 45% of direct care workers in the healthcare system
- Nurse aides represent an additional 10-15% of total workers
- Injury rate-described as at ‘near epidemic’ levels:
 - Nurse aides = 293/ 10,000
 - Nurses = 59/ 10,000*
 - Laborers = 158/ 10,000

* while the rate is lower, the absolute number is high due to the large number of nurses (~3,000,000)

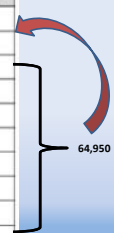


US Bureau of Labor Statistics, 2007

Target Audience: Nurses & Nurse Aides

Table 1: Adapted from US Bureau of Labor Statistics. Number of nonfatal occupational injuries and illnesses involving days away from work by selected worker occupation and major industry sector, top 10 occupations, 2007[1].

Occupation	Private industry (Total cases = 1,158,870)
1. Labor and freight, stock, and material movers, hand	79,000
2. Truck drivers, heavy and tractor-trailer	57,050
3. Nursing aides, orderlies, and attendants	44,930
4. Construction laborers	34,180
5. Truck drivers, light or delivery services	32,930
6. Retail salespersons	32,920
7. Janitors and cleaners, except maids and housekeeping cleaners	30,060
8. Carpenters	23,800
9. Maintenance and repair workers, general	23,460
10. Registered nurses	20,020




Risk Factors for Injury and Back Pain in Nursing

1 most frequently cited= Patient transfer events


- Working conditions: Long hours (OR 1.87 > 13 hrs), short time between shifts (OR 1.55 < 10 hrs), part-time or temp worker (OR 2.6)
 - Also: tight spaces, equipment failures, sudden patient movement or fall, repetitive lifts (cumulative loading), heavy lifts (acute loading), patient population (orthopedics),
- Personal factors
 - Prior injury history (OR 1.8-5.54)
 - Improper body mechanics (OR 4.8)
 - Obesity(OR 3.4)
 - Also: ↑ age, *Fitness, Genetics and muscular strength

* Low fitness level = deconditioned and at risk, high fitness level = more lifts and at risk



Why is this Problem Important?

- Estimated US costs of injury (direct + indirect)
 - Overall US workforce > \$50 billion
 - Healthcare industry > \$16 billion
- Healthcare system impact
 - Average nurse age = 48
 - Loss of nurses and nurse aides to injury =
 - Exacerbation of nursing shortages
 - Projection of 340,000- 1 million nurse shortage by 2020
 - 2006 national vacancy rate for RNs was 8.5%
 - Current 'apparent' nursing excess due to economic downturn
 - Current staff are being asked to work harder and longer




Approaches in Injury Prevention

- Legislation
 - Australia (1996), UK (1998), US (2000), States (8)
- Didactics, body mechanics, demos & screening
 - Snook (1978), Melton (1983), Gates (1986), Taylor (1987), Wood (1987), Feldstein (1993)
- Back belts
 - Mitchell (1994), Wassell (2000), Gatty (2003)
- Lift teams
 - Charney (1991, 1992, 1997), Trinkliff (2003), Kutash (2009)
- 'Comprehensive' approaches
 - Gang (1999), Yassi (2004), Nelson (2003- present), Collins (2004)

Workers' Compensation Costs at Six VA Hospitals in Study


Mean = \$8,183,630 ± 851,182

Nelson, A. B. Owen, et al (2003). "Safe patient handling & movement." American Journal of Nursing 103(3): 37-44



Methods

Hierarchical Task Analysis
Material Development
Simulation Intervention
Tools




An Ergonomic Protocol for Patient Transfer That Can Be Successfully Taught Using Simulation Methods

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Nine Step HTA Process


1. Define the purpose of the analysis
2. Define the boundaries of the system description
3. Access a variety of information sources about the system to confirm reliability and validity of the analysis
4. Describe the system goals and sub-goals; define a sub-goal hierarchy for the task at hand.
5. Try to keep the number of immediate sub-goals under any super-ordinate goal to a small number (3 to 10)
6. Link goals to sub-goals and describe the conditions under which sub-goals are triggered
7. Stop re-describing the sub-goals when you judge the analysis is fit-for-purpose
8. Verify the analysis with subject-matter experts (panel)
9. Be prepared to revise the analysis based on feedback



1. Stanton NA, Stanton NA. Hierarchical task analysis: developments, applications, and extensions. Applied Ergonomics 2006;37:55-79.
2. Amnett J, Cunningham D, Mathis-Jones P, et al. A method for measuring team skills. Ergonomics 2000;43:1076-94.
3. Shepherd A, Shepherd A. HTA as a framework for task analysis. Ergonomics 1998;41:1537-52.



Optimal Task Set Defined: Next Steps

- Develop simulation educational curriculum
 - On-line and hands on components
- Develop data collection tools
 - Laerdal SimMan™, HP IPAQ™
- Recruit subjects- Nurses and Nurse Aides
 - UPMC Rehabilitation and Research Institute
- Conduct baseline observations
- Complete protocol at WISER
 - Train non-ergonomist raters during simulated moves and evaluate inter-rater reliability



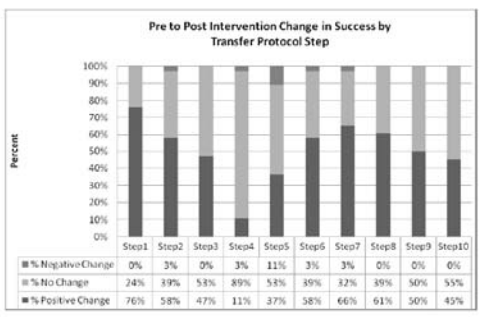
Results- WISER

- Optimum task set for patient transfer was defined and used in development of curriculum and measurement tools
- Simulation curriculum:
 - On-line educational materials were developed
 - Simulation sessions with debriefing of patient transfers after last transfer
- Every team & every step improved
- Data collection platforms HP IPAQ™ and SimMan™
- Inter-rater reliability was evaluated (k range = 0.43-0.83)


Improvement in Success by Step- Simulation

Pre to Post Intervention Change in Success by Transfer Protocol Step




	Step1	Step2	Step3	Step4	Step5	Step6	Step7	Step8	Step9	Step10
% Negative Change	0%	3%	0%	3%	11%	3%	3%	0%	0%	0%
% No Change	24%	39%	53%	89%	53%	39%	32%	35%	50%	55%
% Positive Change	76%	58%	47%	11%	37%	58%	66%	61%	50%	45%

Mean improvement across all steps was 52% ± 15



Conclusions- Initial Simulation Intervention

- Specific aims were achieved
 - Optimum task set was defined using HTA methods = Patient Transfer Protocol
 - On-line curriculum was developed and used in the protocol
 - Simulated patient transfer skills substantially improved
 - Every team improved (n = 19 teams, 71 subjects)
 - Every step improved (n = 10)
 - Data collection platforms were developed and evaluated for ease of use and reliability




The Clinical Data Connection

Submitted to *Simulation in Healthcare* on 10/8/2009 (manuscript number TBA with assignment of an editor)

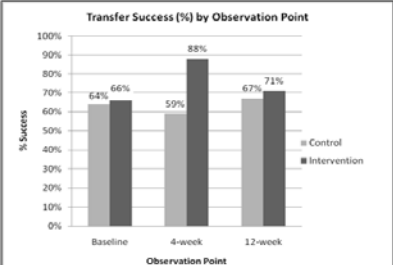
Effect of a Simulation Educational Intervention on Knowledge, Attitude and Transference of Patient Transfer Skills: From the Simulation Lab to the Clinical Setting

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Transfer Success: Clinical

Figure 2: Pre versus Post-Intervention Patient Transfer Protocol Success: In comparing the control and intervention unit transfer success, the Group*Time interaction was significant (ANOVA, $p \leq 0.0004$) with three time increments (pre-intervention, 4 weeks post-intervention and 12 weeks post-intervention) and two groups (control, intervention) in the model. Post-hoc pair-wise comparison revealed that the change in transfer success: 66% at baseline to 88% at the 4 week post-intervention measurement point was significant ($t = 7.447, p \leq 0.0004$).





Observation Point	Control (%)	Intervention (%)
Baseline	64%	66%
4-week	59%	88%
12-week	67%	71%



Why the Regression?


- Dilution effect vs. 'Fade'
- New personnel
 - Between 4 and 12 weeks
 - A net of 10 new and untrained employees were added = 12.3%
 - Similar to the % regression of 17%
- Fade
 - Some steps regressed more than others
 - Greater regression was seen in chair moves






Participant Attitude

- Attitude
 - Pre and post-intervention, five point Likert scale, 15 items.
 - Mean scores were calculated and MANOVA was used to evaluate within subject effects; Wilk's Lambda was highly significant ($F=2.94, p = 0.003$).
 - Post hoc univariate analysis demonstrated statistically significant change in **12/15** items ($p \leq 0.05$)
 - Sig: Knowledge, patient transfer skills, injury prevention, communication, team skills and safety behaviors
 - Non-Sig: Realism of scenarios, equipment knowledge



Program Rescaled with UPMC HP- 'We've Got Your Back' Initiative




Assistive Level and Definition

Minimal Assist	Assisted to movement, unable to support 50% of body weight during transfer.
Moderate Assist	Assisted to movement, able to support 25% of body weight during transfer.
Max Assist	Assisted to movement, unable to support any of body weight during transfer.
Dependent	Unable to movement, unable to support any body weight during transfer.

Follow-Up at Community Hospital

- Selected UPMC McKeesport due to high rates of injury, obesity and other co-morbid conditions in direct care personnel
- Train the trainers + simulation intervention
- 293 providers trained in a three month window (Jan- March 2007) (total trained 327)
- Pre and post training observations conducted of transfers
- Post training surveillance



Transfer Success

Table 5: Pre- and Post-Intervention Success Rate by Protocol Step in a Community Hospital: At the 16 week measurement point, a total of 293 nurses and nurse aides had received the simulation transfer training. Results at baseline (56% success) were similar to baseline in the pilot study (63%) and results at 16 weeks (83%) were similar to 4 week results (88%) in the pilot.

Step	Title	Pre-Intervention (%) (n=13)	16 week Post Intervention (%) (n=112)	Improvement (%)
1	Identify	69%	75%	6%
2	Assess	25%	68%	43%
3	Enlist	69%	88%	19%
4	Gather	80%	94%	14%
5	Prepare	69%	92%	23%
6	Communicate Patient	69%	85%	16%
7	Communicate Personnel	39%	88%	49%
8	Perform	46%	85%	39%
9	Reassess	15%	67%	52%
10	Reset	77%	91%	14%
	Mean	56%	83%	27%

One Year Follow-up

Table 3: Results of the UPMC Health Plan "We've got your Back!" Program. This mandatory, hospital-based program consisted of an interactive, web supported simulation training program. All direct care employees at one suburban facility were required to complete the training (n = 327)

	2005	2006	2007	% reduction; 2005-2007
OSHA recordable injury rates (per 10,000)	13.7	11.6	6.85	50%
% of employees injured (annually)	10.6	9.1	5.0	53%
Injury rate during transfer (per 1000)	1.6	1.5	0.8	50%
Days away restricted transfer (DART)	1200	1300	500	58%

1 Year Outcomes Evaluated: Matched Cohort Analysis

- Matched Cohort
 - Matching variables
 - Sex
 - Age (within two years)
 - Job type (care manager, nurse, nurse assistant or patient care technician)
 - Job status (full vs. part time)
 - Length of job tenure (within six months)
 - Charlson comorbidity index
 - Presence of obesity (BMI >>30)
- Outcomes
 - 28% MSI reduction (p= 0.016)
 - Neck 77% (p< 0.01)
 - Back 65% (p < 0.01)
- Trend started after the program and were sustained across the year

 Buchanan, J., Trautman G., O'Donnell JM, Peele P. The Efficacy of a Workplace Program to Reduce Musculoskeletal Injury in Nurses. In 81st American Health Information Management Association (AHIMA) Convention, 2009, Grapevine, Tx.

Summary

- Simulation training program was scale-able, train the trainers program was successful
- Pre-intervention simulation success rate of 53% similar to pilot data success rates
- Post intervention: 16 week success rate of 83% emphasized that the training effect was sustainable
- Significant reduction in reportable injury rates, % of employees injured, injury during transfer and days away restricted transfer
- Significant reduction in MSI compared to a matched cohort
- Cost of training at McKeesport was \$28,906.00



Future Research

- Targeted use of the protocol in specific patient populations such as bariatric and orthopedics
- Distance Education + BIP with CERMUSA at UPMC Bradford campus
- Effect of combination approaches - lift teams + simulation + comprehensive methods to attain optimum cost/benefit mix
- Long term evaluation of impact with focus on workforce retention and whether nursing career lengths can be extended
- Efficacy vs. effectiveness evaluation
- Evaluation of sustained impact of the intervention
- In-depth economic analysis of the program/ROI
- Evaluation of the actual impact of reduction of nurse aide injury rates (currently unknown)
