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Audrey Nelson, Thomas R. Waters, Nancy N. Menzel, Nancy L. Hughes ...+4 more authors

Institutions: National Patient Safety Foundation, National Institute for Occupational Safety and Health, University of Nevada, Las Vegas, American Nurses Association ...+1 more institutions

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Effectiveness of an evidence-based curriculum module in nursing schools: Targeting safe patient handling and movement

Nancy Menzel

University of Nevada, Las Vegas, nancy.menzel@unlv.edu

Audrey L. Nelson

Patient Safety Center of Inquiry

Thomas R. Waters

National Institute for Occupational Safety and Health

Nancy Hughes

American Nurses Association

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Pamela C. Hagan

American Nurses Association

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See next page for additional authors

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Authors

Nancy Menzel, Audrey L. Nelson, Thomas R. Waters, Nancy Hughes, Pamela C. Hagan, Gail Powell-Cope, and Viviam Thompson

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Audrey L. Nelson*

Thomas R. Waters†

Nancy N. Menzel‡

Nancy Hughes**

Pamela C. Hagan††

Gail Powell-Cope‡‡

Carol Sedlak§

Vivian Thompson¶

*Patient Safety Center of Inquiry, Audrey.Nelson@va.gov

†National Institute for Occupational Safety and Health, trw1@cdc.gov

‡University of Nevada Las Vegas School of Nursing, nancy.menzel@unlv.edu

**American Nurses Association, Nancy.hughes@ana.org

††American Nurses Association, phagan@ana.org

‡‡James A. Haley VAMC, gail.powell-cope@va.gov

§Kent State University College of Nursing, csedlak@kent.edu

¶Patient Safety Center of Inquiry, vivian.thompson2@va.gov

Effectiveness of an Evidence-Based Curriculum Module in Nursing Schools Targeting Safe Patient Handling and Movement*

Audrey L. Nelson, Thomas R. Waters, Nancy N. Menzel, Nancy Hughes, Pamela C. Hagan, Gail Powell-Cope, Carol Sedlak, and Vivian Thompson

Abstract

Nursing schools in the United States have not been teaching evidence-based practices for safe patient handling, putting their graduates at risk for musculoskeletal disorders (MSDs). The specific aim of this study was to translate research related to safe patient handling into the curricula of nursing schools and evaluate the impact on nurse educators and students' intentions to use safe patient handling techniques. Nurse educators at 26 nursing schools received curricular materials and training; nursing students received the evidence-based curriculum module. There were three control sites. Questionnaires were used to collect data on knowledge, attitudes, and beliefs about safe patient handling for both nurse educators and students, pre- and post-training. In this study, we found that nurse educator and student knowledge improved significantly at intervention schools, as did intention to use mechanical lifting devices in the near future. We concluded that the curriculum module is ready for wide dissemination across nursing schools to reduce the risk of MSDs among nurses.

KEYWORDS: nurse educator, safe patient handling, student nurse education, school of nursing

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Problem Statement

Traditionally, nursing school curricula have focused on manual patient lifting techniques and use of “proper” body mechanics, despite the fact that over 30 years of evidence documents that these approaches are not safe (Hignett et al., 2003; Nelson, Fragala & Menzel, 2003). Persistence of these unsafe practices perpetuates the considerable number of work-related musculoskeletal disorders that continue plague the nursing workforce (Edlich, Winters, Hudson, Britt, & Long, 2004; Nelson et al., 2006; Panel on Musculoskeletal Disorders et al., 2001; Smedley, Egger, Cooper, & Coggon, 1995).

Purpose of Study

The purpose of this study was to translate research related to safe patient handling into the curricula taught in nursing schools in the United States (US) and evaluate its effectiveness for use as a component of fundamental nursing education.

Evidence-Based Approaches to Safe Patient Handling

In the past decade research has led to advancements in safe patient handling (Nelson & Baptiste, 2004), including: (1) patient handling equipment/devices, (2) unit-based patient care ergonomic assessment protocols, (3) no lift policies, and (4) training on proper use of patient handling equipment/devices. Advancements in technology have resulted in a wide array of patient handling equipment that did not exist a decade ago. Promising new interventions, which are still being tested, include use of unit-based peer leaders and clinical tools, such as decision algorithms and patient assessment protocols for selecting the right techniques given patients’ needs.

Incorporation of this research and patient handling technologies into nursing schools is critical for educating a new generation of nurses better prepared to promote safe patient handling.

Development of a New Nursing Curriculum Module

Based on a review of nursing textbooks and manual handling content on the U.S. national registered nurse licensing exam, it was evident that safe patient handling techniques had been based on tradition rather than scientific evidence; undergraduate nursing students are taught unsafe manual patient handling techniques and are rarely exposed to the newest patient handling devices. Possible reasons for this gap include lack of knowledge about safe patient handling and lack of available evidence-based teaching materials for nurse educators.

To address this critical need, experts in patient care ergonomics developed an evidence-based educational and training curriculum module on safe patient handling. The project targeted nurse educators who provide the content of basic nursing care to nursing students in the fundamentals of nursing practice and clinical care.¹ An integral part of fundamentals nursing education is the clinical laboratory experience, typically referred to as a “skills lab” or practice simulation lab. The didactic materials consisted of a narrated slide show, as well as required readings, background materials, a quiz, and implementation instructions for nurse educators. The nursing skills exercises were based on conducting a patient assessment for movement needs, as well as safe patient handling algorithms (Menzel, Hughes, Waters, Shores, & Nelson, 2007). Participating nurse educators attended a Safe Patient Handling Conference to review the draft curriculum module and suggest changes to ease implementation. The specific curriculum module is described in a separate article (Menzel et al., 2007); an implementation toolkit is available at: <http://www.visn8.med.va.gov/patientsafetycenter/safePtHandling/default.asp>.

Theoretical Framework

The Theory of Planned Behavior (TPB) (Ajzen & Fishbein, 1980) was used to guide evaluation of the safe patient handling curriculum module. The TPB is a theory from social psychology for predicting intentions to perform specific behaviors (Madden, Ellen, & Ajzen, 1992; Montaña & Kasprzyk, 2002), and includes key constructs of attitudes, social norms, and behavioral control. Intention is predicted to directly influence conduct of the behavior, and intentions are a function of personal attitudes about the behavior in question and social norm influences. Attitudes are a function of beliefs about the behavioral outcome and an evaluation of whether those outcomes are desirable or not. Social norms are what an individual believes that other people think they should do (normative beliefs) weighted by how strongly the individual feels influenced by others (motivation to comply). The original theory was expanded to include perceived behavioral control (Parker, Manstead, & Stradling, 1995); that is, perceived ease or difficulty in performing a behavior (Blue, 1995; Netmeyer, Burton, & Johnson, 1991). According to the TPB, attitude and social norm are the most powerful predictors of intention. Therefore, the model does not include background variables, such as age, marital status, or education. Demographic variables are

¹ Fundamental nursing education refers to basic nursing skills taught in a lab; patient handling is one of these early skills taught in this course, which is typically held the first semester of nursing education.

posited to influence behavioral intention and behavior indirectly through their interactions on attitudes and social norms. Numerous studies support the use of the TPB in predicting health-related intentions and behaviors including sexual behaviors (Myklestad & Rise, 2007), health promotion behaviors (Andrykowski, Beacham, Schmidt, & Harper, 2006), activity and exercise (Dean, Farrell, Kelley, Taylor, & Rhodes, 2007), and health care providers' behaviors (Herbert, Urmie, Newland, & Farris, 2006; Sauls, 2007). While originally developed as an explanatory model, researchers extended its use to interventional research aimed at changing beliefs, attitudes, and behavioral control, thus changing intentions and behaviors (Courneya, Jones, Mackey, & Fairey, 2006; Jemmott, Jemmott, Braverman, & Fong, 2005).

Methods

A quasi-experimental design was used, including a pre/post evaluation of outcomes from an intervention group ($n=26$ nursing schools) compared to a control group ($n=3$ nursing schools). The researchers offered control schools early post-study access to materials and approaches supported by the evidence, similar to a wait-list control design in clinical research. The 26 participating schools were selected from 40 applications submitted following a solicitation through the two US program accrediting bodies, described below. All but one of the intervention schools were baccalaureate programs, which may make the findings less applicable to non-baccalaureate programs. Although the schools were chosen to reflect geographic diversity, funding limited the sample to only a small percentage of all U.S. nursing programs. Nurse educators from intervention schools received training and were given curriculum materials and instructions on safe patient handling; nursing students received the evidence-based curriculum module. Data were collected using questionnaires. We assessed knowledge, attitudes, and beliefs about safe patient handling for both nurse educators and students, pre- and post-training. Additionally a process evaluation included teaching methods, patient handling equipment inventory, level of acceptance, and intention to continue with new curriculum module. Information about the schools was collected from nurse educators using questionnaires. We also included qualitative data to examine facilitators and barriers to implementation, as well as changes made over time to the curriculum module. The qualitative data will be published separately.

Human Subject Protection

An expedited review was obtained from each institution and each local Human Subjects Review Board.

Research Questions:

1. What is the change in knowledge, attitudes, and beliefs of nurse educators after the training program?
2. What is the change in knowledge, attitudes, social norms, beliefs, behavioral control, and intentions of nursing students, pre to post-training?
3. How did the knowledge, attitudes, social norms, intentions, and behaviors of the students who participated in the intervention differ from students at control sites?
4. To what extent did the nursing schools implement each aspect of the new curriculum module?
5. What is the level of acceptance for the fundamental nursing curriculum change to include safe patient handling at the nursing school?
6. To what degree do the intervention sites intend to continue with the new safe patient handling curriculum module in the future?

Sample: In December 2004, the American Nurses Association (ANA) recruited nursing schools through an announcement posted on websites of the National League for Nursing and the American Association of Colleges of Nursing; a total of 40 schools applied. The application for the program included the requirements that the applicant must represent an educational program for registered nurses; submit a letter of support and commitment to all components of the program from the dean or academic head of the nursing school; provide a statement addressing why the applicant wished to participate in the pilot program; describe how implementation would occur; list any resources available to support the acquisition of safe patient handling equipment for the clinical simulation skills laboratory; agree that faculty member responsible for teaching clinical skills would attend the 2005 Safe Patient Handling and Movement conference including the pre-conference and post-conference sessions; and commit to participating in an evaluation study.

The budget limited the number of sites that could be selected; 26 nursing schools, spread geographically across the United States, were selected using the defined criteria included in the application. These schools included large and small programs, in rural and urban settings, and included 2-year community colleges (4%) and 4-year universities (96%). Three additional sites were selected by convenience as control sites. The 29 nursing schools that agreed to participate were generally large public institutions (65%) with a long history of undergraduate nursing education ($M=34$ years, $SD=14.3$), offering Baccalaureate of Science in Nursing (BSN) programs (93%), and an average of 134 students graduating per year.

The faculty sample included fundamentals of nursing education instructors who taught patient handling. Each nursing school had one to two faculty assigned to this area ($n=61$). The mean age of the nurse educators was 48 years ($SD=9$). This group was very experienced, with an average of 25 years in nursing ($SD=11$) and 12 years in education ($SD=9$). Only a fourth of the sample had previous training in patient handling (24%). All were women, and most were Caucasian (90%). There were two groups of nursing students: those participating in the intervention schools ($n=1201$) and those at the control sites ($n=111$). Nursing students included undergraduate students admitted in the fall semester 2005 who were participating in fundamentals of nursing education where patient handling was taught, regardless of whether they were in a 2 or 4 year program. The average age of students was 24 years ($SD=7$), and 89% of students were female. A t -test used to compare mean age between intervention (24.4) and control (23.1) groups found there was no significant ($p= 0.09$) age difference between the groups. Seventy percent of the students did not have any previous training in patient handling. Results of a chi-square test showed there was no significant difference in the proportion of students having had training in patient handling when comparing control (22.2%) and intervention (30.6%) groups ($p= 0.36$). Sixty seven percent of students in the intervention group and 72% in the control group did not have previous work experience in a setting where they provided patient handling tasks (e.g., previous experience as a nursing assistant).

Instruments: Data were collected using questionnaires designed to address three domains: (1) demographic data, including characteristics of nursing schools, nurse educators, and nursing students, (2) assessment of knowledge, attitudes and beliefs about safe patient handling for both nurse educators and students, pre- and post-training, and (3) process evaluation, including teaching methods, patient handling equipment inventory, level of acceptance, and intention to continue with the new curriculum. The questionnaires were pilot tested. Items with low item to total correlations were deleted, and other items were edited to improve clarity.

The final *knowledge scale* consisted of 10 items (Kuder-Richardson reliability coefficient = .67 and .68² for nurse educators and student samples

² Due to restriction of range (low scores on baseline test), which tends to deflect reliability, reliability estimates for the student knowledge scale were calculated on post test data.

respectively), with true/false response choices. Unified items were summed to obtain a total score from each participant. True/false questions included:

1. With proper training, it is safe to lift a patient manually.
2. Using proper body mechanics when handling patients will sufficiently protect nurses from injury.
3. Using proper lifting techniques when handling patients will sufficiently protect nurses from injury.
4. It is OK to lift a patient up off the floor without using equipment so long as at least two or more nurses are doing the lifting.
5. If a caregiver must lift more than 35 pounds of a patient's weight, then lifting assist equipment should be used.
6. When manually transferring a patient from bed to chair, having two or more nurses to help will typically protect them from injury.
7. A ceiling-mounted lift is more challenging to use than a traditional lift.
8. Nurses who use only body mechanics for manual patient handling will predispose themselves to a higher rate of injury.
9. I have practiced using a ceiling-mounted patient lift device.
10. I have practiced using three types of friction reducing devices.

The *attitude scale* consisted of 12 items asking respondents to indicate their opinions about safe patient handling and movement by using a set of semantic differential scales; that is, 5-point scales anchored by bipolar adjectives (e.g. good/bad, convenient/inconvenient, beneficial/harmful). An attitude score was computed as the mean of the 12 items (Cronbach's $\alpha = .72$ and $.90$ for nurse educators and student samples, respectively). The items were scaled so that higher scores reflected more positive attitudes; e.g. wise, good, easy, useful, etc. For students an additional attitude scale was computed for attitudes toward manual lifting techniques (Cronbach's $\alpha = .93$) that consisted of 12 items using the same bipolar response format.

1. Wise/Foolish
2. Good/Bad
3. Easy/Difficult
4. Useful/Useless
5. Inexpensive/Costly
6. Necessary/Unnecessary
7. Convenient/Inconvenient
8. Pleasant/Unpleasant
9. Important/Unimportant
10. Valuable/Worthless
11. Beneficial to students/Harmful to students
12. Beneficial to patients/Harmful to patients

The *beliefs scale* consisted of 9 items tapping into beliefs about teaching the curriculum, rated on a Likert-type response format from 1 (strongly disagree) to 5 (strongly agree). A belief score was computed as the mean of the nine items, Cronbach's alpha = .71. True/false questions included:

1. My personal knowledge of patient handling is strong.
2. Teaching body mechanics to nursing students as a primary technique for safe patient handling and movement tasks should be eliminated.
3. Teaching manual patient handling techniques to nursing students should be discouraged.
4. Even though using mechanical equipment for patient handling may take more time than performing the task manually, it's the best way to reduce injury risk.
5. For nursing schools, replacing body mechanics classes and manual techniques for patient handling with safe patient handling equipment is necessary.
6. Teaching safe patient handling to nursing students will help to prevent injuries after entering the professional nursing workforce.
7. What is taught in schools of nursing should be based on scientific research evidence.
8. The method of patient handling that may be the best test for the nursing licensing examination should be taught in nursing schools
9. Occupational injuries related to patient handling are a critical problem in nursing.

The *social norm scale* consisted of 13 items and measured the degree to which people in the social environment believed they should implement the programs (normative beliefs) multiplied by the degree to which the subject was influenced by these people (motivation to comply) (Cronbach's alpha = 0.84). Students were asked about who might influence them in using safe patient handling techniques, yielding a list of 13 people. For each person, students were asked to judge whether it was likely or unlikely (using a rating scale from [2] to extremely unlikely [-2]) that each person would like them to use principles of safe patient handling and movement every time they transfer or move patients (normative belief). Then students were asked the degree to which they try to do what each person wants them to do (motivation to comply), rated on a scale from extremely likely (5) to extremely unlikely (1). A Social Norm score was calculated as the sum of the products of the Normative Believe and the Motivation to Comply items.

1. My fundamentals nursing instructor
2. My med/surg nursing instructors
3. My classmates in nursing school

4. The nursing staff with whom I have clinical rotations
5. Physical therapists in clinical settings
6. Patient transporters(escorts) in clinical settings
7. The dean of my nursing school
8. The smartest students in my nursing class
9. The National Student Nurses Association
10. Professional nursing journals
11. Family, friends, or people I know who have had back injuries
12. Patients
13. The nursing lab faculty

To measure *behavioral control*, students were asked to rate the question “Using mechanical lifting devices to move and transfer patients would be” by rating 1 to 5 (not under my control- under my control). The “under my control question” was analyzed as an individual response variable, a median was computed, and the Wilcoxon rank-sum test was used to assess differences in central tendencies between control and intervention groups and differences between pre- and post- intervention groups.

To measure *intention*, students were asked how strongly they agreed or disagreed with two statements (a) “I intend to use good body mechanics in the next four months” and (b) “I intend to use mechanical lifting in the next four months,” rated on a 5-point Likert scale from 1 (disagree) to 5 (agree). Both of these questions were analyzed as individual response variables, a median was computed, and the Wilcoxon rank-sum test was used to assess differences in central tendencies between control and intervention groups. A Wilcoxon signed rank test was used to determine differences between pre and post intervention groups.

To measure *program fidelity*, nurse educators implementing the curriculum module were asked yes/no questions on “what topics in safe patient handling are covered as part of the nursing curriculum module.” Program fidelity was assessed by calculating the number of recommended curriculum module elements implemented, divided by the total number of possible curriculum module elements.

To measure *acceptance of the curriculum* module, nurse educators were asked to answer three questions. “What is the perceived quality of the curriculum module?” was scaled from very good to very poor. “What is the likelihood that your school will continue to use the new curriculum module?” was rated on a scale from strong likelihood to very unlikely. “I intend to teach principles of safe

patient handling and movement during the next four months” was rated on a Likert scale from 1 (disagree) to 5 (agree).

Results

Pre/Post Evaluation of the Nurse educators Training Program (Question #1): To assess knowledge before and after training, mean pre and post scores were compared. Group comparisons were conducted using the Wilcoxon Signed-Rank Test. The mean knowledge score significantly improved from 4.7 ($SD=2.0$) at baseline to 7.9 ($SD=0.9$) post training ($p<0.0001$). The mean attitude score was also significantly higher (4.6, $SD=0.2$) post intervention than pre intervention (4.4, $SD=0.6$) ($p=0.0155$). The mean belief score was significantly more favorable post-training 4.09 ($SD=0.32$) when compared to baseline 3.38 ($SD=0.67$) ($p<0.0001$).

Pre/Post Evaluation of the Student Training Program (Question #2): The effectiveness of the curriculum on students was evaluated by using paired sample t -tests to test for pre/post test differences, and an alpha level of 0.05 was used for all statistical tests.

(a) General Knowledge and Beliefs. The mean knowledge score was significantly higher post training 6.7 ($SD=2.1$) when compared with baseline knowledge 3.8 ($SD=1.8$) ($p<0.0001$). See Table 1. It is interesting to note that even after the program, approximately 40% still believed that with proper training it is safe to manually lift a patient and that using proper body techniques and lifting techniques will sufficiently protect nurses from injury, while at the same time almost 98% knew that using mechanical equipment when handling patients would protect them from injury. The mean belief score was significantly higher post-intervention 3.7 ($SD=0.5$) when compared with baseline beliefs 3.3 ($SD=0.5$) ($p<0.0001$).

(b) Use of Mechanical Lifting Devices. Students held very positive attitudes toward mechanical lifting devices, with the exception of costliness. Mean attitude scores after the intervention (4.4, $SD=0.5$) were significantly higher compared to pre-intervention (4.1, $SD=0.5$) ($p<0.0001$). A mean normative belief score of 53.0 ($SD=35.5$) was obtained pre-intervention, and 54.7 ($SD=37.8$) post-intervention ($p=0.2512$), indicating the new curriculum module did not change students’ opinions about who might influence them in using safe patient handling techniques. A median behavioral control score for mechanical lifting devices of 3.0 (Variance=1.2) was obtained pre-intervention, compared to a higher median of 4.0 (Variance=1.3) post-intervention ($p<0.0001$), indicating an increase in the

belief that the student is empowered to use mechanical devices. Post intervention, students were significantly more likely to intend to use mechanical lifting devices over the next four months (4.0, Variance=1.2) compared to 5.0 (Variance=1.2) pre-intervention ($p<0.001$). See Table 1.

(c) Manual Lifting. Students held positive attitudes toward manual lifting techniques, except that they perceived manual lifting as somewhat difficult and unpleasant. As expected, the mean score for student's attitude toward manual lifting was significantly lower (3.4, $SD=1.1$), after the new curriculum than before (3.6, $SD=0.9$) ($p<0.0001$). The curricula did not seem to affect behavioral control and intentions related to manual lifting as no differences in pre- to post-test medians in these area were observed (Table 1).

Table 1. Test Statistics for Student Knowledge, Beliefs, Attitudes, Behavioral Control, Social Norm, and Intentions (pre and post comparisons) ($n=1201$)

	Pre Mean (SD)	Range	Post Mean (SD)	Range	t-statistic	p value
General						
Knowledge	3.8 (1.8)	0 to 10	6.7 (2.1)	0 to 10	44.32	<0.0001
Beliefs	3.3 (0.5)	1 to 5	3.7 (0.5)	1 to 5	22.59	<0.0001
Mechanical Lifting						
Attitudes	4.1(0.5)	1 to 5	4.4 (0.5)	1 to 5	15.67	<0.0001
Behavioral Control (Under my control-Not under my control) ^a	3.0 (1.2)	1 to 5	4.0 (1.3)	1 to 5	58500	<0.0001
Social Norm	53.0 (35.5)	-122 to 130	54.7 (37.8)	-115 to 130	1.15	0.2512
Intention to use mechanical lifting devices in next 4 months ^a	4.0 (1.2)	1 to 5	5.0 (1.2)	1 to 5	19724	<.0001
Manual Lifting						
Attitudes	3.6 (0.90)	1 to 5	3.4 (1.1)	1 to 5	-8.97	<0.0001
Behavioral Control (Under my control-Not under my control) ^a	4.0 (1.5)	1 to 5	4.0 (1.6)	1 to 5	-1089	0.8513

	Pre Mean (SD)	Range	Post Mean (SD)	Range	<i>t</i> -statistic	<i>p</i> value
Intention to use good body mechanics during the next 4 months ^a	5.0(0.7)	1 to 5	5.0 (0.7)	1 to 5	750	0.6774
^a Median and Variance are reported for these items. Wilcoxon signed rank statistic and <i>p</i> -values shown.						

Comparison between Intervention and Control Sites (Question #3): To determine the effects of the curriculum on knowledge, attitudes, social norms, intentions and behaviors of students at control sites compared to students at intervention sites, *t*-tests were performed.

(a) General Knowledge and Beliefs. Students at the intervention sites scored significantly higher in the knowledge test (6.7, *SD*=2.1) than those at control sites (3.7, *SD*=2.0) ($p<0.0001$), and held significantly more favorable beliefs when compared to the control group (3.7, *SD*=0.5 versus 3.2, *SD*= 0.4, $p<.0001$) (Table 2).

(b) Use of Mechanical Lifting Devices. As expected, attitudes toward use of mechanical lifting devices were significantly more positive (4.3, *SD*=0.4) in the intervention site than control sites (3.8, *SD*=0.5) ($p<0.0001$). Behavioral control over mechanical lifting devices was higher for the intervention group (4.0, Variance=1.4) compared to the control group (3.0, Variance=1.1) ($p=0.0004$). Likewise, students in the intervention group were significantly more likely to use mechanical lifting devices (4.0, Variance=1.2) compared to the control group (3.0, Variance=1.1) ($p<.0001$) (Table 2).

(c) Manual Lifting. Despite evidence that manual patient lifting and good body mechanics do not protect nurses, attitude scores supporting manual lifting were significantly higher in students at control sites (4.2, *SD*=0.6) than intervention sites (3.3, *SD*=1.0) ($p<0.0001$). Likewise, students in the control groups reported higher levels of behavioral control over manual lifting than students at intervention sites ($p<0.0001$). Students in control group reported greater intention to use good body mechanics compared to the intervention group when comparing means scores($p<0.0196$) (Table 2).

Table 2. Test Statistics for Student Knowledge, Attitude, Belief and Social Norm Scales (Control versus Intervention)

	Intervention Mean (SD) N=1201	Range	Control Mean (SD) N=111	Range	t- statistic	p value
Knowledge	6.7 (2.1)	0-10	3.7 (2.0)	0-8	-14.30	<0.0001
Beliefs	3.7 (0.5)	1-5	3.2 (0.4)	1-5	-11.7	<0.0001
Mechanical Lifting						
Attitudes	4.3 (0.4)	1-5	3.8 (0.5)	2-5	-10.06	<0.0001
Behavioral Control (Under my control-Not under my control) ^a	4.0 (1.4)		3.0 (1.1)		56019	0.0004
Social Norm	54.6 (37.7)	-40-120	34.2 (35.9)	-115- 130	-5.47	<0.0001
Intention to use mechanical lifting devices in next 4 months ^a	4.0 (1.2)	1-5	3.0 (1.7)	1-5	46512	<0.0001
Manual Lifting						
Attitudes	3.3 (1.0)	1-5	4.2 (0.6)	1-5	12.04	<0.0001
Behavioral Control (Under my control-Not under my control) ^a	4.0 (1.6)	1-5	5.0 (1.0)	1-5	87844	<0.0001
Intention to use good body mechanics during the next 4 months ^a	5.0 (0.72)	1-5	5.0 (0.24)	1-5	76211	<0.0196
^a Median and Variance are reported for these items. Wilcoxon signed rank statistic and p-values shown.						

Program Fidelity at the Intervention Sites (Question #4): Nurse educators implementing the curriculum module were asked yes/no questions on “what topics in safe patient handling are covered as part of the nursing curriculum module.” The topics included in the evaluation of the new curriculum module consisted of seven didactic items, two laboratory items, and fourteen hands-on-practice items using the safe patient handling equipment. Program fidelity was assessed by calculating the number of recommended curriculum module elements actually implemented, assessed by the frequency of yes responses post intervention, divided by the total number of curriculum module elements

proposed. Results show a mean of 83% of didactic items, 92% of laboratory items, and 65% of hands-on practice program elements recommended in the curriculum module were actually implemented, as reported by nurse educators post intervention.

Additionally, nurse educators were asked yes/no questions on “what teaching strategies are used to instruct students on patient handling.” Strategies incorporated in the evaluation consisted of didactic, laboratory, demonstration/return demonstration, and computer-based. Ninety six percent of nurse educators ($n=52$) reported using didactic strategies, 100% used both laboratory and demonstration strategies, while 46% reported using a computer-based approach (Table 3).

Table 3. Item Analysis of Nurse Educators Content and Process of Curriculum Covered as Part of Fundamental Nursing Curriculum ($n=57$).

TOPICS	PART OF FUNDAMENTAL NURSING CURRICULUM		TIME SPENT IN HOURS	
	Freq (%) (Freq. of Yes Responses)		Mean (SD)	
	Pre	Post	Pre	Post
Didactic				
1. Principles and techniques of safe patient handling and movement	36 (65.45)	53 (98.15)	1.5 (1.2)	1.4 (1.2)
2. Epidemiology of musculoskeletal injuries in nurses	21 (40.38)	46 (86.79)	0.3 (0.3)	0.9 (1.0)
3. Purpose of an ergonomic assessment of a workplace	12 (22.64)	42 (79.25)	0.3 (0.3)	0.9 (1.0)
4. Risk factors for causing musculoskeletal injuries and illness in caregivers	39 (73.58)	52 (98.11)	0.7 (0.7)	0.9 (1.0)
5. Characteristics of high risk patient care units	20 (38.46)	40 (75.47)	0.5 (0.5)	1 (1.1)
6. High risk patient care activities	34 (65.38)	52 (100)	0.7 (0.7)	0.9 (1.0)
7. Limitations of body mechanics for injury prevention when moving and handling patients	27 (50.94)	51 (96.23)	1 (1.0)	0.9 (1.1)

TOPICS	PART OF FUNDAMENTAL NURSING CURRICULUM		TIME SPENT IN HOURS	
	Freq (%) (Freq. of Yes Responses)		Mean (SD)	
	Pre	Post	Pre	Post
Laboratory				
1. Assess patients to select the right combination of equipment and personnel needed to handle or move them safely	37(68.52)	53 (98.15)	1.5 (1.2)	1.4 (1.1)
2. Apply positioning and mobility techniques that are safe for patient and caregivers	50 (92.59)	54 (98.18)	1.6 (1.7)	1.7 (1.1)
Hands-on Practice Using the Following Equipment				
1. Friction Reducing Lateral Sliding Aids	17 (32.08)	47 (88.68)	0.6 (0.8)	0.9 (1.2)
2. Air Assisted Lateral Sliding Aids	9 (16.98)	36 (66.67)	0.7 (0.9)	1.2 (1.4)
3. Mechanical Lateral Transfer Aids	16 (30.19)	46 (85.19)	1.0 (0.8)	0.9 (1.2)
4. Sliding Boards	27 (50.94)	40 (74.07)	0.6 (0.7)	1.1 (1.2)
5. Gait Belts/Transfer Belts	47 (88.68)	52 (94.55)	1.1 (1.5)	1.1 (1.3)
6. Stand Assist Lifts	17 (32.08)	50 (90.91)	0.7 (0.6)	0.8 (0.9)
7. Floor Based Lifts	17 (32.08)	41 (78.85)	1.1 (1.3)	0.8 (0.9)
8. Ceiling Mounted Lifts	10 (18.87)	45 (83.33)	1.1 (1.1)	0.9 (0.9)
9. Powered Transport Devices	6 (11.32)	19 (35.85)	2(1.4)	1 (1.1)
10. Powered Driven Beds	9 (16.98)	15 (28.85)	0.8 (0.4)	1.1 (1.1)
11. Powered Stretchers	2 (3.77)	9 (17.31)	1.5 (0.7)	0.9 (0.7)
12. Non-Powered Stretchers	29 (55.77)	33 (61.11)	0.6(0.5)	0.6 (0.7)
13. Typical Electric Hospital Bed (Non-Powered, Electric Controls)	48 (92.31)	49 (90.74)	0.6 (0.6)	1 (1.6)
14. Typical Manual Hospital Bed, Non-Powered, Manual Crank	25 (50.00)	22 (41.51)	1.0 (0.9)	1.6 (2.3)

Acceptance of the Curriculum Changes (Question #5): The majority of nurse educators who taught the curriculum module rated its quality very good (61%) or good (34%), while only 5% rated its quality fair, and none rated it poor or very poor. The majority said there was a strong likelihood (79%) they would continue to use the new curriculum module, with another 18% stating they were “likely” to continue its use. Eighty percent of nurse educators ($n=47$) agreed that

they intended continue to teach safe patient handling and movement principles, while 10% (n=6) disagreed that they would continue.

Limitations

This is the first study to evaluate the effectiveness of an evidence-based curriculum module for safe patient handling. Studies examining the efficacy of interventions are difficult to conduct, requiring optimum evaluation conditions in order to control for potential bias and confounding factors. In an attempt to minimize these potential threats to validity, we adopted a two-pronged evaluation approach that included use of a pre/post intervention study design, as well as use of a control group. We believe this design provided a reasonably strong approach to controlling for potential bias and confounding factors typically encountered.

The lack of random selection of schools for the study may have biased the results to some extent. Due to their interest in adopting the most current evidence-based curriculum and teaching models, the participating schools may have biased the results toward successful outcomes. Ideally, we would have liked to have been able to randomly select schools from a large pool of potential participating nursing schools; however, due to resource limitations and logistics, this was not possible. Nevertheless, the schools in our study site provided a wide distribution of school types and sizes from a diverse geographic area, resulting in a nationally representative sample of schools.

We were not able to randomly assign schools into the treatment and control groups. Because we were limited in how many schools we could accommodate in the study, we asked all schools who were not selected to participate as a control site, and only three were willing. These schools agreed to delay the adoption of the training program until the following year in order to provide us with controls.

Lastly, all of the scales developed for this study had good to excellent reliability scores. Nunnally (1967) suggests reliabilities of 0.70 or higher are adequate for group level comparisons. The knowledge scales in this study fell just below this minimum. However, reliability for these scales is negatively impacted by the response format and by the short number of items; therefore, we think they reflect reliable measures in the context of the study, particularly given our large sample size. Further refinement of these scales may be warranted for futures studies.

Discussion

Results of this study indicate that the nurse educators training program was effective in changing the knowledge, attitudes, and beliefs of nurse educators who taught safe patient handling content in fundamentals courses to nursing students. Knowledge, attitudes, and beliefs among nurse educators were all significantly higher post training compared to the pre-test.

The nurse educator training program was an effective strategy for improving their knowledge about the existence of scientific evidence that supports the use of strategies that can prevent or decrease musculoskeletal injuries associated with patient handling. Educators are in an ideal position for changing the paradigm for how nursing students are educated about handling, moving, lifting, and transferring patients. Nurse educators can no longer continue to teach outdated techniques relying on body mechanics and manual lifting when there is strong scientific evidence supporting that these strategies are not effective in reducing injuries. It is essential that a paradigm shift occur in nursing education that moves from tradition and a mindset of “we have always taught it that way” to the use of evidence-based practices that focus on patient care ergonomic assessment protocols, use of patient handling equipment, low lift institutional policies, and education and training on proper use of patient handling equipment.

Study findings provide strong empirical support for the efficacy of an evidence-based, structured curriculum module on safe patient handling targeting nursing students early on in educational programs. Comparing students pre- to post-test and the intervention to the control group, the program resulted in statistically significant improvements in a number of immediate outcomes, including attitudes toward mechanical and manual lifting; albeit small absolute differences from pre- to post-intervention attitudes, knowledge and beliefs about safe patient handling; beliefs in their abilities to exert behavioral control in using mechanical lifting devices; and finally, in intentions to use mechanical lifting devices in the near future. In addition, compared to the control group, the intervention group reported higher levels of social influences on their ability to implement safe patient handling and movement. From this study, we cannot determine the effects of the program on actual student behaviors, on behaviors when they went to clinical settings, nor how these short term gains translated into sustained improvements. The barriers to long term gains are many, including clinical sites where nursing staff rely on manual lifting techniques and where patient handling equipment is not available. Curriculum changes, programs to increase safe patient handling in practice settings, and legislative efforts to mandate safe patient handling synergistically have the potential to change nursing

practice in a timely manner, rather than the 17 year research/practice gap that has been cited in the literature (Balas & Born, 2000).

While the quality of the curriculum module was acceptable, there is room for improvement to ensure that a larger percentage of those using it judged it very good. The fact that the overwhelming majority of schools plan on continuing its use indicates that participating schools have committed to making changes in teaching safe patient handling and movement.

Recommendations

Results from this study provide important information for understanding how to promote the timely translation of evidence for safe patient handling into health care practices by implementing sound, evidence-based curricula into basic nursing education. Nurse educators are in an ideal position to use the evidence about safe patient handling obtained through the nurse educators' training program and to become champions for facilitating this as a lasting change throughout the curricula in nursing schools across the United States.

This new curriculum module is ready for dissemination to all U.S. nursing schools. Partnerships with state nursing organizations, state nursing student organizations, and state nursing education programs could be used to facilitate implementation by offering "train the trainer" programs at multiple, convenient locations.

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