Cost Effectiveness of a Multifaceted Program for Safe Patient Handling

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Abstract

Objective: The Patient Safety Center in the Veterans Health Administration (VHA) introduced a program aimed at reducing the incidence and severity of injury to caregivers in handling patients. The program involved an ergonomic assessment protocol, patient handling technology, decision algorithms to select equipment, and guidelines for safe patient handling. **Method:** An 18-month observational study measured the incidence and severity of injury to caregivers before and after the introduction of the Safe Patient Handling and Movement project. **Results and conclusion:** This program aided both patients and nursing personnel (registered nurses, licensed practitioner nurses, and nursing assistants). Incidence and severity of injuries to health care workers decreased, and there was general satisfaction with use of equipment by patients and patient handlers. The intervention also was cost effective. A cost-benefit analysis showed that net benefits from lowered incidence and severity of injuries and decreased workers' compensation claims was $200,000 per year. The payback period of the initial investment in patient handling equipment was 4.30 years. Policy implications are discussed.

Introduction

The National Institute for Occupational Safety and Health identifies back injury as the second leading occupational injury in the United States. Back pain is the most common reason for filing workers' compensation claims. In 1990, estimates of the annual cost of back injury ranged from $50 to $100 billion in the United States.[1] A major illness among health care providers is back pain among nurses. Reviewing more than 80 studies conducted in a number of countries, Hignett[2] found that back injury to nurses has a worldwide point prevalence of approximately 17 percent, an annual acute prevalence of 40 to 50 percent, and a lifetime chronic prevalence/disability rate of 35 to 80 percent. Back pain is second only to the common cold as the most frequent cause for sick leave.[3, 4] More than one-third of back injuries among nurses have been associated with the handling of patients and the frequency with which nurses are required to manually move patients.[5, 6] The force needed by a nurse to lift, lower, push, pull, carry, or otherwise move, hold, or restrain a patient is a common cause of injury. Repetitive work practices, a nurse's age or stature, duration of work tasks, work habits, and posture while sitting have also been found to contribute to injury.[7, 8]

In a recent study,[9] workers reported substantial pain and diminished function resulting from work injury; even many months after the date of injury, workers

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with upper extremity nerve damage were most likely to report poor functional outcomes. Nearly 30 percent of workers reported "some" or "a lot" of difficulty performing their job because of the work injury, and nearly 18 percent said the injury limited the kind of work they can do. Such on-the-job injuries can affect patient care. For example, in the Veterans Health Administration (VHA), no provision exists for replacing injured workers on an immediate basis. Hence, a smaller number of clinical full-time equivalents have to move and lift the same number of patients, which would affect quality of care, especially for patients with limited mobility.

The VHA spends approximately $22 million a year on caregiver injuries associated with patient handling and movement.[10] Educating nurses about body mechanics alone has not prevented injuries. Few articles have addressed manual handling injuries among workers caring for people with disabilities in special residential facilities. Recent efforts at reducing back injury in the health care profession have included multifaceted programs for safe patient handling and movement with marked success in reducing injury rates and associated costs.[11, 12] This study addresses the evaluation of such a program in VHA units at high risk for injury.

Back injuries program in the VHA

The Department of Veterans Affairs (VA) provides health care and other services to veterans via Veterans Integrated Service Networks (VISNs) and VHA health care facilities. Health care in VISN 8, headquartered in Florida, is delivered through an integrated system of 7 hospitals, 10 multispecialty outpatient clinics, and 24 community-based primary care clinics in Florida and Puerto Rico. VISN 8 operates many high-risk units or inpatient hospital wards with a high proportion of dependent patients requiring full assistance with patient handling tasks, including lifting and activities of daily living. More than 80 percent of back injuries to caregivers in VISN 8 in 1999–2000 occurred in these high-risk units.

In early 2001, VISN 8 provided financial support for a project aimed at reducing the number of injuries to nurses and nursing associates engaged in patient handling. The motivation for the intervention was the proposed adoption of a no-lift policy in some high-risk units in the VHA system. When a similar policy was adopted in Britain in 1993, it resulted in a significant decrease in job-related injuries.[13] The VHA's no-lift policy states that all hazardous manual handling tasks are to be avoided whenever possible. If hazardous manual handling tasks are unavoidable, they must be assessed in advance, and action should be taken to remove or reduce the risk of injury. The multifaceted patient care ergonomics program was developed to create safer working environments for nurses who provide direct patient care. Key program elements included the development of an ergonomic assessment protocol, implementation of patient handling technology, decision algorithms to assist nurses in selecting the safest equipment, and techniques based on specific patient characteristics. The project was known as the Safe Patient Handling and Movement (SPHM) project.

Key elements of the Safe Patient Handling and Movement project

Ergonomic assessment protocol

This protocol was designed to conduct ergonomic assessments of patient care environments. The protocol consists of nine steps: collecting baseline data, identifying high-risk units, obtaining presite-visit data, identifying high-risk tasks, conducting site visits, analyzing risk, forming recommendations, implementing recommendations, and monitoring results to continuously improve safety. The rationale behind this approach was to ensure that the required patient handling infrastructure was in place prior to instituting a no-lift policy. A detailed algorithm of the ergonomic assessment may be found on the Web site of the Patient Safety Center in VISN 8 at http://www.patientsafetycenter.com.

Clinical decision algorithm

Six algorithms were developed to assist nurses in selecting the safest equipment and techniques based on specific patient characteristics and specific handling tasks, such as lateral movement of patients from bed to chair to toilet. Prior to evaluation in this study, these algorithms were tested at three Veterans Affairs medical centers in six clinical areas and were nationally reviewed and approved by VHA nurse executives. The algorithms on how to move patients include the following:

1. Transfer to and from bed to chair, chair to toilet, chair to chair, or car to chair.
2. Lateral transfer to and from bed to stretcher, trolley.
3. Transfer to and from chair to stretcher or chair to exam table.
4. Reposition in bed: side-to-side, up in bed.
5. Reposition in chair: wheelchair and dependency chair.
6. Transfer a patient up from the floor.

Safe handling equipment

The patient handling equipment installed included manual and mechanical lateral sliding aids, which assist with lateral patient transfers, and powered full body sling lifts (floor based and ceiling mounted), which are vertical transfer devices appropriate for physically dependent patients. Equipment also included powered standing assist and repositioning lifts, which provide an alternative to full body sling lifts, and gait/transfer belts that wrap around the waist of a patient, providing handles for a worker to grasp when assisting or transferring a patient. Peer safety leaders, known as back injury resource nurses (BIRNs), provided ongoing hazard identification and assured competency in the use and selection of the right lifting equipment for each patient.

Evaluation of the SPHM project

Our research attempted to answer the following questions:

1. How effective is the SPHM project in reducing the incidence and severity of injuries among patient handlers?
2. Using a cost-benefit analysis, what is the monetary return on investment of the SPHM project?

Study design and methods

The SPHM program was implemented in 23 high-risk units where the majority of injuries occurred. We used a pre/post design without a control group. Observations were made over the 9 months before and 9 months after implementation of the SPHM project to determine its efficacy in reducing injuries and providing associated cost savings.

Historically, the high-risk units have the highest incidence and severity of job-related musculoskeletal injuries and are most likely to benefit from an effective program intervention. In VISN 8, these units are typically spinal cord injury or nursing home care units. Unlike freestanding nursing homes that cater to elderly patients with reduced self-care capability, the VHA units typically have temporary patients recuperating from surgery or trauma. A total of 19 nursing home units and 4 spinal cord injury units located in 7 inpatient facilities were included in the study. The number of beds in these units averaged 57, with a range from 38 to 80 beds.

Sample

The study population was limited to a convenience sample of staff that agreed to participate in the study by signing an informed consent form. A total of 537 staff in the 23 units participated in this study, representing 93 percent of the staff assigned to those units. The number of full-time caregiver equivalents (FTEs) in these units averaged 28 and ranged from 19 to 35 FTEs. They comprised 173 nursing assistants (NAs), 135 licensed practitioner nurses (LPNs), and 198 registered nurses (RNs), with the remainder comprising other medical personnel, such as student nurses and health care technicians.

Cost-benefit analysis

The usefulness of cost-effectiveness and cost-benefit studies in allocation of resources in health care has been well-documented.[14] Cost-effectiveness analysis is a research method designed to help determine which health interventions provide the most effective and affordable medical care. An alternative to cost-effectiveness analysis is cost-benefit analysis, where a dollar value is placed on both the cost and the effectiveness of an intervention. Costs and benefits can be characterized as private and societal in nature, and much has been written on defining, measuring, collecting, and analyzing these costs and benefits to aid decisionmakers in a variety of health care settings.[15]

Cost categories used in evaluation

In our analysis we considered only the direct costs measurable in dollars and readily available in administrative databases. Indirect costs can be characterized as the loss of earnings due to morbidity or premature mortality or the value of lost output for the same reasons.[16, 17] Monetary estimates of the cost of pain and suffering by injured employees, cost of travel time related to transportation in accessing health care, and various opportunity costs associated with investment were not included in the analysis. Administrative costs related to billing workers' compensation (WC) for injured employees and the cost of medical treatment if employees sought care outside the VA system for work-related injuries were also not included in the analysis. The direct cost elements used in the cost-benefit analysis can be briefly summarized:

- **Capital costs:** Costs related to the acquisition, installation, and maintenance of safe handling equipment.
- **Training costs:** Cost of training nurses and nursing assistants on using the equipment over the lifetime of the project.
- **Direct costs related to treatment of injuries and lost productivity:**
    - Cost of medical treatment at VA facilities, including medical care, ancillary diagnostic services, medications, and occupational/physical therapy.
    - Cost to the U.S. Department of Labor of the VA facility providing medical care not identified above.
    - WC paid to the injured caregiver by VA facilities and the Department of Labor.
    - Cost of lost productivity when injured caregivers are on sick leave or on restricted duty.

Capital costs

Capital costs included costs related to the purchase, installation, and maintenance of patient handling equipment. A total of $774,000 was expended to purchase devices to assist in the handling of patients. Expenditures at the high-risk units ranged from $20,000 to more than $68,000, with a median expenditure of $29,000. The cost of accessories, mainly slings used to facilitate patient transportation and batteries for motors, totaled $72,000 initially over the 23 units. Batteries for the lift motors and belts are replaced every 2 years, and motors for operating lifts have an expected life span of about 10 years, a time period used as the lifetime of the project in our cost-benefit analysis. Per manufacturers' guidelines, we estimated the cost of maintenance at 4 percent of equipment costs to total $309,000 over 10 years, without adjusting for inflation.

Cost of training

Training on the use of the equipment required approximately 6 hours per caregiver and was provided by the manufacturer's representative. RNs, LPNs, and NAs constituted the majority of personnel who handled patients. A turnover rate of nursing personnel of 30 percent per year was documented among caregivers at the high-risk units. The high rate of turnover can be partly explained by caregivers moving to other positions in the VA system or elsewhere, retiring or leaving the system; the effect of demanding schedules and work-related injuries on caregiver burnout, especially in high-risk units, has been well documented in the literature.[18, 19] Based on salary and benefit tables, we initially estimated that a total of 78 caregivers (24 RNs, 14 LPNs, and 40 NAs) were trained at a total cost of $57,000. With an estimated 30 percent turnover of staff at the high-risk units in the VA system, we estimated an annual recurring, non-inflation-adjusted cost of $17,100 per year, including fringe benefits for training personnel. Peer safety leaders, known as BIRNs, were usually senior nurses who provided effective educational support to trainees during the initial period of training. The cost of their time was not included in the cost analysis.

Cost of medical treatment within the VHA

When an employee elects to be treated at a VHA facility for job-related injuries, all medical services are provided to the extent that the Medical Center Director determines that such treatment or service will not interfere with treatment or hospitalization of VA beneficiaries. Medical personnel at occupational health units provide onsite care to injured workers. The injured caregivers or private health insurance companies that cover them are not billed for medical services provided at VHA facilities. In addition to care and treatment, medical services also include pharmacy prescription beyond the 3-day limit for employees, prosthetic appliances and equipment, computed tomography imaging (CAT) scans, magnetic resonance imaging (MRI) scans, and other therapy and treatments.

When a worker is injured and medical treatment provided, the VA facility must bill the U.S. Department of Labor, Office of Workers' Compensation Payment (OWCP) for the estimated cost of care. The interagency rate ($240 in fiscal year 2002) is charged for WC claims to the Department of Labor and may not be reduced. The VHA directive states that if outpatient treatment extends beyond the emergency diagnosis and first treatment, OWCP shall be billed. Flat charges may result from lack of resources and missing documentation that facility managers need to accurately track treatment costs. The VA is self-insured concerning WC. Hence, though the facility is reimbursed for the medical care expenses, they nevertheless represents a cost to the VA because these payments are reflected in higher premiums paid to the Department of Labor for insuring workers in subsequent years.

In our study, the medical care provided to the employee was ascertained from a survey instrument that was circulated among all staff participating in the program. The instrument, the Cost Data Collection Log, includes patient-specific

characteristics, as well as detailed coding of initial assessment and triage, diagnostic tests, and any needed medical care, including pharmacy benefits and therapy for the injured person. Based on a survey of the occupational health departments, we characterized the initial and subsequent medical evaluations as being comprised mainly of 12 current procedural terminology (CPT) codes, which are normally used for diagnosis of ailments. Health insurance companies use the CPT coding system extensively as a measure of resource allocation and reimbursement. A physician evaluated the majority of injured patients, though some were seen initially by advanced registered nurse practitioners (ARNPs). The VA's decision support system database has a listing of all costs incurred by treating patients on an inpatient and outpatient basis. Costs are both facility and modality specific and are available by CPT, inpatient day, diagnostic test, pharmacy benefits, and therapy. We were able to obtain the average facility cost associated with each of the CPT codes in the facilities in VISN 8. The average facility cost for each code was used to determine the cost of providing care for each injured caregiver. Since the costs were unavailable by type of health care provider, each CPT was assigned the same cost, irrespective of whether the patient was seen by a physician or ARNP. We computed the average cost (including readings) of x-rays as $95, EKGs at $55, and CAT scans at $450. The vast majority of injuries did not require medication. Most prescriptions were pain relievers and available over the counter. None of the injured employees in our study required rehabilitation or occupational or physical therapy.

Cost of WC payments

Individual facilities provide cash payments up to 45 days to individuals who are absent from work for a prolonged period of time due to injury. After 45 days the Department of Labor continues payments to the injured individual upon certification by the facility. Injured employees qualify for WC if unable to return to duty 2 weeks after injury. The WC payments by individual facilities are not contained in a centralized database. We were unable to obtain data on specific payments to caregivers who were injured in the safe handling project. The total payment amount for each facility was available for each category of caregiver (RNs, LPNs, NAs). We used this information to estimate payments for each category of injured personnel participating in the safe handling project. We were able to obtain payments by the Department of Labor from a centralized database. We did not include in our analysis legal fees that may have been incurred by individuals or facilities concerning disability claims.

Cost of lost and restricted days due to injury

VA center employees who are disabled due to job-related injuries or illnesses are provided limited duty assignments consistent with their medical limitations and qualifications. A limited duty assignment may consist of assignment to a vacant position, or to a set of tasks/functions established for this purpose, or to a limited range of duties within the employee's current position. It is VA policy that employees who are seriously injured qualify for leave from duty, while less seriously injured personnel are restricted to no-lift duties. Many VA facilities

have directives assigning injured employees to no-lift duties such as filling prescriptions for patients and answering phones. The number of days that an injured person has restrictions placed on lifting or handling patients is referred to as restricted days. Lost days of productivity because of absenteeism from work due to injury represent a financial drain on the VHA, as injured employees are not temporarily replaced in their work units. An informal survey of nursing supervisors revealed that a replacement could substitute for an injured caregiver not handling patients at approximately half the salary and benefits of the employee, as measured by the Federal General Schedule levels. From administrative databases, we were able to determine the cost of lost and restricted days to the VA. Fringe benefits were computed at 28 percent of salaries.

Results

The preintervention period comprised the 9 months from May 2001 to January 2002. Installation of safe handling equipment in the 23 nursing home units and spinal cord injury units was completed in February 2002. To ensure that the two time periods for comparison purposes were indeed distinct, we used the period March 2002 to November 2002 for the postobservation period. Appropriate inclusion and exclusion criteria were identified to denote a reportable injury for evaluation purposes. Only those injuries resulting from direct patient handling and movement or patient care duties related to activities of daily living were considered in the evaluation of the efficacy of safe handling equipment. An algorithm was developed to identify injuries related to patient handling and movement tasks.

Reduction in injury incidence and severity

Injury data included a description of the incident (equipment used and task performed), time and date of incident, unit where incident occurred, days of work lost or modified (light or restricted), and information on nursing personnel injured. Injury incidence rates were defined as the number of reported injuries divided by the total number of hours worked on the unit, reported per 100 workers per year. After adjusting for FTEs and hours worked, the injury rate prior to the intervention was 24.0 per 100 workers per year, and 16.9 per 100 workers per year postintervention ($P < 0.05$). Injury rates in nursing home care units decreased from 26.4 to 18.8 per 100 workers, with the rate in spinal cord injury units falling from 12.0 to 7.7 per 100 workers.

Costs of medical treatment and productivity loss

Decreased costs associated with medical care provided at the facilities, compensation claims, and loss in worker productivity due to sick leave and restricted duty can be considered direct benefits of the technological and nontechnological interventions. Medical care costs billed to WC decreased from $62,702 to $16,260. The estimated cost of medical care at VA facilities not billed to WC increased marginally from $32,388 to $32,983. Initial triage and treatment

(from CPT codes) recorded a slight increase from $23,778 to $25,173. Cost of prescriptions fell from $3,350 to $3,150, while diagnostic tests declined from $5,260 to $4,660. Absenteeism from work due to injury decreased from a total of 256 days to 209 days. For injuries that resulted in more than 45 days of absenteeism, RNs reflected the greatest decrease, from 56 days to 5 days. The mean time to recuperate decreased from 14.2 days to 10.5 days. WC payments by facilities reflected this decrease by dropping from $173,763 to $86,881. The cost of lost time due to sick leave changed from $24,047 to $18,657. Approximately half of the injuries resulted in caregivers being placed on restricted duty. All compensation claims in both periods pertained only to short-term disability, and the estimated cost of lost productivity declined from $84,281 to $4,622 because of a substantial decrease in the total number of days in restricted duty—down from 1,311 to just 75 days. LPNs recorded the largest decrease in days of restricted duty, from 542 to 8 days. The median number of days in restricted duty per injury decreased from 16.4 days to 8.5 days ($P < 0.05$). Table 1 presents the cost comparisons before and after intervention.

Table 1. Cost comparisons: before and after program intervention

Cost element	Preintervention	Postintervention
Cost of medical care provided to injured employees billed to WC	$ 62,702	$ 16,260
Cost of care not billed to WC	$ 32,388	$ 32,983
WC paid to individuals by facilities	$173,763	$ 86,881
Cost of lost days (sick leave)	$ 24,047	$ 18,657
Estimated cost of days on restricted duty	$ 84,281	$ 4,622

WC = workers' compensation

The direct net benefit of the intervention can be characterized as the sum of the savings in the cost of medical treatment, WC, and dollar amounts assigned to lost and restricted days minus the annualized capital costs, including installation and training of employees. The estimated direct benefit of the intervention was $155,719 over the 9 months postintervention, which when annualized to 12 months amounts to $207,626, resulting in a net benefit of $2 million over a 10 year period (nondiscounted for present values of future benefits and costs). The payback period measures the time it takes for a project to break even or the expected number of years required for recovering the initial investment. The payback period for the Safe Patient Handling Project was calculated at 4.30 years without including the indirect benefits associated with reduced injury and patient satisfaction. Assigning a monetary cost to pain and suffering can be subjective and was therefore excluded from the analysis. Such indirect costs have been estimated as high as five times the direct costs, though an estimate of twice the direct costs is an accepted measure.[20] Savings in costs related to recruitment and retention of nurses can be substantial [21] in a workforce traditionally plagued by shortages. Hence, this study conservatively underestimates the social value of the intervention.

Another financial measure often used to measure a return on capital investment is the internal rate of return (IRR). It is defined as the discount rate that equates the present value of the project's expected cash inflows to the cash outflows, or the discount rate at which the net present value of the project is zero. The IRR methodology is frequently used to compare returns on competing projects. The higher the IRR, the more attractive it is as a financial investment. Computations yielded an IRR of close to 19 percent for the Safe Patient Handling and Movement Project. This compares favorably with similar studies in the literature.[22]

Limitations and conclusions

Limitations of this study include the lack of a control group to exclude the effect of other variables that may have impacted injury rates. From a cost analysis perspective, the effect of the no-lift policy and educational component of the Safe Patient Handling and Movement Project is unknown. The study was limited to nursing home care and spinal cord injury units in an acute care setting. The short duration of the pre- and postintervention periods does not allow for a rigorous study of trend analysis in morbidity and duration of back injury reduction due to the Safe Patient Handling and Movement Project. Its applicability in long-term care situations where patients are frail and elderly needs to be proven. Selection bias may have influenced the reporting of injuries, thus confounding the findings. As no information was available for care provided outside the VA system, the results probably biased the benefits of the comprehensive program and technology intervention. Though the injury rate was adjusted for FTEs, the number of handling tasks required for each unit, as projected by patient census and severity of disability, was not accounted for in the calculation of incidence of injury. This study complements other studies that indicate assistive devices in patient handling are useful in decreasing the frequency and severity of injuries among patient handlers if used prudently in a multifaceted approach that includes education and handling guidance.[23]

Future research needs to address the contribution of patients as agents of injury and the effect manual handling activities can have on them. Nursing education and continuing medical education credits should include curricula on safe patient handling, positioning and movement, and the use of lifting assistance devices. The insurance industry should be required to reflect nurse training coupled with no-lift policies and technology introduction in setting workers' compensation premiums. Environmental and workplace design of patient rooms should factor ergonomic principles into the need for nurses to twist, bend, and lift items from the floor and move furniture and equipment. The value of utilizing lifting teams[24] (as compared to individual lifting) should be evaluated. Lifting teams are necessary when certain factors, such as the medical condition of the patient, prohibit lifting by mechanical means. In these situations an assessment must be made of the minimum number of caregivers needed to assist in the transfer and appropriate resources provided.

Many elements in the findings of the Safe Patient Handling and Movement study were incorporated into the Occupational Safety and Health Administration guidelines proposed in early 2003. We hope this paper will facilitate further research of multifaceted approaches to prevent back injury among patient handlers.

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