ED Administration

Patients' satisfaction and wait times at Guelph General Hospital Emergency Department before and after implementation of a process improvement project

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ABSTRACT

Objective: A process improvement program (PIP) was implemented in the emergency department (ED) at Guelph General Hospital in July 2009. The purpose of this study was to examine patients' satisfaction and wait times by level of Canadian Triage and Acuity Scale (CTAS) score before and 6 months after implementation of this program.
Methods: Two samples were recruited: one was recruited before implementation of the PIP, January to June 2009 (T1), and one was recruited 6 months after implementation, January to June 2010 (T2). Patients were contacted by telephone to administer a survey including patient satisfaction with quality of care. Time to physician initial assessment, numbers left without being seen, and length of stay (LOS) were obtained from hospital records to compare wait times before and 6 months after implementation of the PIP.
Results: Patients ($n = 301$) reported shorter wait times after implementation (e.g., 12% reported seeing a physician right away at T1 compared to 29% at T2). Time to physician initial assessment improved for patients with CTAS scores of III, IV, and V (average decrease from 2.1 to 1.7 hours), fewer patients ($n = 425$) left without being seen after implementation, and the mean and 90th percentile of LOS decreased for all patients except the mean LOS for discharged patients with a CTAS score of I. Total time spent in the ED for admitted patients decreased from 11.11 hours in the 2009 period to 9.95 in the 2010 period, and for nonadmitted patients, the total time decreased from 3.94 to 3.29 hours. The overall satisfaction score improved from a mean of 3.17 to 3.4 (of 4; $p < 0.001$).
Conclusion: Implementation of the ED PIP corresponded with decreased wait times, increased patient satisfaction, and improved patient flow for patients with CTAS scores of III, IV, and V.

RÉSUMÉ

Objectif: Un programme d'amélioration du processus a été mis en place au service d'urgence à l'hôpital général de Guelph, en juillet 2009. La présente étude avait pour but d'examiner le degré de satisfaction des patients et les délais d'attente selon l'Échelle canadienne de triage et de gravité (ECTG), avant la mise en place du programme et 6 mois après.
Méthode: Deux échantillons ont été formés: l'un avant la mise en place du programme, soit de janvier à juin 2009 (T1), et l'autre 6 mois après, soit de janvier à juin 2010 (T2). Nous avons téléphoné aux patients pour mener une enquête et poser des questions, entre autres, sur leur degré de satisfaction quant à la qualité des soins. Les valeurs relatives au délai d'attente avant la première évaluation par un médecin, au nombre de patients partis sans avoir été vus et à la durée du séjour ont été tirées des dossiers médicaux aux fins de comparaison des délais d'attente avant la mise en place du programme et 6 mois après.
Résultats: Les patients ($n = 301$) ont fait état de délais d'attente plus courts après la mise en place du programme (ex., 12% ont déclaré avoir vu un médecin immédiatement dans le groupe T1 contre 29% dans le groupe T2). Le délai d'attente avant la première évaluation par un médecin s'est amélioré chez les patients ayant obtenu des résultats de III, IV, ou V sur l'ECTG (diminution moyenne de 2.1 à 1.7 h); moins de patients ($n = 425$) sont partis sans avoir été vus après la mise en place du programme; et la durée moyenne du séjour et celle au 90e centile ont diminué chez tous les patients, sauf la durée moyenne du séjour chez les patients sortants ayant obtenu un résultat de I sur l'ECTG. Le temps total écoulé à l'urgence, chez les patients hospitalisés est passé de 11.11 heures en 2009 à 9.95 heures en 2010, et, chez les patients non hospitalisés, de 3.94 heures à 3.29 heures. Le

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degré général de satisfaction s'est amélioré; il est passé d'une moyenne de 3.17 à 3.4 (sur 4; $p < 0.001$).
Conclusion: La mise en place du programme au service d'urgence s'est traduite par une diminution du délai d'attente, une augmentation du degré de satisfaction des patients, et une amélioration du flux des patients ayant obtenu des résultats de III, IV, ou V sur l'ECTG.

In Canada's emergency departments (EDs), care is provided for more than 14 million visits each year[1] for a wide range of problems. On arrival at EDs, patients are categorized according to acuity using the Canadian Triage and Acuity Scale (CTAS) to prioritize access to care. Whereas some patients require immediate attention for imminent threats to life or limb, many require less urgent care. In fact, 57% of ED visits in 2003 to 2004 were for nonurgent (CTAS V; e.g., sore throat) or less urgent (CTAS IV; e.g., earache) complaints; a small proportion (0.5%) were triaged as requiring resuscitation care (CTAS I) and 43% as requiring emergent/urgent care (CTAS II/III).[1] Although there is a valid concern about the aging population and the many complex conditions these patients may have, the highest proportion of ED visits (61%) is made by adults between the ages of 16 and 64 years.[1] In Ontario and many other provinces, EDs have reached a crisis where there are too many patients, too little space, and long wait times, which result in elevated levels of anger and frustration for both staff and patients.[2] As the number of patients waiting to be seen increases, so too does the number of patients who leave without being seen.[3] Wait times may also affect patient care and outcomes and influence patients' satisfaction with emergency care.

EDs are considered the gateway to hospitals and our health care system; thus, it is understandable that they are targeted for process improvement. In March 2009, the Ontario Ministry of Health and Long-Term Care (MOHLTC) launched Wave 1 of an ED process improvement program (PIP) in the Waterloo Wellington Local Health Integration Network (LHIN), with Guelph General Hospital (GGH) being one of the first hospitals involved, although actual implementation of process improvements did not occur until July 2009. This 8-month program has been designed to engage teams of staff from three sectors of the hospital (emergency, admission, and discharge) to assess and evaluate current practices within the hospital with the goals of reducing ED demand, increasing ED capacity and performance, and streamlining the admission and discharge process. The project goals were to reduce the time patients spend in the ED, improve patient satisfaction, improve staff work environment, and build capacity to support sustainable change.[4] The teams involved in this PIP received training in both Lean and Six Sigma philosophies.[5] The "Lean" approach was first developed by Toyota to streamline its manufacturing plants.[5] It is now used by health care organizations to eliminate waste and redundant processes that do not add value to patient care, with the goal of increasing productivity and increasing patient satisfaction. The Six Sigma concept was originally developed as a set of practices designed to improve manufacturing processes and eliminate defects, but its application has subsequently been extended to other types of business processes.[6,7] In this model, strategies such as process mapping and root cause analysis were used to determine where improvements could be made. In applying these models to health care settings, the patient experience was seen as paramount.

In April 2008, GGH had a higher length of stay (LOS) than the provincial average for low-acuity patients, with only 58% of patients being seen within 4 hours, compared to the provincial average of 84%.[8] This information heightened awareness of the need for action. The goal of the ED PIP was to address barriers to meeting target goals of reduced wait times, which may lead to improved patient satisfaction and an improved work environment for staff. The purpose of this study was to examine patient satisfaction with quality of care and the time to see a physician, number of patients who left without being seen, and LOS at the GGH before (first half of 2009) and 6 months after (first half of 2010) implementation of the ED PIP.

METHODS

Guelph is a city of 120,000 in southwestern Ontario approximately 100 km west of Toronto. GGH is a full-service, regional community centre serving a total

population of 180,000, and approximately 45,000 patients per year visit the ED. Research Ethics Board approval was obtained from GGH and the University of Guelph.

Prospectively, two samples of patients were surveyed on their satisfaction with their ED visit and their perception of wait times: one sample prior to implementation (January to June 2009) and one sample 6 months after implementation (January to June 2010). A nurse from GGH contacted patients randomly chosen from the daily lists generated (in alphabetical order) by the hospital who had visited GGH's ED. The nurse informed these previous ED patients of the study, asked if they would like to hear more about a study on patient perceptions from a researcher from the University of Guelph, and requested permission to give the researcher the patient's first name, telephone number, age, sex, and CTAS code (gleaned from the chart). To ensure that the Privacy of Health Information Act (PHIA) was not violated, a hospital employee assigned patients' names and contact information. If participants were not available by telephone or were unable to answer questions due to language barriers, their names were removed from the list.

Inclusion criteria were patients of any age or caregivers of children or substitute decision makers and a minimal ability to communicate in English. There were no exclusion criteria. Research assistants blinded to the main study purpose (i.e., aware of evaluating satisfaction, unaware of the implementation of a PIP) contacted prospective participants via telephone, fully described the study, obtained informed consent, and administered a questionnaire containing demographic questions and a standardized measure of satisfaction with quality of care from the patients' perspective. If the research assistant was unable to reach the patient by telephone, approximately six repeated attempts were made at different times of the day.

Measures

Metrics derived from documentation on ED charts were obtained from the hospital's database. These metrics were 90th percentile and mean time (hours) of triage to time of physician assessment (all patients) and LOS defined as time (hours) of registration or triage (whichever is earlier) to time the patients physically left

the ED or clinical decision unit (CDU) arrival for discharge and admitted patients, as well as the total number of patients who left without being seen. The two points of comparison were before implementation of the ED PIP from January to June 2009 to after implementation, January to June 2010.

Patient satisfaction was measured with the Quality from the Patient's Perspective of ED (QPP) scale.[9,10] The questionnaire consists of 37 items to capture an overall satisfaction score and four dimensions on a 4-point scale. Medical-technical competence refers to perceptions of physical care (e.g., the physical help needed) and medical care (e.g., I received the best possible medical treatment to the best of my knowledge). Physical-technical conditions involve personal necessities (e.g., access to tasty foods), care equipment (e.g., access to technical aids such as a wheelchair), and care room characteristics (e.g., comfortable bed). Identity-oriented approach refers to personal care (e.g., were respectful toward me) and interest in the patient's psychological situation (e.g., seemed to understand how I experienced my situation). Sociocultural atmosphere includes environment not directed by routines (e.g., my medical care was determined by my own needs rather than the staff's procedures), positive treatment of significant others, and general atmosphere (e.g., pleasant atmosphere). For each item, the patient evaluates the perceived quality of care and the corresponding subjective importance. Patients were asked to share their thoughts on elements of their visit with which they were particularly satisfied and suggestions for improvement. The QPP questionnaire has been shown to be valid and reliable (e.g., Cronbach alpha reliabilities ranging from 0.49 to 0.93).[10–12]

Intervention

At GGH, extensive training was launched in March 2009 by the MOHLTC for the ED PIP. Although the process was guided by Lean and Six Sigma theories, it was built on existing capacities within GGH. This project focused on establishing sustainable changes to process, performance, and culture. Recognizing that patient flow through the hospital was not solely an ED issue, improvement teams were established to examine patient flow from the beginning of their visit to the ED to their eventual discharge from the hospital. Two teams were established: one that focused on the ED

patient flow and a second that focused on in-patient patient flow through to the point of discharge.

The launching platform of the project was an extensive training week, March 23 to 27, 2009. This training was provided for each team leader (staff nurses from emergency and inpatient units, physicians, unit directors, social work, clerical staff educators, decision support, and senior management). The session was organized by the MOHLTC in consultation with the Ontario Hospital Association and facilitated by consultants from McKinsey and Company, Hae Consulting, and the Change Foundation. This 4-day team training included an introduction to Lean and Six Sigma principles, leadership and change models, and an introduction to a new performance management tool called DART (Daily Access Reporting Tool). Additional training included the theory of root cause problem solving and data analysis to assist staff to identify areas that required change.

Following this training week, the hospital arranged a 1-day value-stream mapping session for all team members listed above as well as many of the emergency and inpatient staff. The value-stream mapping process created a visual flow mapping of the ED patient visit from the time of arrival to the time the patient left the hospital and was discharged either from the ED or a clinical in-patient unit. This process was broken into two distinct sections: the ED from arrival to discharge and the in-patient unit from admission to discharge. This analysis was conducted sequentially and examined in minute detail all the steps patients experienced during their hospital visit (e.g., triage, registration, waiting, assessment, diagnostic testing, treatments, and reevaluation). For each process step, the actual time each step of the process took to complete was estimated based on experience. From this value-stream mapping exercise, we identified data gaps and areas that required further exploration to streamline care and avoid wasted process steps that would not add value to the patient experience. Teams were set up to further explore processes that were identified for improvement or needed further data evaluation. These established teams used many Lean process improvement strategies to accomplish this work, break down each identified gap, and collect more information to effectively evaluate that gap for change. The Lean methods employed were the use of spaghetti diagrams, five why's, circle diagrams, and cause-and-effect diagrams. Teams also conducted waste walks, which is a Lean

method used to identify the seven common wastes in business (motion, waiting, transportation, correction, overprocessing, overproduction, and inventory control). From this Lean evaluation, the larger team identified 83 opportunities for improvement. These opportunities were further developed into themes for both the in-patient unit and the ED. The ED and the in-patient unit each identified six key themes (Table 1).

Once these themes were identified, the next step in the process improvement project was to develop an implementation plan that included specific timelines and assigned tasks to individual team members. Implementation teams were encouraged to reach out to front-line staff and engage them in the change process. Pilot changes were trialed using another Lean process tool called Plan-Do-Study-Act (PDSA) cycles. This method gave teams the opportunity to trial a process improvement in a timely fashion and make quick and real-time revisions as needed to ensure the success of the change process. All changes that were implemented reduced redundancy to improve patient flow through the departments by streamlining the processes of care and reducing steps that did not contribute to the direct outcomes of the patient's visit.

The ED team focusing on its six identified themes trialed a few key initiatives that targeted the goal of improving flow through the department. It was identified that during an ED patient's journey, the

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Table 1. Themes identified for improvement for emergency and in-patient units

Emergency department themes
1. Reduce time from triage to MD/NP assessment
2. Accelerate and standardize care for patients using medical directives
3. Reduce time from orders for laboratory/DI to MD reassessment
4. Increase portion of clinician time spent on direct patient care
5. Decrease time from request for consultation to decision to admit
6. Collaborative rapid admissions to decrease ED LOS

In-patient unit themes
1. Predictive discharge
2. Streamline the admissions document
3. Simplify the transfer of care
4. Bed allocation/bed turnaround process
5. Turnaround time processes with CCAC and Allied Health to improve the timelines and efficacy of early involvement
6. Collaborative rapid admissions to decrease ED LOS

CCAC = Community Care Access Centre; DI = diagnostic imaging; ED = emergency department; LOS = length of stay; MD = medical doctor; NP = nurse practitioner.

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patient spent considerable time waiting to see a provider (e.g., physician, nurse practitioner, physician's assistant) and then waiting for the results of diagnostics tests and reevaluation before a decision was reached as to whether the patient needed to be admitted or potentially be discharged home. It was thought that reduced wait times would improve overall care. The team established a process to more effectively use medical directives by allowing nursing staff to initiate treatments and order diagnostic tests early in the process. This change resulted in a more timely start to the diagnostic and treatment processes, and often test results would be complete by the time the physician conducted the initial assessment, expediting disposition decisions.

Another critical improvement strategy for the ED was the establishment of a new see and treat area. The goal of this area was to reduce the time it takes for the patient to see a practitioner (physician or nurse practitioner). This area was designed to be a rapid assessment area for stable, ambulatory, noncardiac CTAS level II to V patients. The triage nurse would identify suitable patients using established criteria, and they would be fast-tracked into this area, eliminating the need for waiting. In this area, the step of a nursing secondary assessment was eliminated, thereby reducing the time to provider assessment. Once assessed by a provider, patients were directed to wait in chairs for their test results, freeing up needed stretcher surfaces. Additionally, in the ED, processes involving support services such as laboratory and diagnostic imaging were to be evaluated and streamlined by reducing unnecessary steps. Paper laboratory reporting was eliminated, and updates were made to the internal tracking system to allow for timely access to results. Another Lean technique called 5-S (sort, set in order, straighten/shine, standardize, and sustain) was used to evaluate all equipment and supplies, organize and label them, and develop centrally assigned locations for ease of access for staff.

The in-patient team's work began with a large culture change. It was identified that instead of the ED "pushing" patients to the floor, the in-patient units should "pull" their patients to the correct location. The ED staff worked with staff in the in-patient units to streamline the admission and discharge process. Staff created documents such as a faxed report and rapid transfer orders to improve communication between areas and facilitate patient transfers. The inpatient interdisciplinary team implemented daily "bullet" rounds that targeted discussion to activities and planning related to the patient's discharge from hospital. At these bullet rounds, the team would decide on a targeted estimated date of discharge that would be used to guide care and communicate with and prepare the family for a discharge to home. Communication whiteboards were set up in each in-patient room. These whiteboards were used to provide patients and families with current information about their care plan and the estimated time of discharge. Discharge brochures were created and implemented in an effort to improve communication between the patient and the family related to the patient's plan of care (such as tests and procedures), including the discharge process and policy related to discharge times.

Integral to the success of the ED PIP was effective communication with all staff and the constant support and presence of the senior management team during this process improvement project. To further communication and share data, on each unit, bulletin boards were hung that displayed that unit's weekly metrics obtained from the DART. This information was shared with staff members at weekly meetings that the senior management team attended. This time allowed staff the opportunity to give input and participate in change solutions. The wide acceptance of change from all staff and the availability of real-time data, available on a daily basis to clinical and administrative staff, was integral to the success of this project. The availability of the data has allowed for rapid change, driven by clinical staff, to address areas of recognized gaps in a timely manner. The resulting culture change and positive collaboration between all groups involved have been crucial to the success of this project.

Data analysis

Statistical analyses were conducted using *SPSS* version 18 (SPSS Inc, Chicago, IL). Demographic and hospital data were presented with descriptive statistics, and the QPP questionnaires were analyzed with independent *t*-test (before and after), with significance at $p < 0.01$. With power at 0.80 and alpha at 0.01, it was estimated that a sample of 95 participants would be required to view a medium effect of 0.50.[13] Our target thus became 100 nonadmitted and 50 admitted patients for pre- and postimplementation. Qualitative responses underwent content analysis.

RESULTS

A total of 301 participants, 150 at time 1 (T1) and 151 at time 2 (T2), participated in this study (Figure 1). There were no statistically significant differences between the two samples in mean age, sex, CTAS, having a family physician, and education (Table 2). There was one statistically significant difference in children's mean age (T1, 7.25 years, v. T2, 4.30 years, $t = 2.8$, $p = 0.006$).

Patient perceptions appear in Table 3. At T1 ($n = 92$), 63% of the sample reported that they were triaged within 15 minutes compared to 66% ($n = 99$) at T2 (not significant). Overall, 31% ($n = 44$) reported that they were brought into the ED right away in T1 compared to 48% ($n = 72$) at T2. At T1, 66% of the
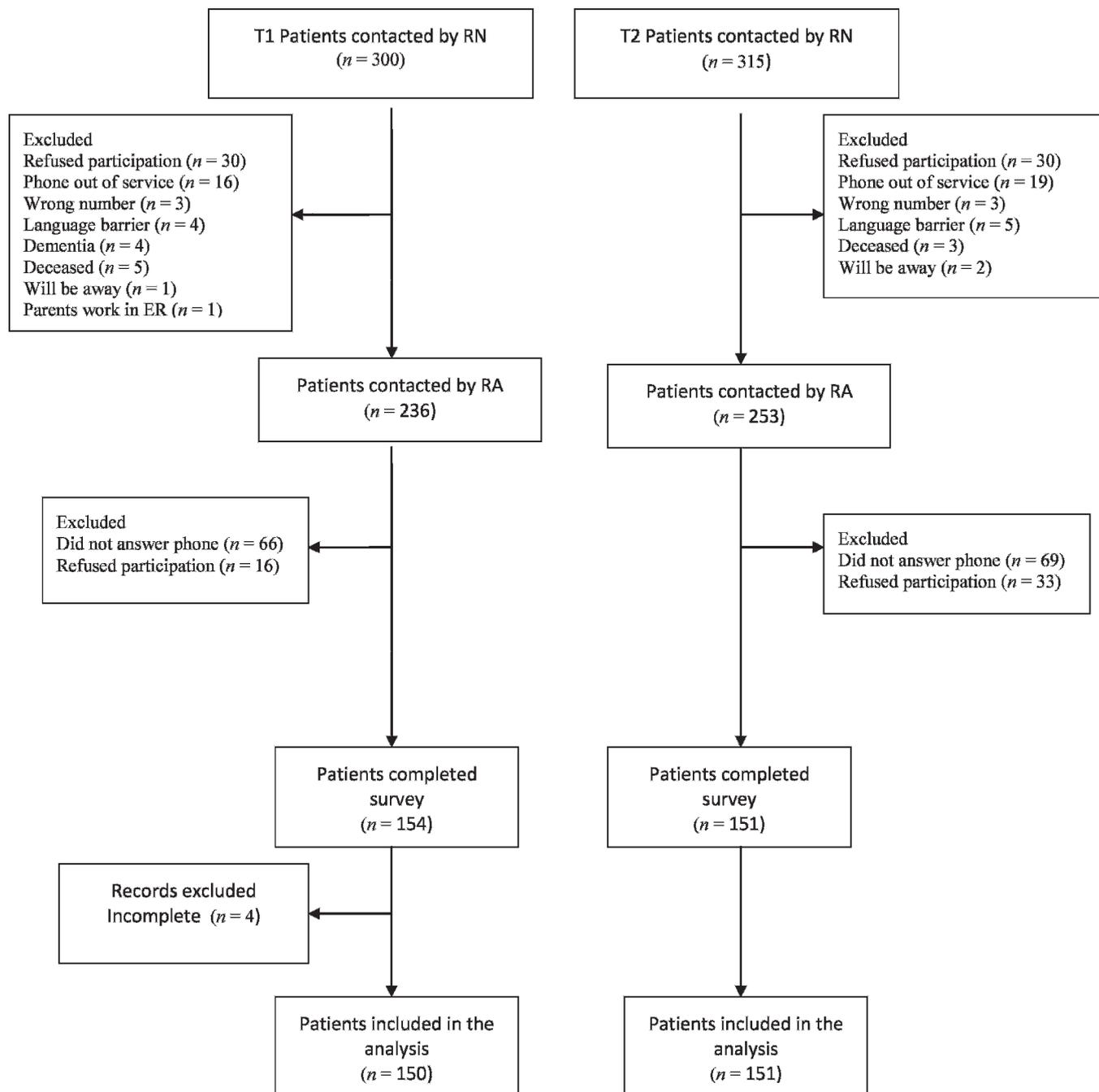

Figure 1. Participant flow. RA = research assistant; RN = registered nurse; T1 = time 1; T2 = time 2.

Table 2. Participant demographics

Characteristic	Time 1	Time 2	Total (N = 301)	Test statistic	p value
Admitted, n (%)	150 patients	151 patients			
Yes	51 (34.0)	51 (33.8)	102 (33.9)	$\chi^2 = 0.002$	.967
No (discharged)	99 (66.0)	100 (66.2)	199 (66.1)		
Family physician, n (%)	149 patients	151 patients			
Yes	142 (94.7)	142 (94)	284 (94.4)	$\chi^2 = 0.24$	.627
No	7 (4.7)	9 (6)	16 (5.3)		
Ambulance, n (%)	150 patients	151 patients			
Yes	33 (22.0)	28 (18.5)	61 (20.3)	$\chi^2 = 0.56$	.456
No	117 (78.0)	123 (81.5)	240 (79.7)		
CTAS level, n (%)	150 patients	151 patients			
II	39 (26.0)	50 (33.1)	89 (29.6)	$\chi^2 = 1.89$	.595
III	70 (46.7)	62 (41.1)	132 (43.9)		
IV	40 (26.7)	38 (25.2)	78 (25.9)		
V	1 (0.7)	1 (0.7)	2 (0.7)		
Mean age (SD), yr	150 patients	151 patients			
	42.4 (28.3)	37.4 (26.7)	39.9 (27.6)	$t = 1.6$	.119
Adult demographics (> 18)			213 patients		
Mean age (and SD), yr	109 patients	104 patients			
	55.6 (21.2)	52.4 (17.5)	54.0 (19.5)	$t = 1.2$	.228
Sex, n (%)	109 patients	104 patients			
Male	51 (46.8)	43 (41.3)	94 (44.1)	$\chi^2 = 0.64$	.424
Female	58 (53.2)	61 (58.7)	119 (55.9)		
Relationship status, n (%)	108 patients	102 patients			
Cohabiting	73 (67.0)	66 (63.5)	139 (65.3)	$\chi^2 = 5.7$	.058
Single	26 (23.9)	34 (32.7)	60 (28.2)		
Other	9 (8.3)	2 (1.9)	11 (5.2)		
Education completed, n (%)	108 patients	102 patients			
Not completed high school	20 (18.3)	22 (21.2)	42 (19.7)	$\chi^2 = 3.9$	.277
High school graduate	41 (37.6)	33 (31.7)	74 (34.7)		
College/university graduate	40 (36.7)	45 (43.3)	85 (39.9)		
Graduate education	7 (6.4)	2 (1.9)	9 (4.2)		
Child demographics			88 patients		
Mean age (SD), yr	41 patients	47 patients			
	7.3 (5.5)	4.3 (4.0)	5.7 (5.0)	$t = 2.8$	.006
Sex, n (%)	41 patients	47 patients			
Male	25 (61.0)	29 (61.7)	54 (61.4)	$\chi^2 = .01$	.944
Female	16 (39.0)	18 (38.3)	34 (38.6)		

CTAS = Canadian Triage and Acuity Scale.

sample reported that they entered an examination room within an hour compared to 76% at T2. At T1, 43% of the sample reported being seen by a physician within half an hour compared to 67% at T2. Patients at T2 reported a statistically better score of overall satisfaction with quality than the patients at T1 ($t = -3.5$, $p < 0.001$), and patients reported improved scores on all subscales except the physical-technical conditions and sociocultural atmosphere. Conversely, patients rated the items as less important at T2 than

T1 ($t = 2.64$, $p < 0.009$) except sociocultural atmosphere.

Content analysis of open-ended questions on suggestions for improvement revealed three main themes: concern for the overall amount of time spent in the ED followed by quality of care and communication. At T1, 27% of patients reported concerns with wait times (e.g., "Waiting times are too long"), inefficiencies (e.g., "Organization is a big problem," "You have to go through two different registration stations," and the

Table 3. Participant perceptions

	Time 1	Time 2	Total	Test statistic	p value
	148 patients	151 patients			
Urgency, n (%)					
Less urgent	16 (10.8)	33 (21.9)	49 (16.3)	$\chi^2 = 8.7$ (2)	.013
Urgent	115 (77.7)	95 (62.9)	210 (69.8)		
Life threatening	17 (11.5)	23 (15.2)	40 (13.3)		
Wait for triage nurse, n (%)	147 patients	151 patients			
Right away	48 (32.7)	52 (34.4)	100 (33.2)	$\chi^2 = .06$ (2)	.972
< 15 min	44 (29.9)	47 (31.1)	91 (30.2)		
> 15 min	42 (28.6)	48 (31.8)	90 (29.9)		
Could not remember*	13 (8.8)	4 (2.7)	17 (5.7)		
Wait to be brought into department, n (%)	142 patients	151 patients			
Right away	44 (31.0)	72 (47.7)	116 (38.5)	$\chi^2 = 8.5$ (4)	.075
< 1 h	51 (35.9)	43 (28.5)	94 (31.2)		
1–2 h	17 (12.0)	11 (7.3)	28 (9.3)		
2–3 h	9 (6.3)	8 (5.3)	17 (5.6)		
> 3 h	16 (11.3)	14 (9.3)	30 (10.0)		
Could not remember*	5 (3.5)	3 (2.0)	8 (2.7)		
Wait for physician, n (%)	148 patients	151 patients			
Right away	18 (12.2)	43 (28.5)	61 (20.3)	$\chi^2 = 16.7$ (4)	.002
< 0.5 h	46 (31.1)	58 (38.4)	104 (34.6)		
0.5–1 h	45 (30.4)	32 (21.2)	77 (25.6)		
1–2 h	19 (12.8)	10 (6.6)	29 (9.6)		
> 2 h	9 (6.1)	6 (4)	15 (5.0)		
Could not remember*	11 (7.4)	2 (1.3)	13 (4.3)		
Quality from the Patient's Perspective (QPP)	150 patients	151 patients			
Overall satisfaction score	3.17 (0.6)	3.40 (0.5)	3.38 (0.6)	$t = -3.5$	< .001
Medical-technical competence	3.07 (0.9)	3.34 (0.8)	3.21 (0.9)	$t = -2.7$	.007
Physical-technical conditions	3.02 (1.0)	3.23 (1.0)	3.13 (1.0)	$t = -1.8$	.070
Identity-oriented approach	3.19 (0.6)	3.45 (0.5)	3.32 (0.6)	$t = -3.8$	< .001
Sociocultural atmosphere	3.19 (0.7)	3.29 (0.7)	3.24 (0.7)	$t = -1.3$	.197
Importance score	3.45 (0.6)	3.29 (0.4)	3.37 (0.5)	$t = 2.6$	.009
Medical-technical competence	3.72 (0.4)	3.54 (0.5)	3.63 (0.5)	$t = 3.4$	.001
Physical-technical conditions	3.31 (0.8)	3.11 (0.6)	3.21 (0.7)	$t = 2.4$	.017
Identity-oriented approach	3.45 (0.9)	3.33 (0.4)	3.39 (0.7)	$t = 1.4$	.165
Sociocultural atmosphere	3.35 (0.6)	3.13 (0.6)	3.24 (0.6)	$t = 3.1$	.002

*Not included in the chi-square analysis.

doctor and the nurse "went over the same information and this took too much time"), and an additional 7% thought that more funding to staff the ED was needed (e.g., "need more doctors and more nurses and more staffing overall"). At T2, 13% of patients still commented on the wait times, and an additional 9% thought more funding was needed. Another suggestion (T1, 14%, and T2, 24%) concerned improving the communication mainly of physicians. For example, respondents stated, "Communication needs to improve between different doctors and departments in the hospital," "[There was] confusion as to where my

results were," and "Doctors should actually listen." Patients reported practical suggestions also, such as the need for separate rooms for different populations and ailments (e.g., cancer chemotherapy patients, pediatric patients, people with mental health problems, and people with a cough or cold). Despite these suggestions for improvement, almost 90% of patients at both T1 and T2 provided qualitative responses outlining areas with which they were particularly satisfied. These responses concerned appreciation for the quality of care received from doctors and nurses. Examples of comments were "Genuine concern from the doctor"

and "I was impressed by the knowledge of the nurses and the care they gave me."

Hospital metrics (Table 4) comparing the period from January–June 2009 to January–June 2010 indicate that the mean and 90th percentile time to physician initial assessment decreased from the first half of 2009 to the first half of 2010 for patients with a CTAS score of III, IV, or V but increased slightly for those with a CTAS score of I or II. During the 6-month interval in 2009, 21,604 visits were made to the ED, and during the 2010 6-month interval, 23,726 were made. Fewer people left without being seen in the 2010 ($n = 1,397$) period than in the 2009 period ($n = 1,822$), most notably patients with a CTAS score of III to V. The mean LOS increased for discharged patients with a CTAS score of I from the 2009 period to the 2010 period; however, the mean time decreased for all other discharged patients. The 90th percentiles for all discharged patients decreased, and the means and 90th percentiles for all admitted patients decreased for all CTAS levels from T1 to T2. Data gleaned from *Ontario Wait Times* indicated that at GGH, the total time spent in the ED for admitted patients decreased from 11.11 hours in the 2009 period to 9.95 in the 2010 period, and for nonadmitted patients, the total time decreased from 3.94 to 3.29 hours.[14]

DISCUSSION

GGH's ED PIP was evaluated by comparing patient perceptions of care and actual hospital metrics before the implementation of the PIP and approximately 6 months after implementation. Samples of discharged and admitted patients reported statistically significant differences in their perceptions, namely, decreased perception of time to see a physician and increased satisfaction with care, after implementation of a process improvement initiative. These perceptions suggest that the focused efforts to improve efficiency in the ED have had an impact on these metrics.

Hospital metrics comparing each time period (see Table 4) suggest that the process improvements undertaken reduced both the time to initial physician assessment and the total ED LOS for patients triaged as levels III to V. Although the time to the initial physician assessment (mean and 90th percentile) was

Table 4. Hospital metrics					
PIA	CTAS I	CTAS II	CTAS III	CTAS IV	CTAS V
2009, mean	0.3	1.0	2.2	2.1	2.0
2010, mean	**0.4**	**1.1**	1.9	1.7	1.5
2009, 90th percentile	0.6	2.0	4.5	4.3	4.3
2010, 90th percentile	**1.0**	**2.1**	3.9	3.8	3.3
LWBS					
2009, n (%)	0	45 (0.01)	843 (0.09)	833 (0.12)	101 (0.19)
2010, n (%)	0	25 (0.01)	639 (0.06)	669 (0.08)	64 (0.12)
LOS					
Discharged					
2009, mean	3.8	4.7	4.4	3.1	2.6
2010, mean	**4.7**	4.1	3.7	2.6	2.0
2009, 90th percentile	8.1	8.5	7.7	5.8	5.2
2010, 90th percentile	7.6	6.7	6.7	5.1	3.9
Admitted					
2009, mean	7.5	10.3	12.0	11.9	7.2
2010, mean	6.9	8.9	11.5	11.3	NA
2009, 90th percentile	19.6	22.2	24.0	24.9	11.7
2010, 90th percentile	15.0	19.5	23.8	24.8	NA

CTAS = Canadian Triage and Acuity Scale; LOS = length of stay; LWBS = left without being seen; NA = not available; PIA = physician initial assessment.
The boldface shows the instances where the time (PIA and LOS) is actually longer after implementation.

actually slightly longer postimplementation for patients triaged as CTAS levels I and II, this finding should be interpreted with caution as there 1) typically were very few CTAS I patients during the study period ($n = 115$ at T1 and $n = 106$ at T2) and 2) it is questionable whether the small differences are clinically significant. It should also be noted that the overall LOS expressed both as a mean and 90th percentile decreased for patients at all levels of acuity from T1 to T2 except for the mean LOS for discharged patients with CTAS level I. An examination of wait times by CTAS has shown that efforts to decrease times for stable, ambulatory, noncardiac patients (e.g., see and treat area) were successful; however, this particular strategy was not designed to benefit patients with a CTAS score of I or II. Given the acuity of CTAS I and II cases, future ED PIP efforts should be focused on these patients.

Qualitative responses suggest that by far the majority of patients at both T1 and T2 were very satisfied with the care they received, and fewer people reported dissatisfaction with their wait for care after implementation of the ED PIP. Patient perceptions with wait times have been shown to be inaccurate. For example, it has been reported that 25 to 50% were inaccurate when estimating actual wait times[15]; however, perceptions do influence political agendas and government action. Given that perceptions can influence policy decisions, that fewer people reported concerns with wait times after implementation may be considered relevant. It is important to note that these respondents were specifically asked about suggestions to improve their ED experience after they were asked to provide their perception of how long they waited and of the care they received. It is possible that these questions influenced their responses.

EDs are experiencing service volume increases while simultaneously the number of available beds to which patients can be assigned is shrinking. Overcrowding and wait times are important issues for EDs. ED overcrowding has been reported to be associated with increased mortality rates[16,17] and greater risk of poor outcomes and patient dissatisfaction.[18] Perceived long wait times have also been associated with patient dissatisfaction,[19,20] which is also influenced by perceptions of the quality of the information delivered and the quality of the expression, such as the courteousness of health professionals.[20] Actual constraints in the ED, such as overcrowding and patients' perceptions of care, are important variables to consider for process improvement initiatives.

Many efforts to improve efficiency in the ED have been proposed and implemented. Some initiatives have targeted emergency physicians,[21,22] to increase the precision of care for individual patient by identifying why the patient is in the ED, establishing a clear plan of action, implementing the plan of care, leading the team, and determining the dispositions. Other improvements have been documented as developing data collection dashboards and making improvements to bedside registration to move patients quickly and effectively through the health care process.[23] Ng and colleagues documented the implementation of the Lean principles similar to those outlined in the MOHLTC ED PIP and provided before and after hospital data: mean registration to physician initial assessment time decreased from 111 minutes to 78 minutes; LOS (time of registration to time that patients physically left the ED) for discharged patients decreased from 3.6 hours to 2.8 hours; and the number left without being seen decreased from 7.1% to 4.3%.[24] Several Lean principles were implemented at this site, including value-stream mapping, workplace organization, and the use of the worker as a source of quality. Although there is some evidence in support of process improvement initiatives,[24,25] direct extrapolation from one ED to another may not be possible given substantial differences in several domains, including patient populations, specialist support, physical space of the ED, and bed availability. Every hospital site has a unique set of barriers to address to improve flow; therefore, each should be evaluated for process improvement. Our evaluation suggests that a focus on process improvement at GGH may have been advantageous and worth the considerable effort that was expended. Other hospitals with similar barriers may also benefit from using some of the strategies described in this evaluation of a PIP evaluation. Moreover, documentation of intervention successes and failures is needed to contribute to evidence-based practice and to foster the uptake of successful strategies that are applicable to different ED settings.

As of June 2011, the 90th percentile total LOS for the province of Ontario was 12.1 hours for high-acuity conditions and 4.5 hours for low-acuity conditions, whereas at GGH, the total LOS was 8.7 hours for high–acuity conditions and 5.0 hours for low–acuity conditions.[14] Although the two time periods in our evaluation

appear to show that those with a CTAS score of I or II waited slightly longer after implementation, it is encouraging that GGH wait times for high-acuity conditions were recently reported as lower than the provincial average. However, GGH is currently close to the provincial target of 8 hours for high acuity and moderately close for low acuity. GGH compares favourably with other community hospitals with the same high volume.

The main limitation of this study is related to the design. Improvements in wait time and satisfaction cannot be directly attributed to the ED PIP without a rigorous design (e.g., randomized, controlled trial), which may be difficult to conduct because the intervention is context dependent and each hospital's context is different. Other limitations of this study are related to the methods used to gather the data and select the sample. Telephone interviews are less costly than face-to-face interviews, have an increased response rate compared to mail surveys, and have better confirmation about who is providing responses than electronic surveys. However, telephone interviews may be difficult for certain groups of respondents, including those with hearing problems or new immigrants (who may have difficulty communicating in English). The use of telephone questionnaires requires less time than other methods, such as face-to-face interviews, but there is potential for interviewer and response bias, which may affect the results.[26] In one study, respondents who were interviewed reported lower scores on the perceived quality measure (QPP scale) than patients who completed the QPP questionnaire on their own,[12] and the extent to which the use of a telephone survey affected respondent perception is not known. Another potential limitation of this study is the sampling process. The sample of ED patients was obtained from patient charts. The accuracy of these data depends on how the patients completed the registration process. There is a possibility that some important data (such as accurate telephone numbers) may be missed during this registration process and the data are only as accurate as what was collected during registration. Also, a stratified sampling technique was not used; thus, there were no patients who had a CTAS score of I included in the study (although their data are present in the hospital metrics and government metrics). Additionally, no formal method for random selection of patients from the list was used. Other possible limitations concern the selection of participants and the possible influence of bias of the nurses and research assistants. Lastly, in this evaluation, preimplementation scores were compared to 6-month postimplementation scores, and the long-term outcomes are not known.

CONCLUSION

The findings of this study suggest that the ED PIP may have led to improved patient flow, especially for patients with a CTAS score of II to V at GGH. The overall goals of the ED PIP of reducing wait times and improving patient satisfaction were met at the time this study was conducted and appear to be worth the considerable effort needed to develop and implement this process at GGH.

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