

**Extending the hours of a pediatric emergency department's fast track
clinic into night shift did not decrease the aggregate length of stay or the
length of stay of the high acuity patients on night shift**

Erete S. Bloom

A thesis
submitted in partial fulfillment of the
requirements for the degree of

Master of Public Health

University of Washington

2012

Program Authorized to Offer Degree:
Public Health and Community Medicine- Health Services
University of Washington
Graduate School

University of Washington

Abstract

Extending the hours of a pediatric emergency department's fast track clinic into night shift did not decrease the aggregate length of stay or the length of stay of the high acuity patients on night shift

Erete S. Bloom

Chair of the Supervisory Committee:

David Grembowski

Professor, Health Services

Professor, Oral Health Sciences

Adjunct Professor, Sociology

Objective: This study set out to see if extending the hours of the pediatric fast track clinic through the first half of night shift in a dedicated pediatric emergency department decreased the Length of Stay (LOS) of all the patients seen on night shift (termed aggregate LOS) and of the high acuity patients seen on night shift.

Methods: This study was conducted in a pediatric hospital run by Multicare Health System in Tacoma, WA. The study was designed as a pre/post-intervention with a comparison to a similar time period the previous year. The intervention was the extension of the hours of Child Express clinic into night shift that started November 1, 2005. The pre/post intervention periods were from October 1 to October 31 and from November 1 to December 2, 2005, respectively, and for the same periods in the previous comparison year (2004). Linear regression was used to determine whether there were observable differences in mean length of stay adjusting for differential inpatient admit rates between pre and post assessment periods using a historical comparison control.

Results: Mean length of stay was found to be 2.1 hours in the post intervention (Child Express) period relative to 2.32 hours in the pre-intervention period. When compared to

the 2.2 hours and 2.3 hours in the respective historical periods, the difference in differences was found to be .22 hours, or 7.2 minutes (95% CI 0.84, and 1.1, $p = 0.37$).

Conclusion: Extending the hours of the fast track clinic into night shift was not associated with a difference in aggregate LOS or the LOS of high acuity patients on night shift. This is consistent with previous findings. Additional factors likely influence the throughput of a pediatric emergency department beyond simply reducing the volume of low acuity patients in the main emergency room.

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Chapter 1: Introduction:

Background and Significance:

Increasing numbers of patients visit Emergency Departments (EDs) every year. The number of visits in proportion to the general population is also increasing. The National Center for Health Statistics reports that from 1996 to 2004, ED visits increased from 90.3 million to 110.2 million visits per year. This translates into rates of 34.2 ED visits per 100 persons to 38.2 visits per 100 persons per year, respectively. The highest proportion of ED visits were ages 75 years and over, followed by ages 15-24, and then ages 15 and under (1,2). Pediatric Emergency Departments are also experiencing larger patient volumes (3). The increasing numbers are not due solely to an increase in urgent problems, for the percentage of urgent problems increased 6.7% for the 15 years and under group and 5.7% for the 15-24 year old groups, while the percentage of total ED visits for those age groups increased 9.9% and 24% respectively (1,2).

The patients using the ED are not necessarily lacking health insurance and/or a primary physician. In studies using a national sample of 49,603 adults, Weber et al (2005) found that 83.1% of frequent ED users had a usual source of care, and that uninsured patients were no more likely to visit the ED than insured patients. In fact, the group lacking a usual source of care was *less* likely to visit the ED (4). A second and third study with the same adult cohort revealed that the percentage of ED visits from patients who had usual sources of care increased from 52.4% in 1997 to 59% in 2004, while the percentage of patients who lacked usual sources of care remained essentially the same at 9.6 and 9.7% (5), and that 84% of frequent ED users had health insurance (6).

In the pediatric population, Halfon, et al., also found that insurance status did not predict ED use. Additionally, he identified other factors that did predict ED use; a child has increased odds of going to the ED for non-urgent care if they are from a single parent family, a poor or urban family, or their mother has less than a high school education (7). Phelps et al. and Zimmer et al., in two different studies, found similar factors associated with non-urgent ED visits, but also found that parents who had their own sick care regularly from an ED were more likely to take their children to the ED for sick care. Lack of insurance was not associated with increased odds of ED use (8, 9). Other reasons stated in the literature for non-urgent ED visits were that the primary MD (PMD) could not be reached, the parent was dissatisfied with the PMD's care, they were unable to get an appointment with the PMD, or they were seen faster in the ED (9, 10, 11). Most pediatric patients that present to emergency departments for non-urgent sick care do have primary doctors; their parents just feel they receive better and/or timelier care in the emergency department (7, 8, 9).

The populations using the ED for non-emergent sick care would likely decrease their ED visits if they had better access to their PMD. Christakis, et al., discovered that increased continuity of primary care with an attending physician decreased the likelihood of ED visits in 2 different studies with two different pediatric populations in Seattle (12, 13). Studies found that primary care offices who adopted a model of scheduling termed "open access" increased their patients' continuity of care *and* satisfaction with their physician. ("Open access" scheduling means that appointments are available for well or sick care relatively quickly, usually the same day or within the next 2 to 3 days, as well as easier phone access to schedulers and nurses (14,15)). Based on the above studies it

seems reasonable to state that EDs, including pediatric EDs, face the public health problem of providing medical care to a segment of the population that has decreased access to their primary care physicians.

Many hospitals are opening “fast track” clinics to handle the growing numbers of low acuity patients seeking care through the ED. The purpose of a fast track clinic is to evaluate and treat low acuity patients more quickly than they would be seen in the main emergency room. Low acuity patients are promptly taken to an exam room and seen by a medical provider separately from the main emergency room, using medical providers dedicated to the fast track patients. The lower acuity patients are therefore shunted away from the main emergency room, where the higher acuity patients are. Many models for a fast track clinic exist, from a single PA to a fully staffed clinic with a receptionist, medical technician, registered nurse (RN) and medical doctor (MD). Generally, a fast track clinic is only open during the busiest times in the emergency department.

In 2004, Mary Bridge Children’s Hospital Emergency Department (which sees patients from 0 to 18 years old), a part of Multicare Health System in Tacoma, Washington, opened its fast track clinic, named Child Express, to handle the growing numbers of lower acuity patients visiting the Mary Bridge ED. From 2000 to 2004, the annual census increased from 24,991 to 27, 519, and then to 29,083 in 2005 (data from Mary Bridge ED). The Child Express clinic aimed to decrease the volume of patients in the Mary Bridge ED during the busiest times. It is considered a part of the Mary Bridge ED, but is physically separate from the Mary Bridge ED. For this paper, the original Mary Bridge ED is referred to as the main ED, and Child Express is Child Express. Together, they are the Mary Bridge ED.

In 2004 Child Express opened at 11 a.m. and closed at 11:30 p.m. Due to increased number of patients checking into the Mary Bridge ED very late into the night, the hours were further extended on November 1st 2005 to be from 11 a.m. to 3 a.m. A second reason the closing time was moved to 3 a.m. was that the number of physicians in the main ED decreased on night shift from two to one. Night shift is from 11 p.m. to 7 a.m. (please see Figure 1 for the diagram of the shifts and hours of Child Express and the main ED). Therefore, at 11 p.m., more patients were coming in, Child Express was closing and only one doctor in the main ED was seeing patients. By keeping Child Express open until 3 a.m., the goal was to decrease the backlog of patients waiting to be seen by the single doctor working night shift in the main ED. After 3 a.m., all patients, both low and high acuity, are seen in the main ED until 11:00 a.m., when Child Express opens again.

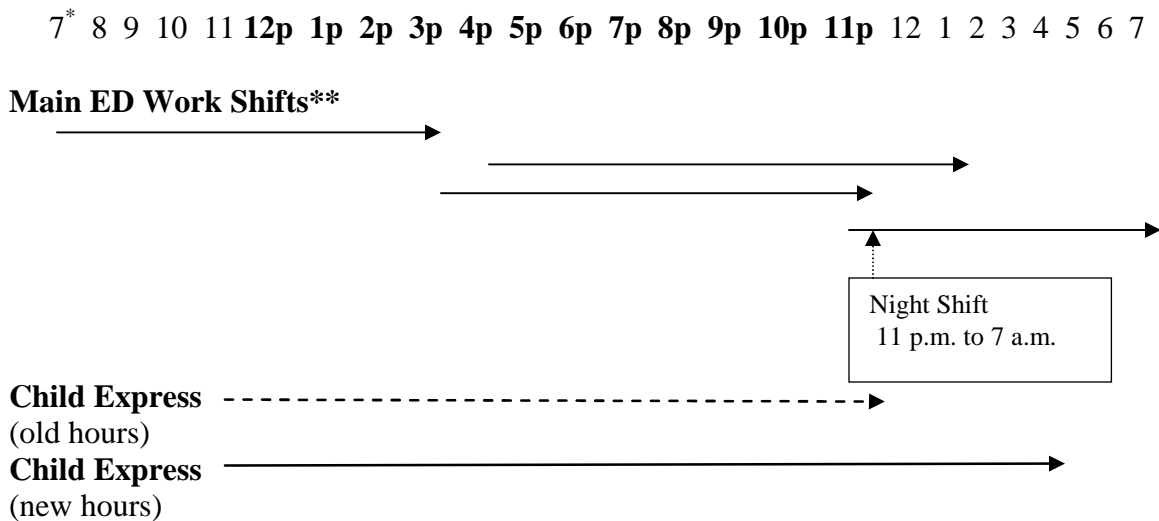


Figure 1: Diagram of work shifts* in the Main Emergency Department and in Child Express

* Ante meridiem (a.m.) hours are in regular type and p.m. hours are in bold face type.

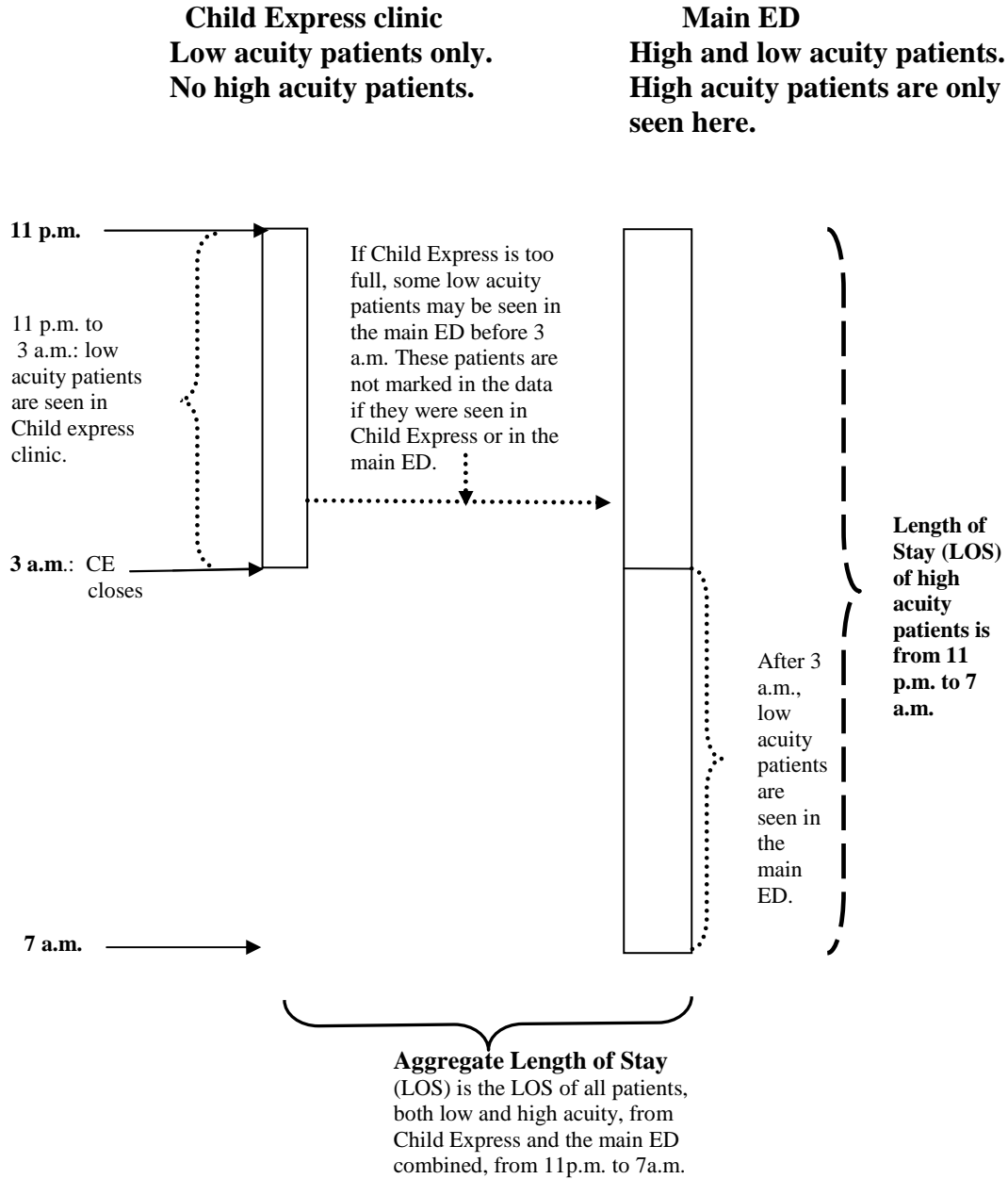
** Each arrow represents one physician's shift.

Study Question:

This study was designed as an evaluation of extending the open hours of Child Express from 11:30 p.m. to 3 a.m., initiated on Nov. 1st, 2005. This study asks the question **“Does extending the open hours of Child Express from 11:30 p.m. to 3 a.m. decrease the length of stay (LOS) for all the patients waiting to be seen on night shift, both in Child Express and in the main ED?”** Length of stay (LOS) is defined as the time from when the patient is entered in the computer system to the time they are officially discharged from the emergency department. For this paper, the average LOS for *all* the patients grouped together, from both Child Express and the main ED is termed “aggregate LOS.” This study only examines pediatric emergency department patients. No adults are seen in the main pediatric ED, named “main ED” in this paper, or in Child Express.

The majority of ED patients on night shift (11 p.m. to 7 a.m.) check in before 3 a.m., and the majority of those patients are low acuity (data from Mary Bridge ED). When the low acuity patients are seen in the Child Express clinic for the first half of night shift, only the high acuity patients remain in the main ED to be seen by the single doctor there. After 3 a.m., the number of patients checking in the Mary Bridge ED decreases dramatically, and both high and low acuity patients are seen in the main ED (please see Figure 2). The low acuity patients seen in Child Express are expected to be seen faster based on literature showing that fast track-type clinics decrease the LOS for low acuity patients (16, 17, 18, 19). By removing the low acuity patients from the main ED for half of the night shift, the LOS of the higher acuity patients may also decrease because the staff have fewer patients to take care of and more time to focus on the higher acuity

patients. After 3 a.m., all of the patients checking in, both high and low acuity, may have a shorter LOS because there is less backlog from the first half of the night shift. Since the majority of patients on night shift are lower acuity patients checking in before 3 a.m., our study also implies the question: “Does seeing low acuity patients separately from high acuity patients decrease the LOS of the high acuity patients?” The study question is not asking if the Child Express clinic actually saw patients faster than similar patients seen in the main ED, although this data were examined for discussion purposes.



Key:

..... = Low acuity patients

----- = High acuity patients

Figure 2: Schematic of the division of low and high acuity patients between Child Express and the Main ED on night shift (11 p.m. to 7 a.m.).

This study was initiated with the expectation that that the aggregate LOS would be shortened by the program intervention. However, a thorough literature review revealed that the null hypothesis (of no difference in the LOS) is more likely to be true. One pediatric study in the U.S. examined the aggregate LOS for all patients when their fast track was in operation. The authors found that the aggregate LOS for all patients did not change, even though the patients seen in the fast track clinic had a significantly shorter LOS than a similar cohort of patients seen in the ED (17). Casalino, et. al. found that the LOS for lower acuity patients was not a significant predictor of a lower or higher than average aggregate LOS in a large study from one French hospital (20). An Australian study performed a prospective controlled study for twelve weeks. They alternated weeks when they had a fast track clinic open verses seeing all patients in the main ED. When they analyzed the data, they also found that the aggregate LOS did not change when the fast track clinic was in operation (21). Further supporting this trend is a Canadian study that analyzed 4.1 million patient visits from all Ontario hospitals and found that every 10 low-acuity patients arriving per 8 hours was associated with only a 5.4-minute increase in mean length of stay and a 2.1-minute increase in time to first physician contact for medium and high acuity patients, demonstrating that the LOS of high acuity patients is not intimately linked to the number of low acuity patients seen in the same time period (22). Only one study of a 24 hour fast track in Dubai, (not the usual operating hours for a Fast track clinic), found a decrease in the aggregate LOS and the LOS of high acuity patients when their fast track was in operation (23). Therefore, although it seems intuitive that our aggregate LOS on night shift should decrease based on our program intervention, previous studies indicate that it may not.

Figure 3 presents a flow diagram of the conceptual model of the Child Express intervention. Moderating concepts, or “moderators,” that may counteract the expected positive effects of the program are included in the diagram. One moderator is that the nearby adult emergency department and Mary Bridge ED share the same registration staff, so a large number of adult patients waiting to be registered and/or insufficient registration staff could easily add to a patient’s time in the emergency department. Another important moderator is the acuity of the patients. Higher acuity patients generally take more time to evaluate and treat. Therefore, even if there are relatively few patients in the main ED, if they are higher acuity, the LOS will be longer. Two other moderators are physician speed, or a physician’s average time spent per patient, and daily pediatric patient volume, both which could significantly impact the overall LOS. Also included in the model is a moderator that could improve the chances of achieving the program goal, decreased patient load in the main ED, which is expected to improve staff morale, further speeding up patient flow. This aspect of the program was not evaluated in this study.

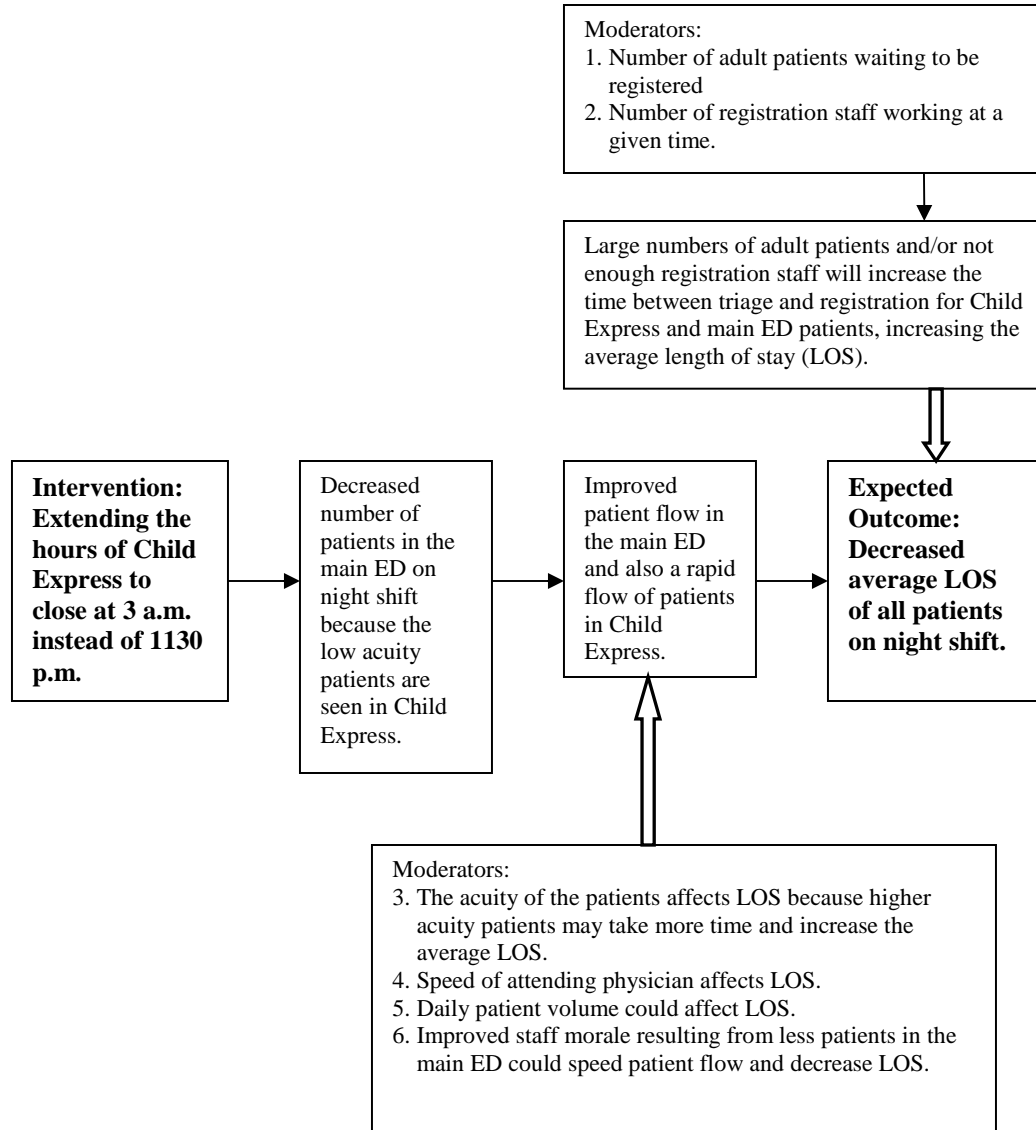


Figure 3: Conceptual model of the extended hours of Child Express and expected outcome.

Chapter II. Methods:

Setting:

To fully understand the patient flow of Mary Bridge ED, one has to know that all children checking in to the Mary Bridge ED, enter through the same door. After entry, a patient is greeted by a medical technician, who places their name in the computer. From there, a triage nurse looks at the queue of people on the screen, and a pediatric triage nurse calls up the next patient into a triage room. The triage nurse decides which patients go to Child Express and which do not. After a patient is triaged, they remain in the triage room (for privacy concerns) to be registered by the registration staff. After registration, they are sent back out to the waiting room until they are called back to either a Child Express or a main ED exam room, depending on their designation (see Figure 4).

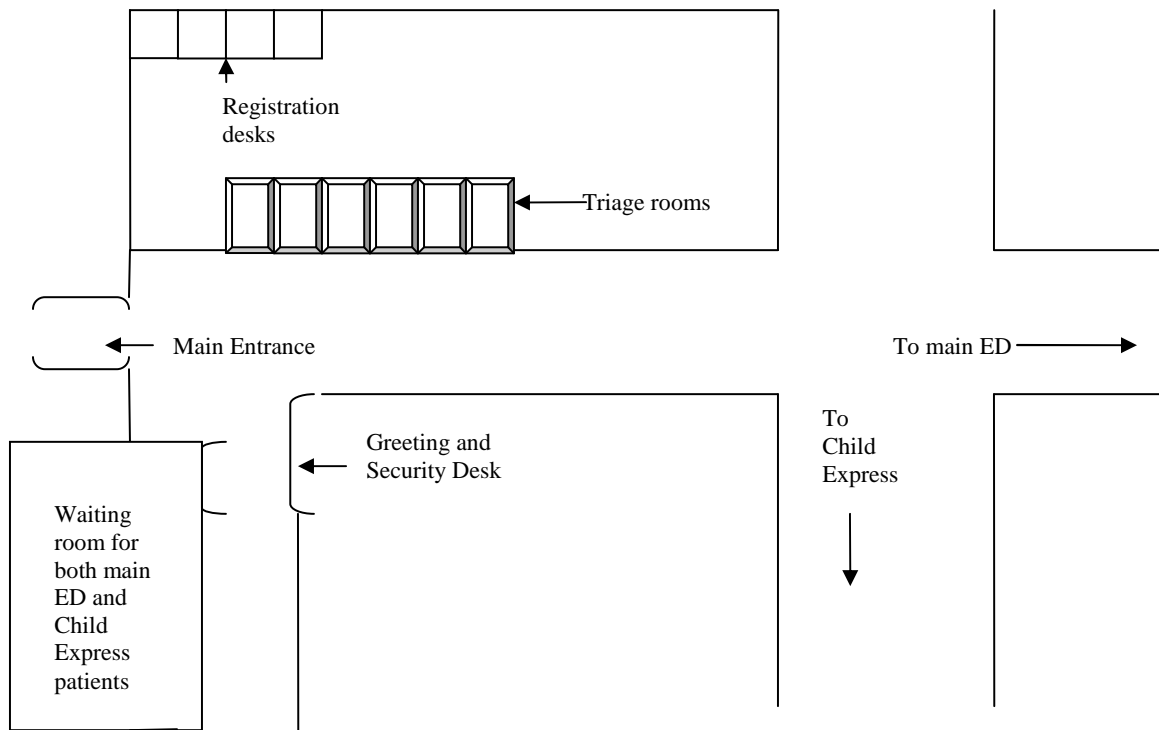


Figure 4: Floor diagram of the Mary Bridge Emergency Department waiting and triage areas.

When a child checks in at triage, if they meet a certain set of criteria, they are sent to Child Express to be evaluated. The criteria are: the patient has no significant past medical history, has no chronic diseases, is not ill appearing and is not stating a complaint that would require a significant amount of time to evaluate, like child abuse or abdominal pain. The triage nurse assigns each child a triage number, which ranges from 1-5, with the highest acuity assigned a number 1 and the lowest acuity a number 5. (This scale is called the Emergency Severity Index and was developed by the Agency for Healthcare Research and Quality (24)). In this paper, “high acuity” refers to triage categories 1, 2, and 3 and “low acuity” means triage categories 4 and 5.

Triage category 1 means the child is taken straight back to the main ED without delay (usually these are trauma patients brought by ambulance or airlift), and category 2 would be a patient who looks ill and needs immediate attention. An example of triage category 3 is a child who is mildly dehydrated and may need intra-venous fluids, but is not too ill appearing. Examples of categories 4 and 5 are a child who is not ill appearing and has a fever and ear pain, and one who has had a skin spot for two weeks, respectively. Most Child Express patients are triage category number 4 or 5. If Child Express is very busy and the main ED is not, then the main ED will also see category 4 and 5 patients.

Category 3 patients are generally seen in the main ED, but if the main ED is very busy and Child Express is not, Child Express might selectively take a few category 3 patients to help out. This rarely happens. Child Express never sees patients that are category 1 or 2.

Child Express is staffed by a general pediatrician (not one that has been subspecialty trained in emergency medicine), a registered nurse, a medical technician, and a

receptionist, most of who also work or have worked in the main ED. Child Express has its own designated space; approximately 200 yards from the main ED, containing 5 patient beds in 4 rooms, a staff area, and a supply room (see Figure 4).

Study Design and Selection of Study Subjects:

This study used a pre/post-intervention design with a comparison of the Child Express intervention period to a similar time period the previous year. The intervention is the extension of the hours of Child Express clinic that started Nov. 1, 2005, and was planned as a permanent change, not a temporary trial. The study periods were from Oct. 1, 2005 to Dec. 2, 2005, and from the same days the previous year. For ease, we renamed the time period from Oct. 1, 2004 to Oct. 31, 2004 as Period 1, from Nov.1 2004 to Dec. 2, 2004 as Period 2, from Oct.1 to Oct. 31, 2005 as Period 3 and from Nov.1, 2005 to Dec. 2, 2005 as Period 4. Period 4 is the post-intervention period. The design of this study directly impacted the selection of study subjects. The population for this evaluation was the entire population of patients, without exclusions, that checked into Mary Bridge ED on night shift (11p.m. to 7a.m.) during the study periods.

We chose thirty-one days for the pre and post intervention periods based on the pattern of seasonal variation of pediatric illnesses in this region (Mary Bridge ED data). For this particular hospital, October and November have similar volumes and illnesses, while December shows more variability compared to October and November (Mary Bridge ED data). Therefore, we decided to limit the time frame on either side of the start of the intervention to 31 days in order to keep the seasonal variation as consistent as possible. We chose to also examine the same time period from the year before as a

historical comparison group. While not a “true” control group, this group does allow us to see if there was a similar trend in LOS in the same months of the prior year without the intervention.

We decided not to compare October 2005 to November 2005 as a simple pre- and post intervention study because the study is much stronger using a comparison group from the previous year. We expect some variation in the LOS from month to month in any year. This study is comparing whether the difference in LOS between October and November of the pre-intervention year (2004) is significantly different than the difference in LOS from October to November of the intervention year (2005), essentially comparing the difference in differences.

Studies of this type, the pre and post intervention evaluation with a comparison to a similar time period in the previous year, are in general subject to the following potential threats to internal validity: history, maturation, testing, instrumentation, and possibly regression, selection and attrition. For this particular study, testing and instrumentation are not an issue because LOS was measured the same way throughout the study, and the patients did not take any test or fill out any survey. History is a possible factor influencing results, as the study periods occurred at different times and different events could have influenced them. No major public health scares or epidemics occurred during the study periods, to the best of the author’s knowledge. Maturation, regression and attrition are not significant threats because the people are different in each of the study periods. Selection is the main threat in this study, because the patients may be different in the pre-and post intervention periods as well as between the years (25).

Data Collection, Quality and Measures:

Prior to obtaining the data, IRB approval was granted from both the umbrella institution of Mary Bridge ED, Multicare Health System, and the University of Washington.

The data were a replica of the daily computer information on each Mary Bridge ED patient with identifying information omitted. Arrival time and date, age of patient, chief complaint, acuity level, attending physician, discharge time and discharge diagnosis were included. The data quality was excellent. Out of 1550 patients, only 20 had incomplete information due to the patient leaving before being seen by a physician. Those patients had an estimated discharge time at the time the staff realized they left. The remainder of the data were complete and assumed to be accurate. Occasionally, a staff member may have forgotten to enter the time a patient was actually discharged from the Emergency Department. In this case, the staff entered an estimated discharge time later on. There is no way to tell from the data when this occurred, but likely less than 5% of the time, based on an estimate from the senior staff member in the main ED.

The dependent variable, LOS, for each patient was calculated by simply subtracting the arrival time from the discharge time using Microsoft Excel. The main independent variable was time, and the other independent variables were acuity, daily patient volumes, and each physician's average time per patient.

The acuity score was a number scale from 0 to 99 generated by the computer at the time of the patient's discharge. Each patient received one number, or acuity score, based on the various procedures and interventions that each patient received during the visit in the main ED or Child Express. Therefore, the acuity score was more accurate than just

the initial triage category because the score was calculated after the patient was evaluated and discharged. The acuity scoring system was developed and implemented in the Mary Bridge ED about thirty years ago. The acuity scores assigned by the computer at the time of the patient's discharge were then re-grouped by the author into high acuities that were numbers 1, 2 and 3, and low acuities that were numbers 4 and 5. (Note: While this categorization looks like the Emergency Severity Index used at the time of triage, it is actually just a grouping for analysis that reflects the true acuity of the patient after they were treated and evaluated.)

Daily patient volumes were calculated based on the 24 hour day and entered as a new variable.

Each physician's average time per patient was calculated in Excel based on their total patient base from all 4 periods for all shifts, not just for night shift, and entered as a new variable named MD time per patient.

Data Analysis:

Descriptive statistics were computed for number of patients, average age, acuity and LOS. The data were analyzed with linear regression using the Statistical Program for Social Sciences (SPSS) version 12.0 (IBM Corporation, Copyright SPSS 2003).

The outcome variable was LOS. The main independent variable was time, divided into the 4 study periods. A variable for the month was entered as an independent variable that assigned the two October months a code of 0 and the two November months a code of 1, then a separate variable was entered for the year which assigned a code of 0 to 2004 and a code of 1 to 2005. A third variable was constructed that multiplied the

month and the year, named “month times year,” so that the pre-intervention time periods (periods 1, 2 and 3) had a code of 0 and the post intervention time period (period 4) was coded as 1. This allowed the model to add another layer of analysis that took into account the month and the year at the same time, which captured the difference-in-differences between the LOS from October to November of 2005 compared to 2004. This is called a test of interaction in longitudinal studies (26).

The three co-variates were then added to the analysis, each one of which could have a strong impact on LOS for that day. First, just the acuity score was entered as a covariate, then the daily patient volume and MD time per patient were simultaneously introduced into the model alongside the acuity score. This was done because we wanted to see the impact of acuity alone on the LOS, while the impacts of the other two covariates were not as important to examine in isolation for this study.

In a stratified analysis, the model also was run twice more with the same co-variates, but separating the acuities to see if there were any difference in the aggregate LOS with only low acuity patients and then with only high acuity patients. Therefore, the acuity covariate was eliminated because the groups were already stratified by acuity, and then the daily patient volume and MD time per patient were introduced simultaneously into the analysis for each acuity group. This was done because the high and low acuity groups were very different clinically. High acuity patients generally required more evaluation or intervention in the emergency department. A predominance of high acuity patients in a given time period could mask a program effect even if the lower acuity patients had a shorter LOS due to the program. Because the low acuity patients were seen both in Child

Express and in the main ED, analyzing them separately in the model reflected the aggregate LOS for all low acuity patients seen in both locations.

Also, the LOS of the low acuity patients seen in the Child Express clinic was compared to the LOS of the low acuity patients seen in main ED using linear regression for discussion purposes only, not as part of the main analyses for the evaluation question. The two groups were divided by the low acuity patients seen before 3 a.m. (the Child Express group) and those seen after 3 a.m. (the main ED group). Only a rough estimate of the two groups was possible, based on the time Child Express closed (3 a.m.), because the available data did not separate which low acuity patients were seen in Child Express versus the main ED (see Figure 2).

Tests and summaries of length of stay were computed on the log scale since differences in geometric mean, or percentage differences, were more relevant as a summary to compare results across clinics of various volumes and acuities.

A power curve was constructed using the computer program R.2.11.1 (Copyright 2010, The R Project for Statistical Computing). For the number of patients in this study (1,550), to detect a significant difference in the LOS of October and November of the intervention year (2005) over the previous year (2004) with 80% power and $\alpha = 0.05$, there would need to be at least a 20% reduction in the “difference-in-differences” in LOS between October and November of 2005 versus October and November of 2004. For example, if the average LOS in November of 2005, the post-intervention period, was 48 minutes longer than in October of 2005, the pre-intervention month, but in the historical comparison year of 2004, the average LOS of November was 60 minutes longer than in October of 2004, then the “difference-in-differences” would be 12 minutes. This would

be a 20% reduction in the difference in average LOS between October and November of 2005, the intervention year, over the baseline difference in average LOS between October and November of the historical comparison year of 2004, and therefore likely would be statistically significant at 80% power and $\alpha = 0.05$, according to the power curve we constructed.

Chapter III: Results:

The total number of patients was 1,550. The majority of patients (80%) were arriving in the first half of night shift (see Table 1). Of those patients, 80% were low acuity and 20% were high acuity. The proportions are the same for the second half of night shift. The low acuity patients arriving during the first half of night shift were the largest group, representing 56% of all the patients checking in during the whole night shift.

The number of patients in each period ranged from 368 to 401 (see Table 2). The average age ranged from 4.53 years to 4.62 years, with similar standard deviations. The average acuities of the patients were lower in the intervention year (recall that 1 is highest acuity and 5 is lowest acuity). The mean LOS ranged from 2.10 hours to 2.32 hours, and the difference in the mean LOS between October and November of the intervention year was larger than between October and November of the comparison year (0.22 and 0.1 respectively). This translates from fractions of an hour into a 13.2 minute decrease in mean LOS from October to November in 2005 and a 6 minute decrease in mean LOS between October and November of 2004. The difference in the differences was 7.2 minutes.

For high acuity patients, the number of individuals in each period ranged from 67 to 89, and the average age was from 5.67 years to 6.91 years. The LOS ranged from 3.32 hours in period 1 to 3.84 in period 4. The difference in LOS between October and November of the intervention year was *smaller* at 5.4 minutes than the difference between October and November of the comparison year, which was 9.6 minutes. The difference in differences was 4.3 minutes in favor of the historical comparison year.

The decrease in the LOS from October to November of the intervention year compared to the previous year was not statistically significant (see Table 3). The results did not change when low and high acuities were examined in separate regression models. A separate linear regression model simply comparing the LOS of low acuity patients seen in Child Express verses the main ED was statistically significant, with the shorter LOS being in the main ED (see Table 4).

Table 1: Numbers and percentages of low and high acuity patients checking in during the first and second halves of night shift pooled from October 1 to December 2 of 2004 and 2005 and from both Child Express and the main ED.

Time Interval	Low Acuity	High Acuity	Total
11 p.m. – 3 a.m.	881 (80%) {56% of all night shift patients, low and high acuity}	229 (20%)	1110 (71.6%)
3 a.m. – 7 a.m.	352 (80%)	88 (20%)	440 (28.4%)
11 p.m. – 7 a.m. (all of night shift)	1233 (79.5%)	317 (20.5%)	1550

Table 2: Descriptive statistics for selected variables and length of stay (LOS) in each period for the total number of patients seen during night shift in both Child Express and the main ED.

2004: Historical Comparison Year:

Time Period	No. of patients seen	Mean age of patient in years (SD)	Mean Acuity* (SD) for mean	Mean LOS (SD) in hours
Period 1 Oct.1 – Oct. 31, 2004	368	4.53 (5.29)	3.82 (0.84)	2.30 (1.37)
<i>High acuity patients only**</i>	89	5.47 (5.84)	2.61 (0.6)	3.32 (1.45)
Period 2 Nov. 1- Dec. 2, 2004	401	4.56 (5.25)	3.88 (0.75)	2.2 (1.31)
<i>High acuity patients only</i>	87	6.54 (5.28)	2.70 (0.53)	3.48 (1.79)

*Acuity is on a scale from 1 to 5 with 1 being the most ill. The acuity categories are based on the amount of intervention and staff time a patient received during their ED stay.

**High acuity patients are acuity categories 1, 2 and 3.

(SD) is standard deviation.

Table 2 continued

2005: Intervention year:

Time Period	No. of patients seen	Mean age of patient in years (SD)	Mean Acuity* (SD) for mean	Mean LOS (SD) in hours
Period 3 : pre- intervention period Oct.1 – Oct. 31, 2005	389	4.62 (5.07)	4.03 (0.94)	2.32 (1.52)
<i>High acuity patients only**</i>	76	5.67 (5.8)	2.49 (0.69)	3.93 (2.06)
Period 4: post intervention period Nov. 1- Dec. 2, 2005	392	4.67 (5.07)	4.12 (0.87)	2.10 (1.38)
<i>High acuity patients only</i>	67	6.91 (5.94)	2.55 (0.59)	3.84 (1.72)

*Acuity is on a scale from 1 to 5 with 1 being the most ill. The acuity categories are based on the amount of intervention and staff time a patient received during their ED stay.

**High acuity patients are acuity categories 1, 2 and 3.

(SD) is standard deviation.

Table 3: Child Express effects on length of stay (LOS): difference-in-difference linear regression results.

Independent Variable(s)	Coefficient (Percentage Difference)*	95% Confidence Interval*	p- value
Child Express (no covariates)	0.95	0.84, 1.10	0.37
Child Express, controlling for: - acuity	0.96	0.87, 1.06	0.39
Child Express, controlling for: - acuity, - average LOS per MD, -daily patient volume	1.02	0.92, 1.12	0.71
High acuity patients only: Child Express, controlling for: -average LOS per MD, -daily patient volume	1.04	0.82, 1.3	0.77
Low acuity patients only: Child Express, controlling for: -average LOS per MD, -daily patient volume	1.00	0.9, 1.12	0.95

*Regression coefficients were obtained from logged outcomes and were exponentiated to obtain fractions of wait times between groups. The confidence intervals do not include zero because they were exponentiated and $e^0 = 1$. Therefore, the confidence intervals that include 1 are correlated with a non-significant p-value.

Table 4: Descriptive statistics and linear regression results for length of stay (LOS) comparing the low acuity patients seen in Child Express to the main ED patients on night shift from October 1 to December 2 of 2004 and 2005.

	N	Average Age (SD)	Average Acuity (SD)	Average LOS in fractions of an hour (SD)	Coefficient (Percentage Difference)*	95% Confidence Interval*	pvalue
Child Express	888	4.38 (5.13)	4.30 (0.46)	1.94 (0.97)	1.73	1.24, 2.42	.000
Main ED	342	3.73 (4.39)	4.38 (0.49)	1.66 (1.07)	-----	-----	-----

*Regression coefficients were obtained from logged outcomes and were exponentiated to obtain fractions of wait times between groups. The confidence intervals do not include zero because they were exponentiated and $e^0 = 1$. Therefore, the confidence intervals that include 1 are correlated with a non-significant p value.

Chapter IV: Discussion:

Fast track clinics are becoming very common to relieve Emergency Department (ED) overcrowding. Many studies report that fast track patients have a shorter LOS than similar patients seen in the main ED (16-19). However, fewer studies focus on analyzing the impact a fast track clinic has on the aggregate LOS and the LOS of high acuity patients during the same hours the fast track clinic is operating.

Our study examined the aggregate LOS of night shift after our fast track clinic remained open through the first half of night shift, when the majority of night shift patients arrive (the majority of whom are low acuity). Our findings agreed with the literature in that the aggregate LOS was unchanged by our fast track clinic (17, 20-22). Only one exception was found from a study in a Dubai hospital for adults and children that had a 24 hour fast track clinic in operation (not the usual model for a fast track clinic) (23).

Some reasons that the aggregate LOS may not decrease significantly are that the staff in the main emergency departments may slow their work speed due to the decreased patient load. They may choose to be more social with each other, or spend more time with the patients when they perceive they have more time. Casalino et al., discussed that team dynamics and cooperation are key factors in ED throughput (20). Therefore, there may be several “soft” and not easily measurable factors in staff interaction and culture that do not decrease the LOS of patients seen in an ED even with decreased volume or acuity. This is important information for hospitals and other health care systems that are looking to invest in a fast track clinic for low acuity patients: the LOS of patients seen in the main ED likely will not decrease (17, 20-22). With this knowledge, the institution

may choose to use their resources to look at other aspects of patient flow and consider other solutions to flow problems before setting up a fast track clinic.

Secondly, we found that the LOS of high acuity patients on night shift was also unaffected by the extension of our fast track clinic. This is also consistent with the literature (20-22). Higher acuity patients generally require more testing, evaluation and intervention and may take a pre-determined amount of time, independent of the number of lower acuity patients needing to be seen. Based on this information, we need to turn our attention to other measures of quality of care for high acuity patients instead of simply looking at LOS. Measures such as processes of care, medical mistakes and patient/staff satisfaction have all been shown to be negatively impacted by ED overcrowding (18, 27-35). Therefore, future studies and program evaluations of emergency department throughput would be more complete by considering additional outcomes beside LOS to reflect quality of care for high acuity patients.

Limitations:

Three factors unique to our study may have contributed to the lack of a statistically significant effect of the intervention. Primarily, the Child Express clinic often closed early (well before 3 AM) if there were not that many patients checking in. Therefore, the program was not implemented exactly as expected. This is called lack of fidelity in program implementation. There is no way to tell what days the Child Express clinic closed early from the data because the patients were not separated in the data into those who were seen in the Child Express clinic versus the main ED. However, if the census was low enough for Child Express to close early, there may have been too few low acuity

patients seen in the main ED instead of Child Express to cause a significant difference in the results of the data analysis.

Another factor unique to Mary Bridge ED is that they share registration staff with the adult emergency department. If many adults were checking in to the adult ED, the pediatric registration may have been delayed even if there were only a few children checking in to the pediatric ED. A delay in registration would have definitely impacted the LOS of the patients. In addition, bedside or in room registration had not been implemented yet in the hospital system, which has been shown to significantly speed up time to registration (36-40). No data were recorded in the system, to the best of the author's knowledge, which measured the time of a patient's arrival to their registration time.

Finally, the Child Express clinic did not actually see low acuity patients faster than the main ED, which undoubtedly contributed to the lack of a shortened aggregate LOS on night shift. The Child Express staffing was divided into a receptionist, medical technician, registered nurse and medical doctor. This model may be too much of a division of labor for a fast track clinic, leading to inefficiencies. Less staff in the clinic may have yielded the expected results of shorter LOS for fast track patients versus similar patients seen in a main ED. Likely, other elements of the fast track operation also contributed to the longer LOS that were not explored in this study, such as the time to registration or the time to be placed in a Child Express room. Organizations that are setting up a fast track clinic need to design a streamlined fast track unit that will see lower acuity patients faster than their main ED.

Conclusion and Future Research:

Our program intervention of extending the hours of our “fast track” clinic into night shift did not change the aggregate length of stay (LOS) of all night shift patients. Our study is consistent with previous studies that show that a “fast track” type clinic does not impact the aggregate LOS of patients (17, 20-22). Health care institutions may choose to direct their resources toward other aspects of ED throughput before investing in a fast track type clinic. Additionally, the LOS of high acuity patients was unaffected by our program intervention, also consistent with previous studies (20-22). In measuring outcomes for high acuity patients in the ED, researchers should turn their attention away from LOS and toward other aspects of quality of care, such as processes of care, medical mistakes, and patient/staff satisfaction.

Future studies of ED throughput should focus on identifying and measuring some of the “softer” factors influencing LOS , such as team dynamics, communication and work efficiency, as well as examining other markers of quality of care, beside LOS, for higher acuity patients.

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