Intra-unit patient transports: time, motion, and cost impact on hospital efficiency

by Ann L. Hendrich, Nelson Lee

Executive Summary

* This study of intra-hospital patient transfer analyzes the process, time, personnel, and cost of the transport procedure.

* Opportunities exist to increase the efficiency of the execution of this discrete process as well as gain overall system efficiency in terms of bed utilization and management.

* The study revealed only 12% efficiency in the transfer process.

* Delays due to administrative requirements, unavailable resources, disruptions, and communication breakdown were cited as causes of the low productivity in the current process.

* Careful consideration for the three primary reasons for transfer--need for additional technology, need for higher skilled staff, and need for higher hours per patient day--offer the opportunity to rethink the drivers of transfer through technology planning, staff training, and staffing flexibility.

TODAY, HOSPITALS ARE FACING an uncertain future with capacity issues, labor shortages, patient safety concerns, shrinking revenue, and increasing consumer demands for quality. The prevalence of traditional hospital design models and patient flow patterns intensifies these issues. In addition, most hospitals are desperately seeking ways to improve clinical quality while reducing direct overhead costs (labor) and capital. Thus, a significant opportunity rests with understanding the impact of patient transports on the hospital at the macro level. Each patient transport requires additional hospital capacity and results in direct overhead expense for facilities, labor, and equipment, as well as costly "waste time." Thus the purpose of this transfer study was to: (a) document the processes, labor, time, and costs of transferring patients between nursing units in the hospital; (b) calculate a process efficiency factor for the transport event; and (c) calculate an inefficiency factor for the hospital system relative to the transfers. In doing so, a significant opportunity factor for improving hospital performance emerges in at least two areas:

1. Optimizing procedures to improve transport efficiency.

2. The potential for improving overall hospital efficiency and even reducing the required number of beds.

Background

Intrahospital transfers can have a profound detrimental and even life-threatening effect on patients and health systems. Patients are at increased risk during transfers due to decreased accuracy of monitoring during the transfer process, as well as physiologic changes which can occur during transfer (Daly, Beale, & Chang, 2001; Minckley et al., 1979; Wallis, Davies, & Shearer, 1997). Intrahospital transfer also causes confusion and significant stress on patients and families (Coyle, 2001; Leith, 1999; Odell, 2000; Poe, 1982; Schwartz & Brenner, 1979).

In addition to patients and families, hospital resources are compromised by transports. First, a significant amount of direct and indirect health care workforce labor is inherent in acute care hospital patient transports (Besserman et al., 1999; Bramen, Dunn, Amico, & Millman, 1987;

Brokalaki et al., 1996; Poe, 1982; Schwartz & Brenner, 1979). Resulting costs can be directly attributed to the movement of patients between rooms on the same unit (intra-unit), between nursing units (inter-unit), and to and from procedures and diagnostics. Each patient transport adds to the workload index of direct and indirect caregivers and may contribute to overall error index of medications, caregiver injury (Saywell, Woods, Hoomes, Sechrist, & Nyhuis, 1987), and a variety of delays and missed treatments.

Second, reimbursement and revenue has historically encouraged multiple patient bed types within the hospital. Today, this trend is changing due to changes in reimbursement from The Centers for Medicare & Medicaid Services guidelines and the Prospective Payment System. The future reduction of revenue, with bed types, will likely eliminate some of the previous hospital incentive to add more levels of care within the same facility. Because of this, fewer patient transports and more flexible patient rooms will become increasingly essential for successful health care systems (Hendrich, Fay, & Sorrells, 2004).

Finally, transports are complicated by a growing health care workforce shortage, a national increase in emergency room utilization, and a significant increase in hospital occupancy rates. Steady occupancy rates of 80% to 95% frequently reach full inpatient bed capacity. Hospitals at capacity cause bottlenecks of patients within the system, resulting in tedious and even life-threatening hospital and emergency room diversions, as well as critical delays in patient care (Anonymous, 2001; Brewster, Rudell, & Lesser, 2001; Oddi & Huerta, 1990; Spencer, 2002).

Purpose

Patients are moved for three primary reasons within the hospital: (a) the technologic capability of the headwall, (b) the clinical skill of the caregiver, and (c) the nursing hours per patient day which helps determine how patients are assigned to beds. A significant opportunity rests with understanding the impact of patient transports on the hospital at the macro level. The purpose of this transport study was to document the processes, labor, time, and costs of transferring patients between nursing units in the hospital; to calculate a process efficiency factor for the transport event; and to calculate an inefficiency factor for the hospital system relative to the transfers. The time and personnel required to transport patients can be converted into workload index, hours of care, and full-time equivalents required to move the patients. In doing so, it is possible to measure the overall efficiency of the transport process. The movement of patients to different units requires additional hospital capacity and results in direct overhead expense for facilities, labor, and equipment.

Methodology and Definitions

To create a valid study methodology, 21 random patient transports were observed for the steps required to move a patient (inter/intra-unit). These transports provided adequate data to perform a statistical "power" analysis to calculate the needed study sample size. Thus, it was determined a sample study size of 167 transports would represent a 95% confidence level. The protocol and study methodology were reviewed by the institutional review board and study approval was granted. Three registered nurses were trained as research assistants (RA) and they rotated observational periods. The transport observations were completed in a large, tertiary-level care facility (750 beds), over a 5-month period. The RAs observed more than 200 random transports representing various days of the week and shifts. The RAs did not interrupt or alter the transfer process during the observation.

As a result of these observations, a standardized instrument depicting each step necessary to complete a patient transfer was used for data collection. The Hendrich Transfer Log, a 22-item tool (see Figure 1), was used by trained registered nurses acting as RAs for the purpose of this study. The transport "time zero" or start time is when the physician or nursing order was written to transfer the patient. Transport time was considered complete when the patient was in the new location and a new admission assessment was completed. The duration of each task (pre-transfer, transfer, and post-transfer) was tracked to create a general timeline of tasks and events. The study showed that most of the wasted time occurred in the pre-transport phase of the process (see Figure 2) (Hendrich & Lee, 2005).

[FIGURES 1-2 OMITTED]

Average hourly wage. The number of participating workers, their job classification, and the time and labor spent in the transfer were recorded in the data collection tool. Total labor by job classification was calculated and multiplied by an industry average hourly cost rate to provide the total labor cost by job classification. The average hourly wage was calculated by summing the total labor cost of all job classifications and dividing by the sum of the total labor time of all job classifications.

The labor by "job classification" per transfer was also calculated and an industry average hourly cost rate was applied (see Figure 3). The Institute of Medicine reports: "RNs working full-time in hospitals earned on average about $47,759 per year ... staff nurses providing direct care to patients (the majority of employed nurses) earned an average of $42,133 annually in 2000 ... recent data indicate that hospital nurses received base salary increases of approximately eight percent in 2002" (Bolster, Hawthorne, & Schubert, 2003; Bureau of Labor Statistics, n.d.; Institute of Medicine, 2004; Spratley, Johnson, Sochalski, Fritz, & Spencer, 2000).

Direct labor cost per transfer. The direct labor cost per transfer was calculated by multiplying the time of the average transfer by the average wage (see Figure 4).

Transfer process efficiency. An important objective of this study included documenting the "waste time" and the cost that occurs due to "waste time" in a patient transfer. Common causes of "waste time" include:

* Delays caused by administrative requirements--physician orders, logging the transfer into the electronic information system or log book, bed not requested or call lag time

* Delays caused by bed control--unavailable beds, unavailable resources (beds, staff)

* Delays caused by unavailable resources--nurses not available, receiving unit not able to take the patient (bed cleaning)

* Delays caused by disruptions--transfer starts but disruptions occur (nurse gets interrupted or distracted, lack of supplies or equipment needed)

* Delays caused by breakdowns in communication--nurse to nurse, unit to bed-control, nurse to physician or unit secretary, multiple hand-offs are disparate

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Waste time or waiting time can be referred to as "non-value-added time," or time that elapses without added value or intervention (see Figure 5). The average and median non-value-added times from all transfers were calculated by subtracting the transfer event time from the total transfer time. Efficiency is a measurement of productivity, utilization, and process effectiveness and can be used as a benchmark for improvement initiatives. Transfer process efficiency was calculated by taking the average value added time divided by the average total transfer time and was measured at 12.4%. Inefficiency, the inverse of efficiency, was measured at 87.6% and is a measurement of lost productivity, utilization, and process ineffectiveness. Inefficiency also represents the scope of the potential benefits that could be gained from an effective improvement effort.

The primary goal of lean methodologies is the total elimination of waste in a process. As non-value-added time is extracted from the process through continuous improvement efforts, the efficiency factor increases. An efficiency factor of 100% is ideal and indicates all waste has been removed from the process and value-added time is all that remains. Elimination of waste in the process can directly reduce cost and simultaneously increase productivity. Once waste is identified and measured using efficiency factor analysis, continuous improvement methodologies and innovative solutions can be implemented to dramatically eliminate waste and increase efficiency.

Using lean methodologies including Kaizen events, brainstorming, diagraming, and simulation, it is often possible to eliminate waste completely and achieve near perfect efficiency.

Discussion of Findings

These findings indicate that actual transfer labor represents a very small portion of the overall time and cost required in the 200 random transports studied. Thus, a real opportunity exists to improve the overall hospital efficiency factor. For example, when direct labor is involved 12.4% of the time, 87.6% represents patient and hospital wait time. This significant amount of wait time can be viewed as an opportunity for improving hospital performance in at least two areas: optimizing procedures to improve transport efficiency, and the potential for improving overall hospital efficiency and even reducing the required number of beds.

First, the transport can be made more efficient by optimizing the procedures associated with the transfer through automation, simplification, and integration. An automated physician order entry system with bed control and unit notification would eliminate multiple hand-offs, waits, and delays. Simplification is achieved through eliminating unnecessary steps in the process, combining tasks, and rearranging fragmented and poorly aligned tasks and events (flow). Organizational effectiveness could be enhanced by integrating process improvements and automated systems into an organization-wide information technology solution.

Second, overall hospital efficiency can also be improved. This can be understood by examining the root cause of why a transfer is nearly always required when a small or moderate change in patient condition occurs, even for mid-level patients who do not need critical care. Such transfers are often for short durations while the patient is stabilized or a more complex assessment is completed; then, the patient is often returned to the same patient care unit or level of care. In general, patients are transferred between units to accommodate their acuity changes and align them with the skills of specialty nurses. However, when growing nursing and health care labor shortages are combined with growing concerns for safety, quality, and cost, health systems may not be able to sustain this current traditional hospital patient flow model. As each transfer consumes scarce hospital resources and interjects the increased chance for error, delays, and waits, quality and cost of care are negatively affected.

Many patient transfers could be prevented by altering facility designs and nursing care models found in acute care hospitals. These new models need to better align with future care needs and the reality of chronic disease burden inherent in shifting demographics. This is especially noteworthy considering the current explosive new construction and growth of hospitals (Burmahl, 2002; Kirschheimer, 2001). Medical-surgical patients represent a significant portion of transfers--some for only brief periods--due to common, fluctuating changes in acuity. The lack of available beds in small progressive care units tends to be a primary cause of bottlenecks and delays in patient placement. A more efficient hospital of the future model would be desensitized to the impact of individual patient variation, demand, and patient acuity. One future state model--a three-tiered hospital with super-acute critical care, acuity-adaptable medical-surgical specialty units, and an interventional short stay unit with post-anesthesia support--would greatly decrease the need for patient transports (Hendrich et al., 2004). The key is acuity-adaptable rooms to alleviate the need for many patient transfers because the patient does not have to move to have her/her fluctuating conditions addressed (Hendrich et al., 2004). As a result, the hospital overall efficiency factor increases. Furthermore, hospital bed capacity improves on the same base (see Figure 6). This could lead to a reduction in the overall number of beds required or provide additional capacity.

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[FIGURE 6 OMITTED]

It should be noted, even with significant building underway, not all hospitals are planning such large scale improvements. It is possible to use the characteristics of these future state rooms within existing rooms, with minor modifications, to create an acuity-adaptable patient room. The key difference in the typical medical-surgical room vs. an acuity-adaptable room is equipment or supports found within the headwall such as gases and lines, and cardiac monitoring capabilities. Creative nurse executives and resourceful managers will find ways to begin this work within existing service lines and/or nursing units to enable this migration. Small renovations, bringing equipment to an existing room, and the embellishment of medical-surgical nursing education will go a long way toward creating "micro" environments within existing units. A few vital critical skills (simple cardiac rhythm recognition, ventilator management, complex assessments, vasopressor drips) added to the medical-surgical nurse's knowledge would create the potential for this altered patient management that preempts transfers. This approach assures each specialty area begins to build acuity capacity, without a patient transfer, and starts to build nursing care models for future transformation

Summary

Hospitals are facing an uncertain future with labor shortages, patient safety concerns, shrinking revenue, and increasing consumer demands for quality. Replicating past models of hospital design and their resultant patient flow patterns will simply intensify current tensions in hospital care delivery. Moreover, emerging and disruptive future-state technologies and micro-surgeries will demand new care models and innovative patient care environments. As this study demonstrates, the current and significant inefficiency of patient transports are a symptom of a much larger problem: the need to transform hospital designs and limit patient movement to meet the challenges of future care delivery in order to reduce workload, improve efficiency, improve patient safety, create a more patient-centered environment, and improve caregiver satisfaction (Burmahl, 2002; Hendrich et al., 2004; Kirschheimer, 2001). Hospital designs/renovations for the future, such as acuity adaptable rooms, can effectively contribute to more efficient and safer care delivery (Hendrich et al., 2004).

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Figure 3.

The Labor and Wage Cost by Job Classification per Transfer

Patient Prep and Transport

Job Class	Hourly Cost	Total Time
1. Ancillary RT	$25.00	22 minutes
2. RN	$40.00	3,288 minutes
3. LPN	$25.00	128 minutes
4. NA	$15.00	617 minutes
5. RT	$25.00	117 minutes
6. Transporter	$15.00	15 minutes
7. Secretary	$20.00	75 minutes
8. Care Coordinator	$40.00	80 minutes
9. Director	$60.00	14 minutes
Subtotal		4,356 Minutes
Average Wage:	$35.17/hour	

Post Transport

Job Class	Hourly Cost	Total Time
10. Housekeeping	$15.00	533 minutes
11. LPN/RN	$32.00	1,816 minutes
12. RN	$40.00	180 minutes
Subtotal		2,529 minutes
Average Wage	$28.99/hour	
Total Average Wage	$32.90/hour	

Job Class	Total Cost	Cost/Transfer
1. Ancillary RT	$9.17	$0.05
2. RN	$2,192.00	$10.96
3. LPN	$53.33	$0.27
4. NA	$154.25	$0.77
5. RT	$48.75	$0.24
6. Transporter	$3.75	$0.02
7. Secretary	$25.00	$0.13
8. Care Coordinator	$53.33	$0.27
9. Director	$14.00	$0.07
Subtotal	$2,553.58	$12.77
Average Wage:		

Post Transport

Job Class	Total Cost	Cost/Transfer
10. Housekeeping	$133.25	$8.25
11. LPN/RN	$968.53	$22.40
12. RN	$120.00	$5.33

Subtotal Average Wage	$1,221.78	$35.98

Total Average Wage

NOTE: Total observed event times were summarized by job classification and an average hourly wage based on the industry averages was used to calculate total cost. The average hourly wage was calculated by taking the sum of total cost divided by 200 transfers. Cost/transfer by labor class was provided for informational purposes only.

Figure 4. Direct Labor Cost Per Transfer

	Average Time	Average Hourly Wage	Average Cost/Transport
Patient Prep for Event	22 min	$35.17	$12.90
Transport Event	7 min	$32.90	$3.84
Post-Transport Event	31 min	$28.99	$14.98
Total	60 min		$31.72

NOTE: The data listed above may be different than the sum of the average time for each event because individual events do not always occur in the transfer process.

Figure 5.

Transfer Process Efficiency: Transfer Timetable

Process Efficiency		Actual (Minutes)	
Average	Median	Average	Median
13.7%	12.4%	306	250

Standard (Minutes)		Wasted	
Average	Median	Average	Median
42	31	264	219

NOTE: Efficiency was calculated to better understand the effectiveness of the transfer process and to quantify the scope of the non-value-added waste time. Transfer process efficiency is calculated by taking the average value added time or standard time divided by the average actual transfer time. Wasted time is the difference between the average actual time minus the standard time and is a measurement of potential improvement and cost reduction that can be achieved. Because there were several outliers, central tendency is reported using both the average and median values.

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Intra-Unit Patient Transports: Time, Motion, and Cost Impact on Hospital Efficiency. Article. Jul 2005.Â Transportation of critically ill patients within the hospital poses important risks. We sought to identify causes, outcomes and contributing factors associated with intra-hospital transport. Cross-sectional case review. Incident reports submitted to the Australian Incident Monitoring Study in Intensive Care (AIMS-ICU). Unit design that reduces nurse fatigue and increases efficiency of patient care. Hands-free electronic communication devices. Electronic medical record systems.Â Intra-unit patient transports: Time, motion, and cost impact on hospital efficiency. Nursing Economic$, 23(4), 157â€"164. Henriksen, K., Isaacson, S., Sadler, B. & Zimring, C. (2007). Longer intra-hospital transport time increases the risk of hemodynamic instability and impending complications. Therefore, reducing intra-hospital transport time is an important issue in patient transport. What is new in the current study. The newly invented easy tube arrange device reduces the time to organize before and after the intra-hospital transport compared to the conventional method. Also, using the easy tube arrange device assists medical staff during the intra-hospital transports and is convenient. INTRODUCTION.