## ORIGINAL RESEARCH

# Impact of an Innovative Inpatient Patient Navigator Program on Length of Stay and 30-Day Readmission

Janice L. Kwan, MD, MPH[1,2]*, Matthew W. Morgan, MD, MSc[1,2], Thomas E. Stewart, MD[2,3], Chaim M. Bell, MD, PhD[1,2,4]

[1]Department of Medicine, Mount Sinai Hospital, Toronto, Ontario, Canada; [2]Department of Medicine, University of Toronto, Toronto, Ontario, Canada; [3]Department of Medicine, Niagara Health System, St. Catharine's, Ontario, Canada; [4]Institute for Health Policy Management and Evaluation, University of Toronto, Toronto, Ontario, Canada.

**BACKGROUND:** The current climate of increasing patient complexity coupled with rising costs have prompted the need for adaptive innovation. There are limited data describing inpatient interventions targeting improvements in both communication and transitional care.

**OBJECTIVE:** Evaluate the patient navigator (PN) program, an innovative inpatient intervention intended to enhance navigation through the complexity of hospital admissions for patients and providers.

**INTERVENTION:** PNs were dedicated patient-care facilitators without clinical responsibilities integrated as full members of the inpatient care team responsible for enhancing communication between and among patients and providers.

**DESIGN:** Observational retrospective cohort study.

**PATIENTS:** All patients admitted to the general medical service between July 2010 and March 2014.

**SETTING:** Academic medical center.

**MEASUREMENTS:** Primary outcomes were hospital length of stay (LOS) and 30-day readmission rate matched by case mix group, age category, and resource intensity weight.

**RESULTS:** Our matched cohort included 5628 admissions (4592 patients) exposed and 2213 admissions (1920 patients) not exposed to PNs. Admissions with PNs were 1.3 days (21%) shorter than admission without PNs (6.2 vs 7.5 days, $P < 0.001$). Thirty-day readmission rate was not different between the 2 groups (13.1 vs 13.8%, $P = 0.48$).

**CONCLUSION:** Implementation of this intervention was associated with a reduction in LOS without an increase in 30-day readmission. *Journal of Hospital Medicine* 2015;10:799–803. © 2015 Society of Hospital Medicine

Inpatient medicine is becoming increasingly complex. A growing number of patients with multiple chronic conditions coupled with mounting care fragmentation leave patients vulnerable to adverse events and readmission to the hospital.[1–3] Moreover, efforts to minimize hospital length of stay (LOS) have resulted in patients being discharged "quicker and sicker" than ever before.[4]

A cornerstone of safe and high-quality healthcare is effective communication.[5] Ineffective communication between and among healthcare providers and patients is a leading cause of medical errors and patient harm. An analysis of sentinel events reported to The Joint Commission revealed that communication failure was the root cause in 59% of these events.[6]

The current climate of increasing healthcare complexity has prompted the need for adaptive innovation.[7] However, there are limited data describing interventions targeting improvements in both communication and transitional care planning. We created a new position, the patient navigator (PN), a dedicated patient-care facilitator not responsible for clinical care. PNs were integrated into the inpatient multidisciplinary clinical team to facilitate patient and provider navigation through the complexity of a hospital admission by enhancing communication between and among patients and providers. The objective of this study was to determine whether this intervention would reduce hospital LOS and 30-day unplanned readmissions.

## METHODS
### Setting
Mount Sinai Hospital is a 446-bed acute care urban academic health center in Toronto, Ontario, Canada. The general internal medicine service operates as a 90-bed clinical teaching unit physically distributed over 4 inpatient wards. The service is structurally divided into 4 nongeographically based multidisciplinary care teams (teams A, B, C, and D) comprised of the medical team (attending physician, senior resident physician, 2–3 junior resident physicians, and 2–3 medical students), pharmacist, social worker, physiotherapist, occupational therapist, speech and language pathologist, dietician, respiratory therapist, and nursing staff allocated by ward. Each team is on call approximately 1 night in 4 with no night float system. At our institution, attending physicians rotate on a 2- or 4-week schedule, resident physicians rotate on a 1-

or 2-month schedule, and medical students rotate on a 2-month schedule. Preintervention, communication occurred in person and by telephone between members of the medical team. Other members of the multidisciplinary care team communicated with the medical team in person at daily multidisciplinary rounds focused on discharge planning, by pager, or using a Web-based communication tool.

## Intervention

PNs were dedicated patient-care facilitators not responsible for clinical care. They acted as liaisons between and among providers and patients. Each PN was a fully integrated member of their multidisciplinary care team. With ongoing medical team rotations, the PN was notably the only consistent member on the clinical team. Each patient saw the same PN throughout his or her hospital stay, as both the patient and the PN were team based. The average number of patients for whom each PN was responsible daily was dictated by the patient census for their team. On average, each team had a census between 20 and 30 patients daily. PNs worked during the daytime from Monday to Friday, and did not have any overnight or weekend responsibilities.

A PN's typical day began by reviewing and rounding on overnight admissions as a formal member of the clinical team. This was followed by participating in daily multidisciplinary rounds, then documenting and circulating the resultant action items. Thereafter, they expedited consultations and tests by liaising with departmental staff, and proactively established contact with the patient and their family. They answered simple factual questions related to test scheduling, consultations, diagnosis, medications, and treatments as discussed and outlined by the clinical team, and promptly relayed care questions beyond the scope of their knowledge to the clinical team. They were available to patients, family members, and providers via a dedicated mobile number using phone calls and text messages. If indicated, they assisted in discharge coordination by arranging follow-up appointments and placing postdischarge phone calls. In addition, they served as primary contact for every patient admitted to their clinical team following discharge to ensure appropriate follow through on discharge plans. There were no set criteria for PNs to disengage from a patient's care. They could always be reached using their dedicated mobile number during business hours, with a voicemail system in place for after-hours calls.

The role was filled by individuals skilled in communication and/or healthcare, such as registered nurses, a masters degree–trained educator, internationally trained physicians, and professionals from the hospitality and human resources industries. There were no prespecified training or degree requirements. Each PN underwent "on-the-job" training and participated in twice monthly PN meetings for ongoing feedback and education.

## Program Implementation

We implemented the PN program on the inpatient general internal medicine service in June 2010 on 2 of 4 multidisciplinary clinical teams. Because a PN became an integrated member of 1 of 4 clinical teams, patient assignment to a PN was determined by the team to which the patient was admitted. On average, each of the 4 teams admitted equally on a daily basis. Initially, there were only sufficient resources to fund 2 PNs. Thus, from June 2010 to May 2011, only teams A and C were assigned PNs. To create fairness between the 4 teams, these 2 PNs moved to teams B and D from June 2011 to November 2011, and then back to teams A and C from December 2011 to April 2012. Following this initial pilot period, the program was allocated further resources, and so expanded to all 4 teams in May 2012. PN salaries were the only program costs. These costs were funded by matching donations from physicians within the Mount Sinai Hospital Department of Medicine and donations to the hospital from community members directed to support the implementation and evaluation of novel care delivery systems.

## Study Design

We evaluated the PN program using a retrospective cohort study that included all general medical admissions between July 2010 and March 2014 matched by case mix group, age category, and resource intensity weight (a relative value measuring total patient resource use compared with average typical acute inpatients).[8]

Our primary outcomes were LOS and 30-day readmission rate. These outcomes were stratified by exposure status to a PN. There were no exclusion criteria for the LOS analysis. Patients who died, were transferred to or from an acute care facility, or signed out against medical advice were excluded from the 30-day readmission analysis. A secondary analysis restricted the timeframe from July 2010 to April 2011, when only 2 of 4 teams were exposed to PNs.

Average LOS has been observed to be higher in Canadian hospitals as compared to their US counterparts across different admission diagnoses, such as coronary artery bypass graft surgery and heart failure.[9,10] We hypothesize that these differences are party due to systems-level differences, including posthospital care. Specifically, the Canadian system does not utilize posthospital acute care, such as skilled nursing facilities, which may in part account for these differences. To help contextualize our data, we standardized LOS using an LOS index called the LOS/expected LOS (ELOS) ratio. It takes the LOS and divides it by the ELOS, a validated estimate of the expected LOS for a given patient generated using a national administrative database for acute hospital care in Canada that takes into account case mix

group, age, comorbidity level, and intervention factors.[8]

Additionally, We performed an interrupted time-series analysis, whereby a log-linear model was fit on LOS and adjusted for weekly and monthly trends, age category, resource intensity weight, major clinical category (a surrogate for case mix group), admission location, and discharge location. The cohort was divided into 3 groups: before program implementation (July 2009–June 2010), after program implementation with PN (July 2010–March 2014), and after program implementation without PN (July 2010–March 2014).

This study was approved by the research ethics board at Mount Sinai Hospital. No patient consent was deemed necessary. Data were obtained from institutional databases monitored by the hospital's performance measurement office.

### Statistical Analysis

In Tables (1 and 2), mean values were compared using a 2-tailed *t* test, and the relationship between categorical groups was determined using a $\chi^2$ test. For the interrupted time-series analysis, 2-tailed *t* tests were used to test null hypotheses of no association between the parameter value and the outcome, and $\chi^2$ tests were used to test for the equivalence of 2 given parameters. $P \leq 0.05$ indicated statistical significance for all comparisons and analyses. All data were analyzed using Stata version 13 (StataCorp, College Station, TX) or R 3.0.2 (R Foundation for Statistical Computing, Vienna, Austria).

### RESULTS

Our matched cohort included 7841 admissions (6141 patients), with 5628 admissions (4592 patients) exposed and 2213 admissions (1920 patients) not exposed to PNs. The discrepancy between the total number of patients and the sum of exposed and nonexposed patients is resultant from patients admitted more than once over the study period, as patients admitted to at least 1 team staffed with a PN and another team not staffed with a PN over the study period were counted in both groups. The 2 groups were similar with respect to several characteristics (Table 1). However, the 2 groups were significantly different for age ($P = 0.046$) and admissions from long-term care ($P < 0.01$) and other facilities ($P < 0.01$).

Admissions with PNs were 1.3 days (21%) shorter than admission without PNs (6.2 vs 7.5 days, $P < 0.001$). Moreover, admissions with PNs had a smaller mean LOS/ELOS ratio compared to admissions without PNs (0.93 vs 1.05, $P < 0.001$). The restricted analysis found a 1.2-day (18%) lower LOS (6.4 vs 7.6 days, $P < 0.05$) and a smaller mean LOS/ELOS ratio (0.91 vs 1.06, $P < 0.001$). Thirty-day readmission rate was not different between the 2 groups (13.1 vs 13.8%, $P = 0.48$) or in the restricted analysis (12.0 vs 13.5%, $P = 0.40$) (Table 2).

In the interrupted time-series analysis, prior to the implementation of the PN program, there was a positive relationship between LOS and time. After the implementation of the program, this relationship became inverse, meaning the curve plotting LOS against time had a negative slope. Furthermore, there

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**TABLE 1.** Patient Admission Characteristics

| | With PN, n = 5,628 | Without PN, n = 2,213 |
|---|---|---|
| Age, y, mean (SD)* | 69 (20) | 68 (20) |
| Female sex, n (%) | 3,018 (53.6) | 1,196 (54.0) |
| Most responsible diagnosis, n (%) | | |
| Pneumonia | 374 (6.6) | 135 (6.1) |
| Chronic obstructive pulmonary disease | 271 (4.8) | 88 (4.0) |
| Congestive heart failure | 217 (3.9) | 87 (3.9) |
| Admission location, n (%) | | |
| Home | 4,665 (82.9) | 1,943 (87.8) |
| Long-term care* | 524 (9.3) | 158 (7.1) |
| Other* | 439 (7.8) | 112 (5.1) |
| Discharge location, n (%) | | |
| Home | 3,824 (67.9) | 1,578 (71.3) |
| Long-term care | 779 (13.8) | 267 (12.1) |
| Other | 1,025 (18.3) | 368 (16.6) |

NOTE: Abbreviations: PN, patient navigator; SD, standard deviation. *Reflects a *P* < 0.05 for the comparison between the 2 groups for characteristic denoted. "Other" reflects rehabilitation or mental health facilities.

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**TABLE 2.** Mean LOS, Mean LOS/Expected LOS Ratio, and 30-Day Readmission Rate for General Medical Admissions With and Without PNs From July 2010 to March 2014 (Primary Analysis) and July 2010 to April 2011 (Secondary Analysis)

| | With PN | Without PN | *P* Value |
|---|---|---|---|
| July 2010-March 2014 | | | |
| LOS, d (95% confidence interval) [n] | 6.2 (6.0–6.4) [5,628] | 7.5 (7.1–7.9) [2,213] | <0.001 |
| LOS/ELOS ratio (95% confidence interval) [n] | 0.93 (0.91–0.95) [5,628] | 1.05 (1.00–1.09) [2,213] | <0.001 |
| 30-day readmission rate, % [n] | 13.1 [5,055] | 13.8 [2,012] | 0.48 |
| July 2010 to April 2011 | | | |
| LOS, d (95% confidence interval) [n] | 6.4 (5.8–7.0) [713] | 7.6 (6.8–8.3) [753] | <0.05 |
| LOS/ELOS ratio (95% confidence interval) [n] | 0.91 (0.85–0.96) [713] | 1.06 (1.00–1.11) [753] | <0.001 |
| 30-day readmission rate, % [n] | 12.0 [627] | 13.5 [681] | 0.40 |

NOTE: Admissions were matched by case mix group, age category, and resource intensity weight. ELOS is a validated estimate of the expected LOS for a given patient generated using a national administrative database for acute hospital care in Canada that takes into account case mix group, age, comorbidity level, and intervention factors.[8] Abbreviations: LOS, length of stay; ELOS, expected LOS; PN, patient navigator.

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was a statistically significant drop in LOS at the time of program implementation ($P < 0.05$). However, there was no difference in slope between the groups with and without PN after program implementation.

## DISCUSSION

We describe an innovative inpatient intervention featuring an integrated patient-care facilitator not responsible for clinical care charged with enhancing communication between and among patients and providers. Data from the almost 4-year period demonstrated that implementation was associated with a 21% reduction in hospital LOS, with no difference in 30-day readmission rates.

The "patient navigator" was first conceptualized in 1990 to help African American women in Harlem with breast cancer negotiate the complex world of oncology.[11] It was later implemented by the National Cancer Institute as an outpatient intervention spanning the continuum of cancer care. This concept has since expanded to other domains of complex single disease outpatient care, including asthma and fertility.[12,13] To our knowledge, there has been limited evidence in the literature describing implementation of such programs in the inpatient general medical setting.

This study contributes to the growing literature on interventions targeting improvements in transitional care, such as transition coaches and discharge advocates.[14,15] Balaban et al. recently described a PN intervention in the safety-net population.[16] A common theme to these interventions was the prioritization of safe care transitions. However, this goal was achieved using related, yet different approaches: transition coaches focused on encouraging the patient and caregiver to assert a more active role,[14] discharge advocates focused on providing a comprehensive discharge plan for patients,[15] PNs from Balaban's study focused on coaching and assistance in navigating patients through the transition from hospital to home, and our study's PNs focused on enhancing communication between and among patients and providers. Additionally, unlike transition coaches and discharge advocates, who were nurses by training, and PNs from Balaban's study, who were community health workers, our PNs did not have any prespecified training or degree requirements.

Patients are at risk of being inadequately informed about important issues related to their care, such as hospital medications, diagnoses, and treatment plans during their hospital stay.[17,18] Furthermore, we know that ineffective communication is a common cause of poor patient outcomes in hospital-based care.[6] This phenomenon can be amplified from external pressures to maximize productivity. For example, Elliott and colleagues found that increasing hospitalist workload is associated with higher hospital LOS and cost.[19] PNs may offload care demands by enhancing communication for providers and patients.

Our study has several strengths. By matching admissions by case mix group, age category, and resource intensity weight, we aimed to reduce potential bias contributed by these covariates. Moreover, a staged rollout of the intervention, whereby over a 10-month period, 2 of the multidisciplinary care teams were assigned PNs, while the remaining 2 were not, enabled contemporaneous comparison. Our study had few exclusion criteria, thus making it potentially generalizable to other inpatient general medicine settings of a similar nature. The relative simplicity of this intervention makes it amenable to scalability. Of note, the intervention has been deemed to show great promise at our institution, and has currently expanded to the cardiology, gastroenterology, and surgical oncology units.

Our study's limitations include a single-center design. Moreover, although we demonstrate similarity in the majority of measurable covariates between the groups, we cannot exclude the existence of unmeasured confounders. Of the covariates that were found to be different between the groups, we suspect the difference in admissions from long-term care and other facilities did not largely influence our study's main findings. Furthermore, though age was found to be statistically different between the groups, we postulate that the 1-year difference between the groups is not particularly relevant clinically. Additionally, 30-day readmission rates were only captured for our institution. However, the vast majority of readmissions in our region are to the index facility, and are unlikely to differ between the 2 groups.[20]

There may have been secular trends at play. In the interrupted time-series analysis, there was a statistically significant drop in LOS at the time of program implementation. There was however, no difference in slope between the groups with and without PNs after program implementation. There are some plausible explanations for this lack of difference in slope. The study may not have been powered to detect such a difference, as this analysis was not prespecified. Furthermore, there may have been a spillover effect of the program, such that PNs may have improved efficiency for the teams to which they were assigned, thereby improving the efficiency of the other members of the multidisciplinary team, many of whom cared for patients assigned and not assigned a PN. Additionally, we measured the LOS in a preintervention control group between July 2009 and June 2010 using the same inclusion criteria as the matched cohort. It was found to be 8.5 days, which suggests a secular trend toward improvement in LOS over time at our institution. We are, however, reassured that our restricted analysis enabling contemporaneous comparison between patients exposed and not exposed to PNs was still found to be significant.

The implementation of this intervention could have implications for policymakers-at-large. Establishment

of criteria for qualifications and a clear educational curriculum to train future PNs is needed, especially in the context of ongoing program expansion. These initiatives are currently underway at our institution. Furthermore, evaluation of the program's operating cost and calculation of its return on investment should include balanced metrics incorporating patient-, provider-, organizational-, and system-level measures. The current cost to the hospital per PN is approximately $73,800 CAD ($58,700 USD), which covers 1 PN's annual salary and benefits. Thus, the implementation of 4 PNs for each of the 4 multidisciplinary teams costs the hospital approximately $295,000 CAD ($234,700 USD) per year. Although the details of our preliminary calculations are outside the scope of this report, it suggests that the savings incurred from shorter LOS outweigh program costs.

We found that implementation of this innovative inpatient intervention targeting improvements in communication was associated with a reduction in LOS without an increase in 30-day readmission. Our experience shows promise and may inform others considering similar interventions. Patient and provider experience and generalizability should be evaluated in future work.

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