

Health & Economic Benefits of a “Zero Lift” Patient Transfer System

A Facility Based Case Study

Co-Sponsors:

**The Smith House Nursing and
Rehabilitation Center,**
Stamford CT, 06905;

Next Health, LLC,
300 Wilson Ave.
Norwalk CT 06854

White Paper May 2014



AGILE *Life*
Restoring Independence

Case Study Objectives:

A 247 day study conducted at Smith House Nursing and Rehabilitation Center, Stamford CT, to assess patient, caregiver & facility benefits of “Zero Lift” transfer technology.

Case Overview:

This case study will compare costs of conventional patient transfer and repositioning methods to the costs of an automated “Zero Lift” solution in a skilled nursing facility. The patient, “Joe”, is 50 year old male who was diagnosed with a severe case of Guillian-Barre Syndrome (GBS) in May, 2012. In Joe’s case, it caused nerve inflammation, ascending paralysis requiring a tracheostomy, ventilator, Foley catheter and gastric tube for approximately 6 months while he was a patient at a previous rehabilitation center (PRC). While at PRC, Joe could not be moved using a sling lift without experiencing severe pain and therefore was unable to participate in rehabilitation. Joe was transferred to Smith House Nursing and Rehabilitation Center in Stamford, Connecticut. Joe’s plan of care required transfer in and out of bed for rehabilitation at least once a day, additional transfer for toileting, and repositioning while in bed. Based on facility information and observation, as well as Joe’s personal representations, Joe’s progress was accelerated, his independence enhanced, and there was substantial labor efficiencies as measured against conventional methods.

Keywords: disability, healthcare, assistive technology, safe patient handling, nursing home, home care, independence

Table of Contents:

1. Challenges of Lifting Residents
2. New Assistive Technology
3. Case Summary
4. Outcomes
5. Business Case:

Contributors:

Robert Mislow, Master of Health Administration, Health/Health Care Administration/ Management, Executive Director The Smith House Nursing and Rehabilitation Center; Stamford, CT

Christine Dunster, BSN, MA, CCAP - Clinical Director Next Health, LLC

John W. Madigan III, Esq. BA, JD, Founder, Director, Next Health, LLC

I. The Challenges of Lifting Residents in Nursing Homes

One of the major issues in nursing homes is the frequent heavy lifting and repositioning of residents that exceed the lifting capacity of most caregivers. Numerous studies have shown that training caregivers how to use proper body mechanics to lift residents is not an effective prevention measure because lifting the weight of adult patients is intrinsically unsafe. Because of the trend towards shorter hospital stays, residents who are being transferred to nursing homes are becoming increasingly frail. Factors that contribute to the difficulty of lifting and moving a resident include the size and weight of the resident, combativeness, and propensity to fall or lose balance. In addition, performing resident transfers in the confines of small bathrooms and rooms cluttered with medical equipment and furniture works against the caregiver being able to use good body mechanics. When lifting or repositioning a resident in bed, the bed generally prevents the caregiver from bending his/her knees to assume the proper posture for lifting. The forward bending required for many patient lifting and moving activities places the caregiver's spine in its most vulnerable position. Even under ideal lifting conditions, the weight of any adult far exceeds the lifting capacity of most caregivers, 90 percent of whom are female. [1.]

I. Patient Needs:

When the human body is immobile, it deteriorates after a short period of time. Early and frequent mobilization of a patient or resident is thus critical to maintaining or regaining health. Many providers observe that the earlier a patient is mobilized, the better the outcome. Conversely, many immobility-related adverse or "never" events, some with long-lasting consequences, are linked to late or insufficient mobilization. [2]

The effects are often a deterioration of numerous body systems, and increased dependence on caregivers to assist with activities of daily living.

Complications associated with chronic immobility include patient injury, development of pressure ulcers, muscle atrophy, metabolic decline, joint contractures, microvascular dysfunction, atelectasis, thromboembolic disease, and psychological decline. These complications are exacerbated in the case of a bariatric patient



VISN 8 (VA) Patient Safety Center in Tampa FL has developed 13 algorithms that define how many caregivers and what devices are required under specific circumstances. The cost evaluation and assumptions applied in this analysis are based on those guidelines specified by the VA. Caregivers report that helping patients into and out of bed and transfer for toileting are the most difficult tasks.[3, 4.]

Conventional Lift Technique

Benefits for Residents

- Improved quality of care
- Improved resident safety and comfort
- Improved resident satisfaction,
- Reduced risk of falls, being dropped, friction burns, dislocated shoulders
- Reduced skin tears and bruises
- More frequent movement resulting in better health outcomes

II. Caregiver Needs:

One major source of injury to healthcare workers is musculoskeletal disorders (MSDs). In 2010, nursing aides, orderlies, and attendants had the highest rates of MSDs. There were 27,020 cases, which equates to an incidence rate (IR) of 249 per 10,000 workers, more than seven times the average for all industries. [5] Researchers have found that 81 percent of nurses are affected by MSDs.[6] As significant as the existing injury data appears for patient caregivers, many musculoskeletal patient handling injuries are not reported. [7] According to some estimates, at least 50 percent are not reported at the time of initial injury. [8] Because of this, we are not aware of the true extent of caregiver injury or the consequences for patient care.

The level of risk in already high-risk tasks can be increased by their frequency and duration; the patient's size, weight, level of cooperation, and unpredictability; transfer distance; space constraints; awkward positions; and the availability of technology to reduce the risk. Caregiver and patient health outcomes have direct and indirect economic impact on facilities.

Some examples of patient handling tasks that may be identified as high-risk include: transferring from toilet to chair, transferring from chair to bed, transferring from bathtub to chair, repositioning from side to side in bed, or lifting a patient up in bed.

Facilities that have implemented injury prevention efforts focusing on resident lifting and repositioning methods have achieved success in reducing work-related injuries and career threatening MSD occurrences among staff. Providing a safer and more comfortable work environment has also resulted in additional benefits for some facilities, including increased productivity, improved employee morale, and increased resident comfort. [6]

However, conventional patient assistive lift equipment requires significant caregiver intervention and

High-Risk Tasks Included in VA Patient Care Ergonomic Guidelines

- Transfer of patients to and from bed to chair, chair to toilet, chair to chair, or car to chair
- Lateral transfer of patients to and from bed to stretcher or trolley
- Transfer of patients to and from chair to stretcher, chair to chair, or chair to exam table
- Repositioning of patients in bed, both side to side and up in bed
- Repositioning patients in wheelchair or dependency chair
- Transfer of patients up from the floor
- Tasks requiring sustained holding of limb(s) or access to body parts of bariatric patients
- Transporting bariatric patients (stretcher, wheelchair, walker)
- Bariatric toileting tasks

Source: Patient Care Ergonomics Resource Guide: Safe Patient Handling and Movement (Tampa: Veterans Administration Patient Safety Center of Inquiry, 2001); www.visn8.va.gov/ Patient Safety Center/Safe Pt

patient manipulation and lifting. Awkward reaching, or what is sometimes referred to “cantilever care”, often leads to an accentuation of the actual weight that is being moved. Capt. James W. Collins, Ph.D., M.S.M.E. Associate Director for Science, Division of Safety Research National Institute for Occupational Safety and Health (NIOSH) testified before congress that:

“NIOSH recommends that no caregiver should manually lift more than 35 lbs. of a person’s body weight for a vertical lifting task. NIOSH further recommends that when the weight to be lifted exceeds this limit, assistive devices should be used. These recommendations have been adopted by the Veterans Health Administration (VHA) and incorporated into its current patient handling recommendations and patient handling algorithms. Moreover, other major interest groups, such as the American Nurses Association (ANA), National Association of Orthopaedic Nurses (NAON), and Association of Perioperative Registered Nurses (AORN) have all adopted similar patient handling guidelines that recommend use of technology-based solutions for patient handling and movement.[8,9,10]”

Given the increasingly hazardous biomechanical demands on caregivers today, it is clear the healthcare industry must rely on technology to make patient handling and movement safe. Patient transfer and assistive devices are key components of any effective program to control the risk of injury to staff associated with lifting, transferring, repositioning, or movement of patients.

Benefits for Caregivers

- Reduced risk of injury
- Improved job satisfaction
- Increased morale
- Injured caregivers are less likely to be re-injured
- Pregnant caregivers can work longer
- Staff can work to an older age
- More energy at the end of the work shift
- Less pain and muscle fatigue on a daily basis

III. Facility Goals:

The cost of labor as measured in time required to transfer or reposition a patient is the most measurable cost component associated with patient transfer. The current standard for mechanical assistance in institutions is a sling lift system (e.g., Hoyer Lift). However, performing a transfer with a sling lift requires two or more specially-trained caregivers using extreme caution. Even with transfer and repositioning devices, staff and patient suffer injuries, resulting in workman’s compensation claims, medical bills, and civil and criminal lawsuits. In addition, difficulties in the transfer procedure can tempt caregivers to limit transfers, further jeopardizing patient well-being.

A study was recently conducted at The Christ Hospital TM, a 500 bed acute care Magnet facility in Cincinnati, Ohio, in which multiple automated repositioning systems were used in lieu of traditional manual lifting for a total of 146 patient days. Included in the data was

information specific to the time and number of caregivers required to move each patient with an automated device as compared to conventional approach to repositioning and transfer.

Table 1: Christ Hospital ROI Study 2012-2013

No. of AgileLife PTS	Lift/Reposition Eliminated p/yr. ¹	Patient Disturbances Eliminated p/yr. ²	Staff Distractions Eliminated p/yr. ³	Inefficient Time Saved hrs. p/yr. ⁴	At Risk Time Eliminated p/yr. ⁵
100	299,702	130,305	169,397	37,767	14,334
300	899,105	390,915	508,190	113,300	43,001
500	1,498,508	651,525	846,983	188,834	71,668

Source: The Morel Company 2013 (see Exhibit A for assumptions)

In addition to the direct labor savings, indirect costs will be reduced significantly. Indirect costs include items such as employee replacement, incident investigation time, supervisor time, staff training and staff morale, social cost of pain and suffering, possible resident injury, breakup of work teams, administrative time, and paid overtime.

Commitment to a PHAM program demonstrates a high commitment to safety in the workplace. A well-executed initiative also helps enhance caregiver recruitment and retention, and attain accreditations such as:

- TL2EO – Use of technology to support nursing goals
- TL3EO – Outcomes from efficiency process changes
- EP3EO – Nurse satisfaction
- EP30EO – Workplace safety improvements for nurses
- EP35EO – Patient satisfaction

Benefits for Facilities

- Reduced number and severity of staff injuries
- Improved resident safety
- Reduced workers' compensation medical and indemnity costs
- Reduced lost workdays
- Reduced restricted workdays
- Reduced overtime and sick leave
- Improved recruitment and retention of caregivers
- Fewer resources required to replace injured staff

2. New Assistive Technology

NEXT HEALTH™ now offers a system that can reduce care giving cost while contributing to better outcomes. The **NEXT HEALTH AgileLife™** Patient Transfer and Movement System (PTS) is an automated patient transfer and therapy device. There is no straining or lifting. With the ability to safely, easily and frequently transfer a bedridden individual, the patient, caregivers and facilities can all benefit.

The AgileLife™ PTS is an integration of several assistive technologies that together automate the transfer of immobile individuals to and from a hospital bed and wheelchair/commode chair, thus eliminating any lifting. The PTS is the only “zero lift” patient transfer solution. The **PTS** includes a fully powered hospital bed with head, foot and height adjustments, a fully integrated yet detachable wheelchair/commode chair, and a transfer function that gently moves the bed bound individual to and from the bed. The **PTS** has a “Sheet Up/Down” function so that a caregiver can reposition the patient towards the head or foot of the bed without any need to tug or pull. These automated processes eliminate significant caregiver and patient cost, while improving outcomes for all constituents in the long term care continuum.

Additional key features include the ability to integrate several therapeutic pressure redistribution mattresses and seat cushions. The system also includes in-bed scales to continually monitor an individual’s weight, as well as patient movement and positioning.

Two sets of controls enable either independent use or caregiver provided assistance. The PTS is designed for home or institutional use and can transfer patients weighing up to 500 pounds.

3. Case Summary: Joe’s Story

Patient Profile: Joe is a 50 y/o male, 5’4” and averaged 190 pounds during the 247 day evaluation period. He was diagnosed with a severe case of Guillian-Barre Syndrome (GBS) in May, 2012. He is currently being treated at Smith House Nursing and Rehabilitation Center.

GBS is a serious health problem that occurs when the body’s immune system mistakenly attacks part of the nervous system. This leads to nerve inflammation that causes muscle weakness or paralysis and other symptoms. In Joe’s case, it caused ascending paralysis requiring a tracheostomy, ventilator, Foley catheter, and gastric tube for approximately 6 months while he was a patient at a previous rehabilitation center (PRC). There is no cure for GBS and treatment is aimed at reducing symptoms, treating complications, and speeding up recovery. Joe experienced a number of complications secondary to the disease process, treatment complications and immobility at another Medical Center where he was hospitalized prior to PRC. . Prior to Smith House (SH) Joe had multiple conditions including PNA x 2, aspiration of food/liquid, frequent UTIs, C-Difficile infection x 2, and incontinence. He was anxious, depressed and in pain. Once Joe’s diaphragm began to resume function and the breathing tube was removed, his further recovery was hampered by the fact that he was in too much pain to be transferred by a mechanical lift to a wheelchair to go for physical (PT) and occupational (OT) therapies. He also experienced skin bruising, abrasions and a fear of falling/injury from the mechanical lift. Insurance would no longer cover his stay at PRC and he was transferred to SH for continued skilled nursing care and to receive the necessary PT and OT since he was unable to perform any ADLs (“activities of daily living”) including feeding himself. The Agile Life device enabled Joe to get out of bed to attend therapy without pain, fear or anxiety. Over a 247 day period, Joe was transferred to and from bed daily. In addition, Joe

was repositioned in bed (sheet-up/down) frequently. There were a total of 2,090 patient repositioning activities and 490 chair or bed transfers during the 247 patient days. The Total 247 day activities and average daily patient transfer activities are shown below.

Table 2: Total PTS activity over 247 day case study.

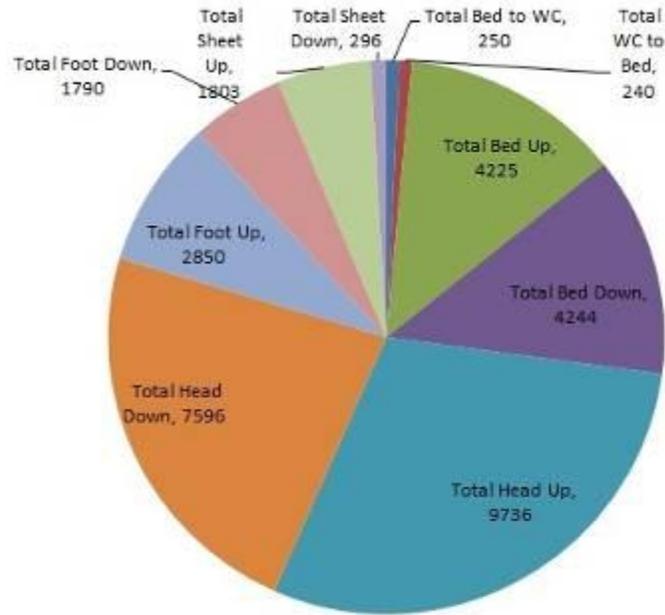
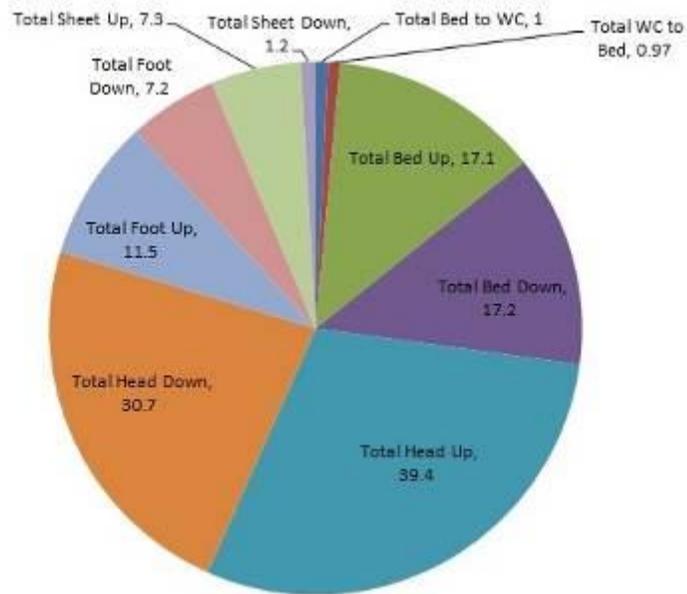


Table 3: Average daily activity over 247 day case study.



Source AgileLife Patient Transfer & Movement System Data Log

Joe did not utilize the commode chair during the test but subsequently began using the feature. For purposes of this evaluation, it is assumed that Joe would have transferred twice daily for toileting, one half of the prescribed number.

4. Status: Cost Savings and Better Outcomes

The PTS was delivered and installed at Smith House (SH) on 7/24/13. The caregivers and the patient at SH were trained on the system by Next Health (NH) certified trainers. Daily follow-up, including weekends, was provided by NH with the assigned account manager visiting the patient during transfer hours for the initial eight weeks in order to validate activity and assure proper use. In addition, PTS data tracking log provided continual system monitoring to verify patient activity. Follow up has continued since then with, 24 hour service available as needed.

Joe's paralysis has been gradually reversing and he is slowly regaining feeling, muscle strength and mobility but he remains in pain. He is now able to turn himself in bed, feed himself and brush his teeth with minimal assistance (has difficulty grasping) but remains unable to perform most ADLs. He has improved mobility and has had no further episodes of PNA, no recent UTIs and no skin integrity issues. He continues both PT and OT services, is able to stand with assistance. However he suffers from foot drop which may be impeding this progress. His doctors anticipate his recovery process will continue for another 4 – 6 months. The Executive Director at SH feels the Agile Life device has fostered a sense of independence for Joe, as well as caregivers since there is no longer a need for two staff members to transfer Joe, or boost him in bed. He added that it has been helpful in preventing cardiovascular, pulmonary and skin integrity issues for Joe. It is believed that he will be transferring a minimum of four times a day once the commode chair is used. SH administration believes it will aid bowel training and help avoid staff injuries and save time since SH would otherwise use a mechanical lift plus a minimum of two caregivers to transfer Joe to the toilet. Joe is also eager to be less dependent on others and "be there" for his seven year old son. Joe's charge nurse, Sue, stated that the PTS enabled Joe's healing to progress due to the safe and gentle transfer to the wheelchair to go for PT and OT. Prior to having the PTS, Joe refused to use the mechanical lift due to the acute pain and fear associated with it, and as a result he was virtually bed-bound. Both Sue and the occupational therapist, Manjila, observed that Joe's skin integrity has been maintained due to the PTS and he has experienced reduced depression and anxiety levels. Joe initially experienced a reduction in the frequency of UTIs and recently stated that he has not had a recurrence in "several months". The nurses and CNAs "love" the PTS and feel it has also prevented staff injuries. The staff repeatedly referenced the "sheet up" function as a significant time saver and eliminating physical strain on both the caregivers and patient. Typically, the two required staff members are not always available when a patient needs to be boosted up in bed, and the primary attendant must wait for the availability of a second caregiver.

5. Business Case

In an uncertain and increasingly cost-constrained health care environment, it is critical that administrators demonstrate that investment in assistive technology and the necessary training is cost-effective operationally and will produce better outcomes as well. In addition, the case must be made that, among the many competing priorities for funds to improve patient care, a new assistive technology should be the priority. In making that determination the direct cost impact as well as the consequential costs and quality of life elements must be assessed.

Utilizing the time and labor assumptions associated with patient transfer studies and applying them to Joe’s level of daily activities, the reduction in direct labor cost can be extrapolated based on the hourly savings reflected in Table 3 below. In this case, over a 247 day period, Joe was repositioned in bed an average of 8.5 times per day, was transferred in and out of bed for rehab once a day (two transfers), and as part of his plan to prepare to transition home, Joe will transfer for toileting twice per day (four transfers). In addition, Joe’s weight fluctuation is such that facility policy mandates that Joe be weighed once a week (two transfers). The reduction of time per transfer and repositioning, coupled with the elimination attendant labor required when transferring with the AgileLife PTS, can result in significant direct cost reduction associated with patient activities as shown in Table 4.

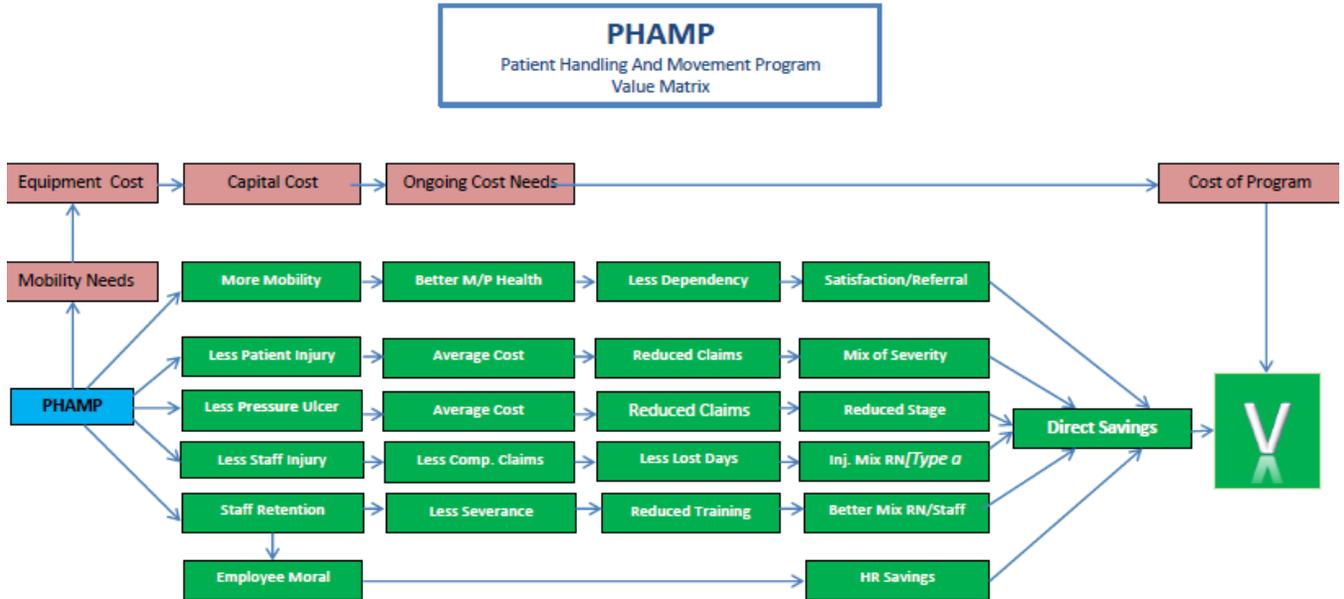
Table 4

No. of AgileLife PTS	Lift/Reposition Eliminated p/yr. ¹	Patient Disturbances Eliminated p/yr. ²	Staff Distractions Eliminated p/yr. ³	Inefficient Time Saved hrs. p/yr. ⁴	At Risk Time Eliminated hrs. p/yr. ⁵
25	146,205	112,465	146,205	25,762	19,817
50	292,410	224,931	292,410	51,525	39,634
75	438,615	337,396	438,615	77,287	59,452

Source: Next Health, LLC PTS System Data Log

The analysis should not stop at the direct labor savings. Applying Stanford University Medical Center analysis, both direct cost, such as labor, and indirect costs and derived benefits are to be assessed in determining the worthiness of an investment in assistive technology. The Facility Guidelines Institute (FGI) published the 2010 edition of the Guidelines for Design and Construction of Health Care Facilities. The guidelines are used by more than 42 states and several federal agencies to regulate health care facility design and construction. The 2010 edition includes a patient handling and movement assessment to be performed during the planning process. In an environment where programs must be nimble enough to address a myriad of unique patient conditions, yet sufficiently disciplined to adhere to regulations, many of the facilities have followed Six Sigma principals in evaluating an implementing programs. (see sidebar) Factors to be considered when evaluating direct and indirect costs and benefits of Patient Handling and Movement Programs are set forth in Table 5.

Table 5



Source: Martin H. Cohen, FAIA, FACHA, Chair Gaius G. Nelson, RA, Vice Chair David A. Green Roger Leib, AIA, ACHA Mary W. Matz, MSPH, CPE Phillip A. Thomas, AIA: Patient Handling and Movement Assessments: A White Paper © 2010 Facility Guidelines Institute

In addition, OSHA provides standards in its 2009 edition of *Ergonomics for the Prevention of Musculoskeletal Disorders: Guidelines for Nursing Homes*. The most important recommendation in the OSHA nursing home guideline was that **“manual lifting of residents be minimized in all cases and eliminated when feasible.”** [11]

Although studies of patient outcome measures are few, indications are that positive relationships exist between the programmed use of safe assistive technology and improvements in the overall quality of patient care as reflected in specific outcome measures such as reduced skin tears, falls, and increased mobilization. As noted previously, when mobilization is limited, prolonged bed stays may result in diminished health status and functioning of patients, leading to extended and/or repeated stays in health care facilities-with associated costs. [12]

Introducing new technology has been shown to improve caregiver efficiency, substantially decrease workers' compensation costs, and give a return on investment ranging [13] from two to four years.[14] Reductions in indirect costs caused by increased staff morale, decreased need for retraining and overtime pay, plus improvements in the quality of care and decreased associated costs have been estimated as high as five times the direct costs, but more commonly are around two times. [15]

6. Conclusion:

Prior to his arrival at Smith House Nursing and Rehabilitation Center, Joe was virtually bed bound and suffering from several co-morbidities. Without the use of the AgileLife PTS, Joe would not have progressed as rapidly as he has. Joe's charge nurse, Sue, stated that the PTS enabled Joe's healing to progress due to the safe and gentle transfer to the wheelchair to go for PT and OT. If the criteria developed Facility Guidelines Institute for valuing assistive technology is applied, the AgileLife PTS would result in a rapid return of capital investment, with better health outcomes. Joe feels more comfortable, personally empowered, and hopeful for a full recovery and said the Agile Life has been a "game changer" for him. In his words, "*the Hoyer caused extreme pain and this (the PTS) is totally comfortable. I felt a sense of freedom when this (the PTS) came and can't say enough about it.*"

Six Sigma & Safe Patient Mobilization

Two hospitals significantly improved their employee injury rates from patient mobilization tasks by using the six sigma process.

- **Define:** Develop the patient's history and learn why s/he is in the hospital, thus defining the project of making the patient well.
- **Measure:** Nursing gathers data, such as input/output, test results, etc., to obtain a baseline of the patient's health status or condition.
- **Analyze:** Nursing and the physician analyze the patient's data to determine next steps toward making the patient well.
- **Improvement:** Accomplished by administering medication to the patient to make the patient well.
- **Control:** Control measures for a successful patient outcome are implemented by nursing staff throughout the patient's stay. These control measures follow standard practices of care recommended by nursing protocols to ensure that the hoped-for standard results in the patient being successfully treated and discharged.

EXHIBIT A

Assumptions for Time Savings Evaluation *Source: The Morel Company 2013*

(a) 85% Average occupancy rate

(b) 4.2 Average number of patient repositionings per patient per day

(c) 8.3 Average time in minutes to manually pull up a patient in bed by caregiver(s)

(d) 2.3 Average number of caregivers required to manually pull up patient

(e) 1.7 Average time in minutes to move patient with the Hercules

1 Staffed Beds x (a) x 365 Days x (b) x (d) $500 \times 85\% \times 365 \times 4.2 \times 2.3 = 1,498,508$

2 Staffed Beds x (a) x 365 Days x (b) $500 \times 85\% \times 365 \times 4.2 = 651,525$

3 Staffed Beds x (a) x 365 Days x (b) x (d - 1) $500 \times 85\% \times 365 \times 4.2 \times (2.3 - 1) = 846,983$

4 (Staffed Beds x (a) x 365 Days) x ((b x ((c x d) - e)) ÷ 60 minutes) $(500 \times 85\% \times 365) \times ((4.2 \times ((8.3 \times 2.3) - 1.7)) \div 60) = 188,834$

5 (Staffed Beds x (a) x 365 Days) x (b x (c - e) ÷ 60 minutes) $(500 \times 85\% \times 365) \times (4.2 \times (8.3 - 1.7) \div 60) = 71,668$

Exhibit B

Case Study Assumptions for Savings Measurement

- (a) 85% Average occupancy rate
- (b) 14.5 Average number of patient repositioning per patient per day
- (c) 8.3 Average time in minutes to manually pull up a patient in bed by caregiver(s)
- (d) 16.5 Average time in minutes to transfer patient to chair from bed with sling lift
- (e) 2.3 Average number of caregivers required to manually pull up or transfer a patient
- (f) .5 Average time in minutes to reposition patient with the AgileLife PTS
- (g) 2.0 Average time in minutes to transfer to chair/bed using AgileLife PTS
- (h) 8.5 Average number of daily repositions per 247 day case study
- (i) 6.0 Average number of daily transfers for rehab & toileting per 247 day case study
- (j) 7.8 Time saved in minutes using PTS vs. manual reposition
- (k) 14.5 Time saved in minutes using PTS vs. sling lift
- (l) \$21.50 Hourly cost associated with patient transfer per BLS 2011
- (m)

1. Staffed Beds x (a) x 365 Days x (b) x (e-1.3): (25); (50); (75); x 85% x 365 x 14.5 x 1.3 = 146,205

2. Staffed Beds x (a) x 365 Days x (b): (25); (50); (75); x 85% x 365 x 14.5 = 112,465

3. Staffed Beds x (a) x 365 Days x [(c-f) + (d - g)] x (e-1) ÷ 60 minutes (25); (50); (75) x 85% x 365 x (7.8 + 16) x 1.3 ÷ 60 = 100,831

4. Staffed Beds x (a) x 365 Days) x m[(h x j) + (l x k)] ÷ 60 minutes) (25); (50); (75); x 85% x 365 x 1.3 [(8.5 x 7.8) + (6 x 14.5)] ÷ 60 = 20,075 per 25 staffed beds

5. Staffed Beds x (a) x 365 Days) x [(c-f) + (d-g)] ÷ 60 minutes x (l) (25); (50); (75); x 85% x 365 x [8.5 x (8.3 -.5) + (16.5-2)] ÷ 60) x \$21.50 = 20,075 hrs. p/yr. x \$21.50 per 25 staffed beds

Bibliography:

1. Fragala, G., PhD, PE, CSP. 1996. Ergonomics: How to Contain On-the-Job Injuries in Health Care. Joint Commission on Accreditation of Healthcare Organizations.
2. Gina Kolata, "A Tactic to Cut I.C.U. Trauma: Get Patients Up," New York Times, January 11, 2009.
- 3, 4. Neugaard B, Andresen EM, DeFries EL, Talley RC, Crews JE. Characteristics and health of caregivers and care recipients-North Carolina, 2005. *Morbidity and Mortality Weekly Report*. 2007;56(529-532). # Rigby H, Gubitz G, Phillips S. A systematic review of caregiver burden following stroke *Int J Stroke*. 2009;4 (4):285-292.
5. Linda Enos, Safe Patient Handling A Summary of the Issue and Solutions: "Evidence Base; at <http://www.hcergo.org/SPH%20Aug%2009%20Facts%20and%20References.pdf> , accessed on April 6, 2014.
7. Arjo USA, Injury Prevention Program Data.
8. Waters T. (2007) When is it safe to manually lift a patient? *American Journal of Nursing*. Vol. 107(8): 53-59.
9. AORN Workplace Safety Taskforce. (2007). *Safe Patient Handling & Movement in the Perioperative Setting*. Denver, CO: Association of periOperative Registered Nurses (AORN).
10. de Castro, A.B. (2006). Handle With Care[®]: The American Nurses Association's Campaign to Address Work-Related Musculoskeletal Disorders. *Orthopedic Nursing*, 25, 6, 356-364. Reprinted from de Castro, A.B. (2004). Handle With Care[®]: The American Nurses Association's Campaign to Address Work-Related Musculoskeletal Disorders. *Online Journal of Issues in Nursing*. Vol. #9 No. #3.
11. NAON (2009) Safe Patient Handling. Special Issue. *Orthopaedic Nursing*, 28(2S) 2-35.
12. OSHA (2009) *Ergonomics for the Prevention of Musculoskeletal Disorders: Guidelines for Nursing Homes*. U.S. Department of Labor, Occupational Safety and Health Administration. Document No. OSHA 3182-3R.
13. Chris Allen, Paul Glasziou, and Chris Del Mar, "Bed rest: A potentially harmful treatment needing more careful evaluation," *The Lancet* 354 (October 9, 1999): 1229-33.
14. W. S. Marras, G. G. Knapik, and S. Ferguson, "Lumbar spine forces during manoeuvring of ceiling-based and floor-based patient transfer devices," *Ergonomics* 52, no. 3 (2009): 384-97.
15. Occupational Health and Safety Agency for Healthcare (OHSAH) in British Columbia, "Ceiling lifts as an intervention to reduce the risk of patient handling injuries: A literature review" (Vancouver, BC: OHSAH, 2006).

