ABSTRACT

• **Objective:** To determine if 2 interventions introduced in an emergency department reduced the rate of patients who leave without being seen (LWBS).

• **Methods:** Retrospective chart review before and after implementation of a clinical greeter and a Monday intake shift.

• **Results:** The LWBS rate before implementation of the clinical greeter was 5.4% (95% confidence interval [CI], 5.0–5.6) and after implementation was 5.3% (95% CI, 5.0–5.6) ($P = 0.91$). Total patient volumes before and after implementation were 22,198 and 23,180, respectively. The LWBS rate during the intake shift implementation was 2.8% (95% CI, 2.4–3.5%) and after cessation was 3.6% (95% CI 3.0–4.3%) ($P = 0.05$). Total patient volumes on Mondays during implementation and after cessation were 3981 and 3438, respectively.

• **Conclusion:** While the implementation of a clinical greeter function did not impact the LWBS rate, a Monday intake shift decreased the LWBS rate despite a higher daily volume.

Overcrowding is a common problem in U.S. emergency departments (EDs) [1]. Patient volume, bottlenecks in ED and inpatient patient flow, and lack of ED and inpatient capacity contribute to the overcrowding problem. As access to primary care and outpatient specialized care continues to decrease for both insured and uninsured patients, increasing numbers of patients are utilizing the ED to address their health care needs. In addition, many patients who do not receive care for their chronic medical conditions present to the ED with high acuity problems requiring multiple resources and interventions to stabilize [1]. At the same time, budget and resource constraints result in fewer staff to deal with more patients as health systems seek to control their costs for care delivered [1]. Lack of inpatient bed availability, delays in the diagnostic workup, and difficulties with follow-up care also contribute to the ongoing crisis [1].

A related problem faced by EDs is patients who leave without being seen (LWBS), that is, patients who present to the ED but leave before a physician evaluation is completed. National LWBS rates for ED visits range from 1.7% to 9% [2–6]. A number of studies indicate that prolonged wait times are strongly associated with patients leaving without being seen [2–6]. LWBS has been associated with poor patient outcomes and increasingly is regarded as a surrogate measure of patient satisfaction and as a quality indicator of the ED and of the hospital as a whole [7].

There is a paucity of research addressing interventions that impact the LWBS rate. In an attempt to improve several operational parameters in our ED, including LWBS rate, patient flow and safety, and patient satisfaction, we have implemented a number of interventions over the past decade. These changes include bedside registration (2001–2002), physician-directed nursing triage protocols (January 2009), the opening of an ED-based observation unit (February 2009), creation of an institution-wide ED surge protocol (July 2009), on-call ED physician coverage for surge periods (July 2009), and creation of triage/intake beds for nursing and physician assessment of patients at triage (September 2009). Such approaches are considered “best practices” and have been shown to potentially improve ED flow and quality [8].

Two other interventions were also introduced. In July 2008, we introduced a clinical greeter, a registered nurse who is the first contact for the patient upon presentation to the ED. The greeter records a chief complaint into the electronic medical record and screens for high-acuity problems such as heart attack, stroke, critical illness, or serious injury. Patients with potential high-acuity problems are placed in a bed immediately, thereby bypassing attempts to lower the rate of patients that leave the emergency department without being seen.
the standard ED triage system. In addition, in November 2009, we introduced a 6-hour physician intake shift on Monday evenings. The intake shift concept refers to an attending emergency physician evaluating, treating, and dispositioning patients directly from the intake/front end area of the ED prior to being placed in an ED bed. Patients were selected at the discretion of the intake physician, with a preference for evaluating patients whose dispositions (admission or discharge) were expected to be straightforward. The goal of the shift was to expedite evaluation and disposition of these patients to avoid the need to place them in an ED bed. Monday was selected due to it being the highest volume day in our ED, and the shift was positioned in the ED when peak ED demand occurred.

These 2 interventions, because they did not temporally overlap, were the focus of our analysis. We sought to determine if these interventions had an effect on rate of LWBS.

METHODS
Setting
The Ohio State University Wexner Medical Center is an academic tertiary referral center for the city of Columbus and the surrounding central and southeastern Ohio region [9,10]. It consists of 6 hospitals, outpatient surgical centers, and numerous outpatient clinics throughout the city and region. The ED at the Medical Center is a level 1 trauma center staffed by board-certified emergency medicine attending physicians and emergency medicine resident physicians. The ED serves over 1200 inpatient beds at the Medical Center campus, and approximately 72,000 patients are seen and evaluated in the ED per year. Admission rates average 26% with an additional 6% to 8% of patients placed in observation status for up to a 24-hour period. Of those admitted, 15% are triaged to an intensive care unit [10].

Chart Review
We retrospectively audited patient charts for 4 four-month periods to evaluate whether the clinical greeter and/or the Monday intake shift led to reductions in LWBS. The researchers were blinded to any patient identifiers. For the clinical greeter intervention, we examined data from the 4-month period prior to introduction of a clinical greeter (March–June 2008) and a 4-month period after the greeter had been in place for 2 months (September–December 2008). We included all patients who presented to the ED during these periods in out review. For the Monday intake shift, we examined data from a 4-month period in which the intake shift was in operation and fully implemented (March–June 2010) as well as 4 months following termination of the program (September–December 2010). Only the charts of patients who presented on Monday during these periods were reviewed. We collected aggregate data on patient volumes and number of patients who left without being seen for each intervention. For each time period, we calculated the proportion of patients who LWBS with 95% confidence intervals (CI). To measure differences between periods we used the chi-square test set at a significance of $P = 0.05$.

RESULTS
For the clinical greeter intervention, there were 1188 patients who were LWBS out of 22,198 patients presenting to the ED prior to the intervention (5.4%, 95% CI 5.0–5.6), and 1235 patients who were LWBS out of 23,180 presenting to the ED with the clinical greeter in place (5.3%, 95% CI 5.0–5.6). There was no difference in LWBS rates between the 2 periods ($P = 0.91$). Average daily patient volumes were 182 patients per day in the pre-intervention period and 190 patients per day during the intervention.

For the Monday intake shift, 113 out of 3981 patients (2.8%; 95% CI 2.4–3.5) were LWBS when the program was running, and 125 out of 3438 patients (3.6%; 95% CI 3.0–4.3) were LWBS after the program was terminated. This difference was statistically significant ($P = 0.05$). Mean daily volumes were 221 patients per day during the intervention (March–June 2010) and 202 patients per day when the intervention was not in effect (September–December 2010).

DISCUSSION
Although LWBS represents a significant problem for hospitals, limited research has been conducted on why patients LWBS. In a study of 1272 LWBS patients, Mohsin et al identified 3 factors that increased the probability of LWBS—younger age, longer waiting times, and lower acuity triage levels. Long waiting time was the most common reason for LWBS in this patient population [7]. One urban academic ED reported that 51% of their patients were willing to wait no more than 2 hours to be seen [11]. In a multicenter study in California, hospitals that serve lower income and poorly insured patients had higher LWBS rates [12]. In a United Kingdom study.
investigating ED waiting times, LWBS patients were more likely to be younger, male, lower acuity, and present during periods of longer waiting times [13].

According to Asplin's model of acute care [14], ED operations consist of input, throughput, and output. The input variables include emergent care patients, unscheduled urgent care patients, and safety net care patients. In the throughput phase, variables include triage and room placement, diagnosis and treatment, and patient disposition. Output variables include discharge to ambulatory care follow-up, transfer to other facilities and admission to the hospital. LWBS rate is typically an indicator of ED over-crowding in the input phase [15]. The clinical greeter and physician-in- triage represent 2 attempts to modify this input phase and have shown to be beneficial in other settings [16,17]. Our clinical greeter paired with a registration clerk resembles the Rapid Triage and Treatment system described by Murrell et al [16], in which patients undergo a rapid triage with low-acuity patients seen and treated by a physician in the triage area. Murrell et al found rates of 4.5% and 1.5% before and after implementation of the system.

We found no decrease in LWBS rates with the implementation of a clinical greeter. The reason for lack of effect of the clinical greeter on LWBS rates in our study is unclear. It likely represents department-specific factors not accounted for in the study. The greeter would have had the greatest effect on high-acuity patients by getting them to a room quickly. The greeter likely had less effect on the low-acuity patients, who are more likely to LWBS. Although no effect on the LWBS rate was noted, the clinical greeter has remained a core ED intervention since its implementation. In our experience, the clinical greeter improves several other parameters including patient flow and safety in our ED. High-risk, high-acuity conditions are recognized within the first few minutes of presentation and the triage process is streamlined. The critical steps of the registration process, such as creating an account number and obtaining demographic information, are completed. This amalgamated process facilitates rapid triage and physician evaluation.

Prior studies have also evaluated intake physicians as a way to affect the input phase of ED crowding. A systematic review of 12 nonrandomized controlled studies evaluating the effect of an intake physician on the LWBS rate found a significant decrease in the LWBS rate. In the 2 randomized controlled studies evaluated, however, there was no reduction of LWBS [16].

We found a statistically significant increase in LWBS rate from 2.8% to 3.6% after the intake shift was discontinued. The lower rate that occurred when the intake shift was in place was achieved despite a higher daily volume, suggesting that without the increase in volume the rate may well have been lower.

Although statistically significant, the absolute difference of 0.8% in LWBS rate is of questionable clinical significance. Overall, this difference was not as substantial as we had hoped to see and made the economics of the program infeasible. One possible explanation for the failure of our intake shift to achieve more impressive results was difficulty in coordination of staffing between physicians and ancillary staff. The high patient volume experienced by our ED on Mondays left fewer nurses available to work in the intake areas. As a result, the physician staffed the area alone, with ad hoc arrangements for ancillary staff to facilitate patient care.

Without an experienced, efficient intake staff, it proved quite difficult for the intake physician to order diagnostic studies, administer medications, and discharge patients productively. Therefore, from an efficiency and economic perspective, the cost-benefit analysis of the Monday intake shift proved to be inappropriate for the ED at that time. The Monday intake shift was re-instituted in January 2011 in an attempt to improve patient flow and door-to-doctor time but ultimately discontinued again due to cost concerns and the inability to coordinate increased physician staffing with additional nursing resources. Interestingly, due to building construction challenges, loss of existing ED capacity, and service demands, we anticipate re-instituting the intake shift in April of 2013. We will use the above previous experience to better staff this area and to ensure that a coordinated team of physician and nursing staff can work together to accomplish the goal of more prompt initial evaluation and sorting of patients when they present to the ED.

While the interventions did not have the intended impact on LWBS, there were a number of perceived benefits that should be mentioned. First, patients appreciated having initial contact with an experienced triage nurse immediately upon ED arrival. In fact, it became clear to us that this was the expectation of most patients when they presented to the ED. Second, the ED staff felt that there were a number of clear “saves” where critically ill patients in extremis were able to be identified immediately upon arrival, allowing for near immediate recognition of seri-
ous illness or injury. Finally, while the number of patients evaluated by the intake physician was small overall, such patients frequently commented positively about the experience. Due to the small number of patients, and the fact that the intervention was on our busiest day when wait times were an issue regardless of the intake shift (with wait time being a direct relationship to patient satisfaction), we did not see a clear improvement in patient satisfaction scores.

There were several significant limitations to the study. First, this study was a retrospective chart review. With the exception of the patient’s disposition and medical record number, investigators were blinded to other clinical information. Secondly, there were several potential confounding variables which were not accounted for in this investigation. Although patient volume remained constant during our 2 interventions, other variables such as level of acuity, inpatient bed capacity, and level of ED staffing did not remain constant. Lastly, in 2009, a major construction project aimed at increasing ED and inpatient capacity commenced resulting in challenging accessibility, ongoing changes in traffic patterns, noise pollution, and decreased ED space. The dynamic nature of these construction changes may have affected LWBS rates. However, we expect the largest effect from this construction would be on patient volume and we did account for this. The project will culminate in 2014, when the ED will move to a new hospital building with an increased number of ED and inpatient beds.

CONCLUSION

LWBS continues to be problematic in our ED but we are maintaining a proactive approach to resolve this issue. Although institution of a clinical greeter had no effect on LWBS rates, use of a physician intake shift at peak times had a small but significant effect on LWBS rate. Multiple confounding variables and the difficulties in controlling for these variables makes LWBS research rather difficult. In order to isolate the LWBS variable in the input phase, the other variables in the throughput and output phase in the acute care model need to be addressed.

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REFERENCES

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