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DeAnna Faye Dingus Hamilton
University of Kentucky, deannadingus@aol.com

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Evaluation of the Effectiveness of Emergency Department Through-put based on
Provider Type in a Critical Access Hospital

Submitted in Partial Fulfillment of the Requirements for the Degree of Doctor of Nursing
Practice at the University of Kentucky

By

DeAnna Dingus Hamilton BSN, RN

Martin, KY

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Abstract

Purpose: To evaluate effectiveness and timeliness of through-put in the emergency department based on provider type in a rural critical access hospital in eastern Kentucky.

Design: A retrospective, observational review was conducted at a small critical access hospital. Descriptive statistics including Mann Whitney and Chi square were performed to evaluate significance.

Methods: Pre-intervention 552 charts were abstracted and 1656 post-intervention charts were abstracted. Arrival time to triage, triage to provider and provider to disposition times in minutes were collected. A prospective survey regarding comfort level with performing advanced practice skills was given to the advanced providers who were working in the emergency department.

Results: There was a decrease in arrival to triage, triage to provider and provider to disposition. However, the only decrease to show statistical significance was the triage to provider time.

Conclusion: While times improved for emergency department through-put no sustained significant change was noted for the overall study. The majority of advanced care providers felt uncomfortable performing certain advanced practice skills. Further study and education is needed to evaluate provider specific effects on through-put as well as effects of patient education on triage by acuity, signage in the lobby educating patients and visitors that patients are taken into triage by severity of illness to determine effects of through-put and patients leaving without treatment. Triage to provider was improved, however there is more that could be studied to improve timely patient care and decrease AMA and LWOBS in the emergency department.

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Dedication

I would like to dedicate this project and my journey towards this project to my father, Charles Douglas Dingus. Without him, I would have never dreamed that I could achieve such a goal or complete this journey. It was his love, understanding and unwavering support that allowed me to reach for a goal that was far from ordinary reach. He was with me the day I interviewed with Dr. Melander, he met her and spoke with her about my hard work, dedication and desire to go further in my career. I only wish he was here today to see what we have achieved together and that I could not have done without him. I would also like to thank my husband Josh, my mother Delores, my brother Kris who have had to put up with the long study hours, the long days/nights of clinicals and the frustration of thinking I wasn't going to make it. To my friends who have had to deal with my absence during my full time study, I thank you for your understanding and continuing support. I want you all to know, I truly could not have made it where I have without your love, kindness, understanding and support.

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Introduction

In 2017, there were more than 140,000,000 emergency department visits in the United States, which resulted in more than \$76,000,000,000 in charges for services (Moore & Liang, 2020). Emergency department (ED) visits have increased yearly since 2006 throughout the U.S., with the largest increase reported in the 44-65 age range (Moore & Lang, 2020). The CDC reported that from 2003-2009 there was nearly a 12 minute increase in average wait times, to almost 60 minutes (Hing & Bhuiya, 2012). While most patients do not expect to be seen as soon as they enter the emergency department, waits of one hour or far more are becoming increasingly common (Chu et al, 2019). This increase in wait times is negatively affecting patient outcomes across the nation (Bleustein et al., 2014). Plunkett et al., (2011) reported that if total ED time could be decreased to under 6 hours that total deaths could decrease by nearly 100 patients yearly.

The rates of patients leaving without being seen (LWOBS) and leaving against medical advice (AMA) are now tied to reimbursement for most hospitals as well, both directly and indirectly in connection with patient satisfaction scores (Sonis et al., 2018). Since implementation of the Affordable Care Act, there has been a decrease in the number of uninsured patients presenting for treatment however, there has been a overall increase of nearly 5% in ED visits, mostly for patients with Medicare and Medicaid coverage (Probst et al., 2019) With the increase in patients presenting to the ED there is also an increase in wait times, which has been linked to an increase in AMA rates (Reese, 2019). Decreasing wait times, LWOBS and AMA rates and improving patient comes in the ED will require attention to detail, process development and follow-through. Finding a systematic approach to address the increase in

patient volume and the decrease in available providers and staff is a difficult task. A decade ago this critical access hospital employed providers who staffed the ED Sunday-Friday with contracted provider coverage on the weekends, due to retirements and relocations the ED is staffed entirely by a staffing group which staffs all the EDs for the system. The nursing staff at the hospital where this project was conducted has declined from a high of 36 positions (ED, MS, SCU) to 24 currently (ED, MS, SCU), including travel nurses and supplemental staff from other hospitals in the system. The decline in nursing staffing has been due to the high pay for travel nurses in the past 3-4 years and a local hospital offering a \$20,000 sign-on bonus. Although staffing for the ED has declined, the number of patient visits remains steady.

The process and patient flow in the ED that dictates who gets in, who gets seen, and when they are seen is based on triage protocols. Patients with life threatening conditions are seen first, then emergent, then urgent, then non-emergent. This, combined with the amount of time providers spend with the patients and their families, determines wait time (Espisito, 2015). Finding a balance in effective patient flow and patient care is necessary for all parties (patients, hospitals and insurance companies). The importance of patient flow, safety and quality of patient care as well as patient outcomes are all issues that impact ED through-put. ED through-put is the median time from arrival to triage, triage to provider and provider to disposition (Gardner et al., 2018).

Hospital reimbursement is based in part on meeting benchmarks set by the Centers for Medicare and Medicaid from arrival to triage, arrival to provider, arrival to disposition, leaving AMA and LWOBS (Agency for Healthcare Research and Quality, 2018). Reimbursement is not the only reason to improve; there is also the risk to patient health and functioning when patients leave the ED without seeing a provider, experience long wait times, or leave AMA. Without

treatment, the patient's condition may deteriorate and what could have been a minimal intervention, could now require intensive care treatment and worsen the patient's outcome.

Emergency department through-put includes arrival to triage (<4 minutes); triage to provider (<20 minutes); arrival to disposition (66.5 minutes) average for all patients that present to the emergency department (HOAG Memorial Hospital, N.D.). Left without being seen is also benchmarked at less than 2% for all total patients presenting to the emergency department (HOAG Memorial Hospital, N.D.).

Adding an APRN to the staffing model along with staff education, and staff participation are interventions that may also positively affect patient flow. Additionally, the introduction of an APRN to the ER service line could reduce arrival to provider times which could mean that patients will be treated sooner, patients will be identified as at risk sooner and this will impact patient outcomes (Marino et al, 2014). Decreasing time of arrival to provider screening is the first step in improving patient outcomes (Pierce & Gormley, 2016). Improving patient flow in the emergency department is vital to hospitals and to patients. One possible intervention to solving the patient flow issues within the ED is using an advanced practice provider trained in critical care. The overall goal is to decrease AMAs and have patients seen more quickly while addressing their healthcare issues sooner, and improve patient outcomes in the long-term.

Theoretical Framework

The theory of planned behavior is useful in healthcare settings because it provides a framework for assessing goals/behaviors as well as the staff's beliefs and/or intentions with regard to achieving the goal (Ramsey et al., 2008). Staff attitudes, recognition of the importance of timely patient care, and the belief that they can effect change are vital components of

successful change (Manstead, 2002). Any successful change in attitudes and patient care rely on staff buy-in and their belief that they can have an impact on patient outcomes.

The theory of planned behavior was a useful framework in this project to guide a change in staff attitudes about patient flow in the ED. First there had to be a change in the attitudes of the hospital medical staff that advanced practice providers could work the ED safely and effectively, and then there had to be acceptance and passage of the by-laws to allow for the change in the staffing model. Nursing staff were educated on the role of the advanced practice provider and their ability to order and diagnose patients and manage critical patients. Then there was a review of the benchmarks for through-put with all involved parties.

Literature Review

A review of the PubMed and CINAHL databases was performed using various combinations of the following search terms: AMA, wait times, emergency department, patients, LWOBS, and through-put. Results were then examined for relevance to the current project. The search was initially limited to research articles that were published in English between 2000 and 2019. Studies were included if they were conducted in Canada, USA, India, or Sweden, and if they focused on the ED through-put. Studies published in a language other than English were excluded from this review. This initial search yielded 61 articles. After checking publication dates and reviewing abstracts, 10 studies were chosen for this literature review. The purpose of the literature review was to determine if there were clear solutions to improve ED through-put and decrease patient wait times with the goal of improving patient outcomes.

In several studies, researchers used quick/rapid triage to decrease ED through-put, AMAs, LWOBS and overall length of stay (Sharieff et al., 2013; Chan et al., 2005; Gardner et al., 2018 Pierce and Gromley 2016). This involved moving patients into triage immediately in

two studies (Sharieff et al., 2013; Chan et al., 2005), and within 5-10 minutes of arrival in the other two (Gardner et al., 2018; Pierce and Gromley, 2016). Pierce and Bromley's (2016) intervention also involved putting an NP in the room with the patient during triage which resulted in overall decrease in length of stay as well as decrease in arrival to triage and triage to provider timeliness.

While there are no data that conclusively show that adding an advanced practice provider to the staffing model in the ED will decrease LWOBS and AMA rates and wait times, there is evidence to suggest that the mere presence of the APRN in the triage setting decreases the amount of time between arrival and triage, and from arrival to provider screening (Hayden et al., 2014). Effective and timely care is important to ensure positive patient outcomes and patient health. An advanced practice provider (APP) would identify and begin treatment sooner on a patient that would otherwise be sitting, waiting, and perhaps leaving the hospital in no better condition than they arrived, in some case they could be leaving the hospital worse than they arrived (Hayden et al., 2014). The APP would base decisions on his/her education, knowledge and best practice training identify patients at risk and start their treatment to recovery a little sooner than sitting in the lobby waiting to be called over to a room (Hayden et al., 2014).

In two studies, redesigning the layout and room configuration of the ED improved through-put, length of stay (Sharieff et al., 2013; Chan et al., 2006), patient satisfaction, and wait times (Chan et al., 2006). Sharieff et al. (2013) added additional staffing, began placing patients in zones and utilized recliners and gurneys; these changes resulted in a statistically significant decrease in overall length of stay of over two hours.

Three studies focused on the reasons patients LWOBS or left AMA but did not seek out or determine changes that would deter patients from leaving AMA or LWOBS (Lee et al., 2016; Gautam et al., 2018; Ding et al., 2007).

One of the findings that stood out from the others was that the attitudes and behaviors of providers or staff could affect the patient's decision to stay or leave regardless of the wait (Burstrom et al., 2013). Providers reported that they were not asked for input into the processes of the ED, but were instructed on the rules instead. This contributed to poor staff attitudes and morale, which was then passed on to the patients. The researchers also reported that there was no direct communication between staff and the patients or families in the waiting room, which sometimes led to erratic behavior and escalating situations in the waiting room. In examining the problem, the researchers came to the realization that there were not enough beds, staff or equipment to care for all the patients who were presenting to the ED. In response, a plan to improve patient flow and processing was developed and implemented, which included setting up zones for patient care and treatment as well as adding a junior physician in one of the zones (Burstrom et al., 2013).

In summary, there was no single determining factor that could be pinpointed as the reason patients LWOBS. However, there are some indications that increased staffing and improved triage processes can decrease wait times, which also has a reciprocal effect of decreasing the number of LWOBS. There was no exact time frame that determined whether a patient would leave the ED without being seen by a provider. There are some data to suggest that patients without insurance or low socioeconomic backgrounds may leave without treatment more often than those with medical coverage. While there is no one factor that was identified, improving timeliness of care for ED patients is vital to improving patient outcomes .

Several gaps in the literature became apparent during this review. There was no clear solution for decreasing ED throughput, decreasing LWOBS or decreasing AMAs; there were no studies focusing on rural critical access hospitals and without investing large capital for redesigning and reconstruction that offered significant reduction in ED throughput. There were no studies found in CINAHL or PubMed using keywords in Boolean/Phrase mode, any related topics with full text within last 10 years using multiple combinations of the following words: APP, APRN, Advanced Practice Provider, skills performance, impact on ED wait times and/or confidence in skills performance. In conclusion, there is a need for further investigation to determine the effectiveness of ED throughput based on provider type as well as opportunities for studies regarding APP skills performance in relations to ED throughput.

Specific Aims

The purpose of this DNP project was to determine if there was a significant difference in the ED throughput time based on provider type at a critical care hospital in eastern Kentucky. More specifically, the project aimed to determine:

- a. Arrival to triage time MD/DO compared to MD/DO/APRN/PA
- b. Triage time to provider MD/DO compared to MD/DO/APRN/PA
- c. Provider time to disposition MD/DO compared to MD/DO/APRN/PA
- d. Number of AMA/LWOBS MD/DO compared to MD/DO/APRN/PA
- e. Advanced Practice Provider experience performing advanced skills compared with confidence level of performing skill

Methods

For this project, the goal was to evaluate throughput timeliness for pre-intervention, Group 1 (staffing only by MD/DO) providers and the post-intervention , Group 2 (staffing by

APRN, PA, MD or DO). The intervention, having APP lead the ED was initiated July 1, 2019 in this critical access hospital. Once the intervention was put in place, then re-evaluation continues to determine effectiveness (Ramsey, Thomas, Croal, Grimshaw, & Eccles, 2008). The timeliness of care for Group 1 and Group 2 were then compared to benchmarks set by the Centers for Medicare and Medicaid Services (CMS, 2018) to determine if the changes were working or if new changes needed to be considered. In addition, a survey was distributed to the APP to verify performance of advanced practice skills such as intubation, central line placement, chest tube insertion, surgical airway etc., and their comfort level in performing skills in the ED.

Design

A retrospective, observational design was used for this study. The study period included a pre-intervention period of June 1, 2019 through June 30, 2019 and a post-intervention period of July 1, 2019 through -September 30, 2019.

Setting

The setting for this project was the ED at McDowell ARH critical access hospital in Eastern Kentucky. McDowell ARH is part of the Appalachian Regional Healthcare hospital system comprised of 13 hospitals across southern West Virginia and Eastern Kentucky, with a mission “To improve the health and promote the well-being of all the people of Central Appalachia in partnership with our communities” (CEDIK, 2019). Their vision is to “provide unparalleled experience as the most trusted home for healthcare” (ARH Strategic Plan staff, 2018). The values statement of McDowell ARH is to make patients and patient satisfaction the most important priority (ARH Strategic Plan staff, 2018). These areas of the strategic plan match up to the project because patient care, outcomes and experience are the focus. Improving ED through-put would provide care in a more timely manner, with the goal of fewer patients leaving

without treatment or against medical advice. This, of course, also has the potential of improving patient satisfaction. Improving emergency department through-put could be a model for quality and performance improvement to be used system wide at improving the ED metrics and patient outcomes.

Sample

Stakeholders for McDowell ARH include any patient that presents to the hospital, clinics or the ED; employees, providers, insurance companies, pharmaceutical companies, suppliers, financial institutions and government agencies. Specific facilitators for the project will be the ED director, staff, the CCEO and the CCNO.

During the pre-intervention phase there were 15 patients who left without being seen and 12 patients who left against medical advice. During this time there were 46 patients who left without being seen and 32 patients who left against medical advice. These dates were important because prior to July 1, 2019 the ED was staffed solely by MD/DO providers.

The sample for this project included all patients presenting to the ED at the critical access hospital during the evaluation period. The only patients excluded from the study were those who did not present to the ED for treatment during the sample/focus period. The initial start date for the data was proposed to have been April 1, 2019, since this was three months prior to the change in staffing/intervention. Due to a computer system change over, access to charts prior to June 1 was not available. A convenience sample of the charts already in existence was used for the study. Demographics such as date of arrival, time of arrival and chief complaint were available. Age, date of birth and gender were not revealed in the data abstraction. Provider responses to the skills survey were anonymous (see Table 1).

Procedure

A waiver of informed consent was approved by the Institutional Review Board for the medical record abstraction part of this study. Data related to arrival to triage, triage to provider, provider to disposition time, disposition status, and chief complaint at time of triage were extracted by the Data Science Analyst.

A survey for the advanced practice providers at the critical access hospital was created to 1) determine the frequency with which they performed an advanced practice skill within the last 6 months prior to taking the survey and 2) their comfort level with performing the skill. Skills included: intubation, central line and arterial line insertion, chest tube insertion, thoracotomy, surgical airway placement, lumbar puncture and conscious sedation which are all skills valuable to a provider during emergency situations where time is of the essence. A letter addressed to each advanced practice provider working in the ED was distributed along with the IRB approval letter from UK and ARH accompanied each survey request, along with a pre-addressed envelope with delivery instructions for the survey.

Statistical Analysis

Descriptive statistics were used to determine mix of patients for pre and post intervention samples. Spearman's Rank Correlation and T-tests were performed to indicate significance to timeliness changes in the groups. These tests revealed right sided skewness; therefore the Mann Whitney U test and Chi square test were used (see Table 2). All data were analyzed using IBM SPSS version 25. A p-value of less than 0.05 is considered significant for all analysis performed.

Results

During the study period, there were 2,611 ED encounters at the project setting. Of these, 618 were included in Group 1 (pre-intervention) and 1993 were included in Group 2 (post

intervention; see Table 3 for historical data). Of these results nearly 100 were excluded because data (time) was not documented or the time documented was a negative number (for example, the provider saw the patient 30 minutes prior to arrival at the facility). Figure 1 details arrival to triage, triage to provider and provider to disposition times for groups 1 and 2. As noted, the overall arrival to triage time for Group 1 was 11 minutes. This was slightly higher than Group 2, which had an overall arrival to triage time of ten minutes. The average time from triage to provider for Group 1 was 27 minutes (again, higher than the AHRQ benchmark; AHRQ, 2018) and higher than Group 2's rate, which was 19 minutes (better than the benchmark). Provider to disposition time for Group 1 was 135 minutes (greater than the benchmark) and 115 minutes for Group 2 (AHRQ, 2018). One of the confounding issues which may be attributed to the lack of statistical significance in decrease in provider to disposition times could be the lack of EMS transportation available for transfers and those patients who required EMS transfer home. The EMS available to the hospital serves a five county region and there can be waits of over 24 hours depending on their availability.

The APP working the ED at the time of the study were given a survey asking if they had performed an advanced practice skill (such as intubation, central line placement, arterial line place ect.) along with their attestation as to comfort in performing those advanced skills. The results from the APP skills survey could be used for future studies and/or educational opportunities with the advanced practice providers. Only 16% of the advanced care providers felt comfortable performing surgical airways and lumbar punctures (with one respondent stating they would feel comfortable with provider back-up). None of the providers had performed a surgical airway and only one had performed a lumbar puncture in the last 6 months. Thirty-three (33%)

percent of the advanced care providers felt comfortable with performing arthrocentesis, with only 2 of the 6 providers having performed the skill in the last 6 months.

Discussion

The purpose of this study was to evaluate the effectiveness of ED throughput after the implementation of the APP based on provider types during the study period for a critical access hospital in rural Kentucky. While there was an improvement in ED through-put and a decrease in patients leaving AMA and leaving without being seen there was no significant decrease overall. The only significant improvement as evidenced by the Mann Whitney test was the triage to provider time; Spearmans correlation and t test were right sided skewed. Therefore, Group 2 providers improved the timeliness in which patient were seen triage to provider significantly and saw patients in a more timely manner than Group 1. There was clinical significance with the skills survey on the need for future provider educational offerings of advanced skills opportunities for APP working the ED.

Implications

Future researchers should determine if patient education on triage protocols, such as signage stating “patients taken by severity of complaint” posted in the lobby and waiting areas correlates with a decrease in LWOBS rates. There are opportunities for more throughput studies which could be broken down to include transfer times and wait times for EMS. Evidence-based practice can help improve timeliness of care and patient outcomes. Future studies could examine staff attitudes about triage processes and protocols and provide feedback for future improvement. Future studies could also focus on when AMA or LWOBS occur (i.e., shift, time of day) and where the staffing levels are when most of these occur. The advanced provider skills survey is

clinically significant in identifying a need for future education on advanced skills to ensure more timely patient interventions.

Limitations/Strengths

The sample size for both groups was small, and not equal due to a retrospective, convenience study. Sample size would have been larger if the project had been conducted at a larger facility and if there had not been limitations due to computer system changeovers during data collection.

The strength of the study is that this is the first study of ED throughput at a critical access hospital that has been conducted at the University of Kentucky. Next steps include educational opportunities for advanced care providers on performance of advanced skills.

Conclusion

ED throughput, patient wait times, AMAs and LWOBS are all vital components of patient care that can adversely affect patient outcomes. Understanding and identifying processes to improve patient care is of the utmost importance. Patients who leave without treatment or AMA risk adverse effects on their health. Staff (nursing and provider) knowledge and ability to perform skills is necessary to ensure better patient outcomes.

The project was designed to evaluate the effectiveness of ED throughput in a critical access hospital based on provider type. There was a concurrent prospective survey administered to advanced practice providers working in the ED. The provider survey was successful in identifying a need for education on advanced practice skills. The researcher found there were improvements to processes and education had been provided to staff working during the implementation, in 2019. There were improvements in timeliness, but while these improvements in timeliness were clinically significant, they were not statistically significant. Opportunities

continue for future research involving improvement in ED throughput and APP confidence is performing advanced skills in an effort to improve overall length of stay and ultimately, patient outcomes.

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Table 1. Provider experience with advanced skills and comfort with performing (N =6)

Skill	Times performed <i>In last 6 months</i> <i>Mean</i>	% confident
Central Line insertion	6.3	67%
Arterial line insertion	1.5	50% *
Chest tube insertion	2.6	50% *
Intubation	6	67%
I & D	8.6	100%
Conscious Sedation	2.6	67%
Arthrocentesis	1.2	33%
Thoracotomy	0.33	50% *
Surgical Airway	0	16% *
Lumbar Puncture	0.17	16% *

**denotes replied comfortable with skill with physician backup*

Table 2. Yearly Emergency Department Indicators

Month	Group 1			Month	Group 2		
	AMA	LWOBS	Total visits		AMA	LWOBS	Total visits
June	12	4	613	July	12	17	665
				August	15	19	658
				September	6	10	697

Table 3. Comparison emergency department throughout over time

	May 1, 2019-June 30, 2019	July 1, 2019-Sept 30, 2019	<i>p</i>
	<i>Median (IQR)</i>	<i>Median (IQR)</i>	
Time			
Arrival to triage	6.38 (2.77 – 14.95)	3.80 (3.27-14.95)	.38
Triage to doctor	20.21 (11.27-38.58)	16.23 (8.00-31.83)	<.001
Doctor to depart	88.08 (51.40-152.80)	87.61 (51.56-144.35)	.44
	%	%	
AMA	1.9%	1.6%	.08

Figure 1

Row Labels	Column Labels					
	GROUP 1			GROUP 2		
	Average Arrival to Triage	Average Triage to Doc	Average Doc to Depart	Average Arrival to Triage	Average Triage to Doc	Average Doc to Depart
Admitted as IP to this Hosp	0:14	0:19	7:11	0:10	0:12	3:07
Court/Law				0:13	0:04	1:47
Expired	0:24	0:15	1:33			
Home or Self Care	0:10	0:28	1:35	0:09	0:20	1:35
Intermediate Care Fac	0:25	0:40	1:10	0:06	1:25	3:28
Medicaid Nursing Fac	0:03	0:22	2:02			
Nursing Fac w/plan Readmit				0:15	0:11	2:31
Other Acute Care Facility IP	0:23	0:26	5:12	0:11	0:14	5:03
Other Health Care Inst.	0:20	0:37	4:28	0:09	0:11	5:02
Other Home Health	0:03	0:00	2:47			
Psych				0:14	0:47	6:35
Psych w/plan Readmit	0:03	0:13	20:36			
Grand Total	0:11	0:27	2:25	0:10	0:18	2:06

Figure 2

ED throughput Comparison for transfers to other facility

Row Labels	Column Labels					
	GROUP 1			GROUP 2		
	Average Arrival to Triage	Average Triage to Doc	Average Doc to Depart	Average Arrival to Triage	Average Triage to Doc	Average Doc to Depart
Intermediate Care Fac	0:25	0:40	1:10	0:06	1:25	3:28
Other Acute Care Facility IP	0:23	0:26	5:12	0:11	0:14	5:03
Other Health Care Inst.	0:20	0:37	4:28	0:09	0:11	5:02
Psych				0:14	0:47	6:35
Psych w/plan Readmit	0:03	0:13	20:36			
Grand Total	0:21	0:30	5:31	0:10	0:14	5:03