EMERGENCY DEPARTMENT DIVERSION VIA A TEXT MESSAGE CAMPAIGN

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ABSTRACT

Emergency departments (ED) are being overused. The public health significance of EDs being too crowded includes both health and/or financial consequences for the patients, staff, hospital system, region, community, and tax payers. EDs are overburdened for many reasons, and most are related to what is perceived as an emergency, issues in accessing other care, or revisiting the same ED because of a reoccurring issue.

Campaigns have focused on reducing crowding and the number of unnecessary ED patients, some successful and some not. Multiple interventions focus on different tactics and methods to achieve the results that are desired. These are reviewed in this paper. An emerging communication channel with potential to change behavior related to receipt of health care is text messaging. Text message campaigns have become an excellent channel to communicate to members within a health system.

During the summer of 2017, the University of Pittsburgh Medical Center (UPMC) Health Plan's Population Health Engagement and Optimization (PHEO) team created a text message campaign to reduce ED visits among a subset of their Medicaid-insured population. The intervention ultimately changed its goals due to the relatively small number of individuals in the target population and the variety of factors beyond text messaging that influence ED utilization. The primary focus is now the introduction and use of existing UPMC resources to reduce ED visits. The campaign is currently being reviewed for approval, with a launch planned April 30, 2018.

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PREFACE

I would like to acknowledge Dr. Ellen Beckjord for bringing me onto the Population Health and Engagement Optimization team, and giving me the opportunity to work on a project as interesting and challenging as this. None of this would have been possible without you.

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1.0   INTRODUCTION

1.1   PUBLIC HEALTH SIGNIFICANCE

Emergency departments (ED) across the United States (US) are seeing more and more patients. At times, the healthcare system cannot keep pace with the increasing number of patients who make ED visits both necessarily and unnecessarily. The number of ED visits has increased from 44 million in 1968 to 166.8 million visits in 2007 (Adams, 2013) (Smulowitz, Honigman, & Landon, 2013). The rate of ED use from 1968 to 2007 increased 383.6% whereas the US population from 1965 to 2007 only changed 155% (US Department of Commerce, 2011). A large proportion of these visits can be attributed to those known as frequent users, or those who use the ED at a high rate yearly. Adams (2013) states that 4.5%-8% of the individuals who utilize the ED account for 21 to 28% of all ED visits. This high rate of ED utilization leads to negative consequences such as crowding of the ED and high costs. Patient wait times, ambulance diversion, and the frequency of poor patient to staff ratios are increasing, which may impact a patient's health by delaying time sensitive treatments (Lee, Schuur, & Zink, 2013; Warner et al., 2015; George & Evridiki, 2015). Financially speaking, the ED is a massive burden, accounting for roughly 5% of the national health expenditure, and Lee et al. (2013) state that individuals overusing the ED cost $38 billion each year. A channel that could be used to reduce the number of individuals misusing and overusing the ED is text messaging.

The Background chapter begins with the rates of ED utilization. There is a focus on the trends that have occurred throughout time as well as frequent ED users who could be treated in a primary care setting. Next, utilization of the ED is looked at among different populations, finding that the most frequent users are those with Medicaid insurance, are over the age of 65, have less than a high school education, and are Non-Hispanic blacks. The conditions section of the Background chapter includes the top 15 conditions that result in ED visits, and the variations among admission rates. The consequences of having a crowded ED are also covered including those associated with finances and those associated with a crowded ED. A crowded ED negatively impacts other local hospitals, staffing, and patient's health outcomes (George & Evridiki, 2015). An ED that is being overused is expensive and is a five percent source of the national health expenditure (Lee et al., 2013). The main drivers of ED utilization include the perceived acuity and the issues accessing other forms of care including primary care, and ED revisits.

The Results chapter focuses on interventions that deal with either diverting patients from the ED or text message based interventions that were aimed at general health issues. Successful and unsuccessful components of the campaigns are highlighted to show the best practice for diverting patients from the ED, how to have a successful text message campaign, and what should be avoided. Also discussed are the pros and cons associated with a text message campaign.

The Discussion chapter's theme is campaigns to divert individuals away from the ED by using text messages as a channel. This chapter draws attention to the approaches that were successful and unsuccessful for each study to highlight the best methods of creating a text message campaign. One highlighted study includes a table that measures the change of likelihood for a patient to visit a primary care setting after receiving each text message.

Chapter Five focuses on the University of Pittsburgh Medical Center's ED Diversion Campaign. There is discussion around the creation of the text messages, the participants who will

be targeted, and the primary and secondary outcomes the study is measuring. The desired outcomes have changed from the beginning of the study. The study will target Medicaid members with TracFones. This campaign has been months in the making, and is still going through the approval process.

The last chapter includes the limitations and a closing statement. The limitations revolve mostly around the review of literature and how important articles could have been missed. The closing remark is a message looking to inspire anyone looking to potentially create a text message campaign that focuses on the ED or other topics.

2.0   BACKGROUND

2.1   HIGH ED UTILIZATION RATES

2.1.1   Rates of Use

Throughout recent history, few issues with the medical system are as ever-present as that of utilization of the emergency department (ED). In fact, discussions surrounding the high utilization of the ED goes back four decades (Adams 2013). The ED has been used, misused, and abused for such a length of time, that it was highlighted in policy by Presidents Lyndon B. Johnson, Bill Clinton, George W. Bush, and Barack Obama (Adams 2013). The rate of use of EDs has increased regardless of policies trying to stem their use. According to Adams (2013), ED utilization has increased from 44 million visits in 1968, to roughly 134 million visits each year from 2007-2010. Meanwhile, as ED use has increased, the number of available EDs has decreased (Lee, Schuur, & Zink, 2013). In fact, Lee et al. (2013) state that in the decade from 1999-2009, the number of ED visits increased by 32%, whereas the number of EDs conversely declined by 2%. Smulowitz, Honigman, and Landon (2013) state that the number of ED visits has outpaced the growth of the population, and that the rate of ED visits has increased from 94.9 million to 116.8 million visits per year, or 23%, from 1997 to 2007 What explains this growth in utilization? One possible cause might be the frequent use of the ED by some individuals.

The definition of "frequent user" varies from study to study, but a frequent user is someone who uses the ED at a high rate yearly. Roughly 4.5% to 8% of users are considered to be frequent users, but they account for 21% to 28% of ED utilization (Adams 2013). Evidence has shown that

frequent users are at risk-patients, and interventions may improve their health outcomes (Moe et al., 2017). Another study found that in Massachusetts, 3.8% of ED users visited five or more times in 2003, which accounted for roughly 17.6% of all ED visits in the state that year (Adams 2013). The number of ED visits continues to climb, and many policy makers and government agencies point to the ED as an example of how expensive healthcare is and the potential savings that could be achieved by reducing "nonurgent" or "inappropriate" ED visits (Smulowitz et al., 2013). As the literature shows, the number of ED visits is growing, but to understand, one must understand the populations that are using the ED.

2.1.2 By Population

Among the people who visit the ED, a disproportionately large number have Medicaid (Capp, Rooks, Wiler, Zane, & Ginde, 2014). Capp et al. (2014) found that among an insurance adjusted population, patients with Medicaid have 5.6 visits compared to the 3.6 visits among people with private insurance (2014). Medicaid is in fact the single most expensive service provided by the United States, and it is more expensive than primary and secondary education, safety, and preparedness (Adams 2013). The number of people who are enrolled into Medicaid is expected to increase with the continued implementation of the Affordable Care Act as an additional 21 million Americans are projected to enroll into the Medicaid program by 2022 (Capp et al., 2014).

Capp et al. (2014) used the National Health Interview Survey (NHIS) for a large study to test if there was an association between health insurance type and perceived access issues among individuals who were discharged from the ED. Capp et al. (2014) categorized individuals in their study into having Medicaid, Medicare, those with both Medicaid and Medicare, private insurance, uninsured, and those with insurance not in these categories as other. Among US

adults, 20.3% had at least one visit to the ED in the year previous to their study. Roughly two thirds of those adults visiting the ED were discharged whereas 31.1% were admitted. Non-Hispanic blacks with Medicaid and less than a high school education had the highest percentage of ED utilization. Individuals with Medicaid were more likely to be discharged from the ED than other insurance types. This could mean that they have a higher rate of misuse as less severe medical issues would be discharged whereas true emergencies would typically be admitted. The exception is that those with both Medicaid and Medicare were more likely to be admitted to a hospital than other insurance types (Capp et al., 2014).

The NHIS documented the difference in ED visits across age groups and found that the percent of each age group to visit the ED was similar apart from those over the age of 65. They had the highest rates of visiting an ED, 16.4%, and they had the highest percentage admitted. Of adults who went to the ED, 69.7% were 18-34 years old, 72.9% were 35-49 years old, 73.9% of adults were 50-64 years old, and 83.6% were greater than 65 years old. Adults with private insurance, Medicare patients, and Medicaid patients all had similar percentages of seeking emergency care because of issues perceived to be emergencies (Capp et al., 2014).

When it came to perceived barriers to access, there was a significant difference between those with private and public insurance, especially those with Medicaid. Capp et al. (2014) suggest that these barriers may be a major modifiable cause of high ED utilization. The population that overuses the ED may share characteristics such as low education, public insurance, and minority ethnicity. Overuse is defined as the use of the ED for treatment that could be acquired elsewhere, such as a primary care doctor's office.

2.1.3   By Condition

EDs are the primary portal for hospital admissions, and as such see a variety of conditions (Venkatesh et al., 2016). Venkatesh et al. (2016) found that whether or not patients were admitted for treatment and monitoring varied greatly from hospital to hospital. In fact, there is nearly threefold variation among admission rates. Little is known about whether admission is consistent across various EDs or different conditions, meaning that the protocol on admissions may vary on lesser serious cases among hospitals (Venkatesh et al., 2016).

A cross-sectional analysis of the 2009 National Emergency Department Sample (NEDS) was done. NEDS is the largest all-payer ED database globally and represents roughly 20% of US based hospital EDs (Venkatesh et al., 2016). The conditions frequently found at EDs can be separated into 275 mutually exclusive condition categories (Venkatesh et al., 2016). These categories include over 14,000 diagnoses as defined by the International Classification of Diseases, Ninth Revision (ICD-9) by using a computer program called AHRQ Clinical Classification Software (CCS), (Venkatesh et al., 2016). There were also 3,900 ICD-9 procedure codes included in the 275 condition categories (Venkatesh et al., 2016). NEDS does not include the reason for the ED visit or the patient's main complaint, so all visits were grouped based on the discharge diagnosis. Venkatesh et al.'s (2016) main outcome was the ED risk-standardized admission ratio for each clinical condition identified by the CSS. The top 15 conditions that most frequently led to a hospital admission were identified (see Table 1). To account for confounding factors, the risk-standardized admission ratio was adjusted for patient age, sex, income, and insurance status.

Table 1. Association between hospital characteristics and risk-standardized admission ratio for five conditions with high admission variation

Clinical Condition	# of ED visits	# of Admissions	Average Admission Rate
All conditions	21,885,845	4,470,105	63.58%
Pneumonia	292,417	185,922	85.08%
Congestive heart failure	215,027	182,935	18.97%
Nonspecific chest pain	832,426	157,928	97.53%
Septicemia	159,902	155,957	34.85%
COPD and bronchiectasis	387,784	135,128	44.63%
Cardiac dysrhythmias	292,824	130,691	92.33%
Acute cerebrovascular disease	124,116	114,593	96.22%
Acute myocardial infarction	113,939	109,636	45.02%
Mood disorders	243,106	109,458	18.74%
Urinary tract infections	572,479	107,255	16.21%
Skin and subcutaneous tissue infections	587,009	95,125	56.01%
Diabetes mellitus with complications	160,320	89,789	78.83%
Coronary atherosclerosis and other heart disease	112,119	88,382	45.83%
Fluid and electrolyte disorders	170,276	78,029	55.77%
Biliary tract disease	139,274	77,668	63.58%

(adapted Venkatesh et al., 2016)

Among these top 15 conditions resulting in a hospital admission, five had much higher variation rates than others even after adjusting for patient-level characteristics and mixes of

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hospital cases (Venkatesh et al., 2016). These five conditions are mood disorders, chest pain, skin and soft tissue infections, urinary tract infections, and chronic obstructive pulmonary disease (COPD). All five of these lack clear clinical practice guidelines or established clinical pathways, meaning that the admission rates vary from ED to ED as there is no black and white process. Some clear guidelines to establishing a treatment plan for these ambiguous diseases and disorders could result in fewer ED admissions (Venkatesh et al., 2016).

Adams (2013) found that in a national sample of 34,942 ED visits during 2009, 6.3% of patients had conditions that were treatable in a primary care setting. The main problem with launching an intervention targeting this is that 88.7% of non-emergent conditions showed symptoms that are concurrent with more serious events (Adams, 2013). One of the more common of these is chest pains (Adams, 2013). This makes trying to create an intervention based strictly on perceived acuity very difficult and potentially dangerous for the patient (DeGregorio, personal communication, January 15, 2018).

2.2   RESULTS OF HIGH ED UTILIZATION RATES

2.2.1   Crowding of ED

Approximately half of the EDs in the United States are operating at or above capacity. Roughly half a million ambulances are diverted annually because EDs do not have the space required to treat additional patients. The average wait time has increased 25% from 2003 to 2009 (Lee, et al., 2013). One possible cause, as previously mentioned, is that the number of EDs has decreased as the number of ED visits are increasing (Smulowitz, et al., 2013). ED crowding has been referred

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to as one of the most serious problems threatens the reliability of the health care system worldwide (George & Evridiki, 2015).

Crowding is defined as a situation in which the identified need for emergency service surpasses the resources available to treat patients in the ED and/or the hospital (George & Evridiki, 2015). This has multiple causes, but is most usually related to a momentary mismatch between resources including staff and the demand for patient care (Warner et al., 2015). Staffing is a main factor in crowding of EDs, and half of EDs do not meet the suggested ratio of one nurse to four routine beds (George & Evridiki, 2015). Sixty-eight percent of EDs surpass the recommended ratio of one nurse to one critical care bed. In one study, the ratio changes throughout the average day, from 1:15 in the morning to 1:7 in the afternoon to 1:4 at night. This reflects the influx of patients during the morning and day so that the recommended ratio of nurses to patients is not maintained (George & Evridiki, 2015).

The average length of stay in the ED increased from 132 minutes to 154 minutes, almost 15%, within the four-year period of 2001 to 2005 (George & Evridiki, 2015). While patients are waiting to be transferred from the ED to inpatient units, no beds are available to take new patients, and the patients who are waiting to be transferred use ED resources that could be used to treat other patients (George & Evridiki, 2015). George and Evridiki (2015) referenced a study that noted if the trend among current bed use continue to rise and the number of frail older patients increases exponentially as expected, the number of hospital beds must increase by 62% to meet the expected demand by the year 2050.

Boarding is the term used when admitted patients are kept on stretchers or beds in the hallways of the ED (Kelen, Peterson, & Pronovost, 2016). A report links boarding to delays in the completion of admission orders and to patient safety implications. Interventions that alleviate ED boarding are vital, but must take a broad system view. The main factors that contribute to

prolonged boarding are not directly in the ED, so in order to properly intervene, one must focus on the entire system's causes. Kelen et al. (2016) simulated the results of preventing two to three ED admissions each day, and noticed a profound effect on the inpatient capacity and boarding relief.

ED crowding results in long waits to be seen; for example, the odds of being examined by a physician within the time recommended by triage decreased by 30% from 1997 to 2006 (George & Evridiki, 2015). ED crowding also leads to increased length of stays, and may impact health of patients by delaying time-sensitive treatments such as treatment for patients with heart disease, higher mortality rate, higher rates of cardiovascular complications among patients with chest pain, and poorer patient experiences or satisfaction (Warner et al., 2015). Kelen, et al. (2016) point to these for why ED crowding remains one of the underappreciated but significant threat to patient safety.

Every hour spent in the ED as a patient increases the chances of an adverse event in the hospital increases by 3% (George & Evridiki, 2015). This includes an increased frequency of medication errors (George & Evridiki, 2015). The patients whose average crowding exposure was in the highest quartile had doubled odds of experiencing a preventable adverse effect in the hospital compared to patients in the lowest quartile of average crowding exposure (George & Evridiki, 2015). Not only does crowding have a negative impact on the patient, it can also impact the providers including burnout, violence toward ED staff including verbal abuse to death, turnover, decreased productivity, and the risk of legal action (Kelen, et al., 2016).

2.2.2 Financial Burden

Though overuse of the ED is a controversial burden for the medical system and taxpayers who are paying for Medicaid and Medicare. In fact, Adams (2013) and Lee et al. (2013) both state that overuse of the ED costs $38 billion each year. However, the American College of Emergency Physicians argues that the total spending of emergency medicine is only $48 billion. This turns out to be roughly 1.9% of the national health expenditure (Lee, et al., 2013). The "Just 2% Campaign" is based on the statistic that emergency medicine's spending is only 1.9% of the national health expenditure. Therefore, it is suggested that substantially reducing costs should be achieved using strategies other than focusing on the small number of patients with nonurgent conditions, who incorrectly believe that they belong at the ED (Adams 2013). Smulowitz et al. (2013) agree by stating the following:

> Although seemingly 'low-hanging fruit,' diverting minor injuries or illnesses to other settings would not be expected to result in substantial cost savings, even with diverting up to 50% of visits. The cost of these visits is responsible for a small proportion of the 2% to 4% of total health expenditures accounted for by the ED (p. 297).

Even if one could somehow divert a majority of these nonurgent cases, there is no clear consensus on how many or which type of patients could be treated in alternative settings (Smulowitz et al., 2013). This low percentage suggests that emergency care is cost effective and does not significantly contribute to health care costs (Lee, et al., 2013).

The Just 2% Campaign was based on the Medical Expenditure Panel Survey (MEPS), a collection of medical encounter surveys from both individual and providers (Lee et al, 2013). One of the strengths of the MEPS is that it is a very detailed report on individual health costs and expenditures. Household visit data are matched to providers who report payments for their services. In this regard, MEPS is superior to other national databases that report only charges (Lee,

et al., 2013). MEPS says that the total spending of the American ED was $48.3 billion, or 1.9% of the national health expenditures which aligns with the "Just 2% Campaign" (Lee, et al., 2013).

However, there are discrepancies with the Just 2% Campaign that make the ED seem like a much more affordable option. The first discrepancy is that the Medicaid patients have been underreported (Lee, et al., 2013). Another issue with MEPS is that the National Hospital Ambulatory Medical Care Survey's (NHAMCS) results show that ED visits were 129.8 million in 2010, which is much higher than the MEPS estimate of 48.9 million. The NHAMCS was compared with seven other data sources. All were within a few percentage points of each other; the exception was the MEPS study, which was an outlier. Lee et al. (2013) state these results were applied to the MEPS data on patients who were discharged, then were multiplied by the NHAMCS's estimated visits, which led to ED expenses of $131 to $136 billion. The MEPS data showed that this is closer to 5% of the national health expenditures, suggesting it is a misconception that the ED is 2% of the national health expenditure (Lee et al., 2013). See Figure 1.

$160 ── 6.2%

NHAMCS: 130 million ED visits

MEPS: 49 million ED visits

Aggregate ED expenditures (billions)

ED expenditures as % of NHE

$969	$985	$1,001	$1,016	$1,032	$1,048	$1,064	$1,080	$1,095	$1,111	$1,127
1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0

Per-visit ED expenditures (all patients)
Ratio of admitted to discharged ED expenditures
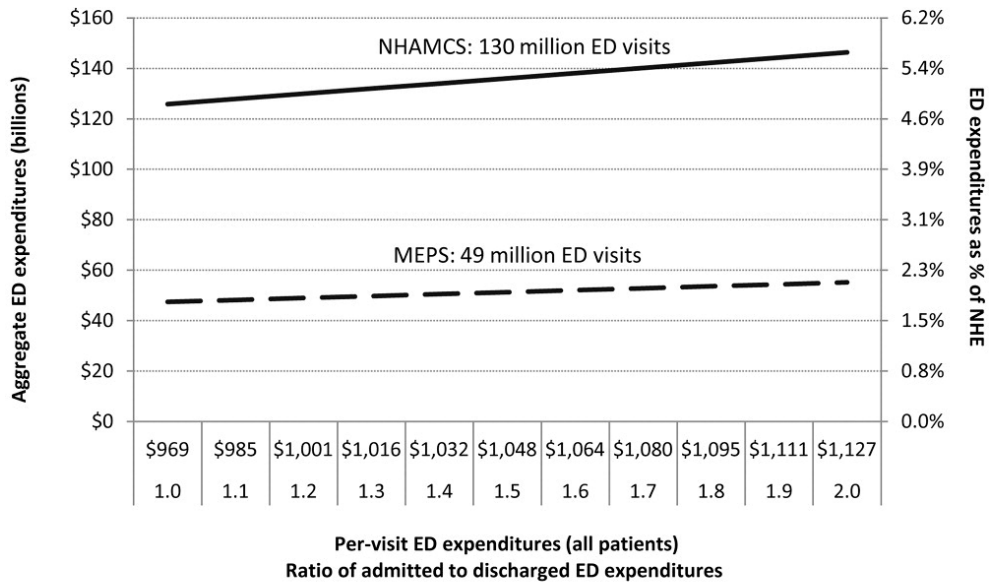
MEPS = Medical Expenditure Panel Survey
NHAMCS = National Hospital Ambulatory Medical Care Survey
NHE= National Health Expenditures

(Open Access, Lee et al, 2013)

Figure 1. Effect of the ratio of admitted to discharged patient spending on aggregate spending

One common view is that the ED is a high fixed cost and a low marginal cost enterprise (Lee et al., 2013). Lee et al. (2013) explain that EDs maintain continuous staffing and other resource-intensive services such as laboratory testing, radiology, and access to consultants. These services are paid for regardless of the number of patients who arrive. A study conducted by Williams (1996) found that the average cost for visiting an ED ranged between $88 to $150 in 1991 dollars and $209 to $357 in 2010 dollars.

In a secondary analysis, the estimated average and marginal costs that led Williams (1996) to state the ED is an economically efficient place to treat low acuity patients are a few variables short of being accurate (Lee et al., 2013). The issue with William's (1996) method of pricing is when the ED is at full capacity. While patients are waiting for treatment, the marginal cost is technically infinite at that moment (Lee et al., 2013). There are "shadow" costs associated with

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waiting patients such as opening additional space and calling in backup staff. This issue of cost is explained in more detail by Kaplan and Porter's 2011 study referenced by Lee et al (2013). They measure costs with an "activity-based cost accounting" method that has been commonly used in manufacturing. This process begins with mapping every step during the process including encountering the patient, and clinical, administrative, and diagnostic procedures. Each step of the process has a cost assigned to it, including the time spent and the cost of resources used to deliver (Lee et al., 2013). This process is straightforward for costs such as labor, but gets more complicated when calculating capital goods. Assumptions must be made about capacity utilization. Once all the costs have been calculated, combining costs over the entire process gives a final number (Lee et al., 2013).

The activity-based cost accounting process could be used to measure the cost of common ED processes or the cost of specific ED complaints. This process is traditionally used to identify which steps cost the most, allowing for cost reduction. In this context, the activity-based cost accounting process could be used to increase value of care by reducing costs of the ED process (Lee et al., 2013).

According to Lee et al. (2013), the role of time is usually not factored into charge-based estimates of ED costs. Low-acuity ED visits that require a lot of time in the facility may cost much more than a charge-based approach would show. Examples of this are an intoxicated patient who must be held until sobriety and an admitted patient who is staying in the ED. On the other hand, less time-intensive high-acuity events that send people to the ED, such as a stable case of acute coronary syndrome, may be much less expensive when measured with an activity-based cost compared to traditional accounting (Lee et al., 2013). If time is shown to impact ED costs, then a focus must be made on improving the pace of patients passing through the ED, and not just raise estimates and costs (Lee et al., 2013).

Adding the costs found with the activity-based cost accounting method has led to aggregate ED costs being much higher than those previously published (Lee et al., 2013). A conservative estimate is 5% of the national health expenditure, but it may be as high as 10%. With 130 million visits, 28% of all acute-care visits, and accounting for nearly half of all hospital admissions, the ED should account for a large share of the national health expenditure. Table 2 shows the percentage of the national health expenditure by insurance type, and the percent of each group's total spending at the ED (Lee et al., 2013).

Table 2. **Components of NHE and estimate of ED expenditures using private insurer data**

Source of Payment	% of NHE	ED Spending as % of Total Spending by Type
Private health insurance	35	8.6–9.5
Medicare	22	4.9–9.3
Medicaid	18	9.0–11.9
Other insurance and third-party payers	13	2–10
Self-pay	12	2–10
Total	100	6.2–10.0

(Open Access, Lee et al., 2013)

The findings of Lee et al. (2013) shows more value in trying to divert the nonurgent patients away from the ED that Adams (2013) and Smulowitz et al. (2013) said would not have a great impact on the national health expenditure. Determining costs by using the activity-based cost accounting method holds promise that may answer questions that are vital for passing appropriate policies on the diversion of ED patients. One question in particular is whether or not diverting nonurgent care to another location would be cheaper if the activity-based cost accounting process was used (Lee et al., 2013).

2.3   REASONS FOR OVERUSE

Reasons that people overuse the ED are very complicated. Smulowitz et al. (2013) states that for various reasons individuals either choose to use the ED or are referred to the ED including convenience, 24-hour availability, and lack of access to other sources of care. One of the populations that uses the ED more frequently, those with Medicaid, is more likely to face barriers

when attempting to access primary care than individuals with private insurance. Few studies have looked at the patient's perspective and ED utilization (Capp et al., 2014).

2.3.1   Perceived Acuity

Patients come to the ED for a variety of reasons including acute medical conditions that they perceive need immediate medical treatment; some come for nonurgent care that may be treated in other settings if access to other care was available (Capp et al., 2014). Capp et al. (2014) found that roughly 65.0 % of all adults had one or more acuity issues, or perceived an emergency as a reason for seeking care at the ED. About 55.4% of adults stated that only a hospital could treat them, and 19.4% of adults said they were advised by a health care provider to visit the ED. The same study found that 42.6% of adults said that their medical issue was too serious for a doctor's office.

Capp et al. (2014) reference a study from the 1990s that found that 45% of all patients who visited the ED because of the health issue's perceived emergent or urgent need, but the study did not consider the different type of insurance types and their effect on perception. The original study did not show a difference in rates of ED utilization among those with an emergent, urgent, or semi-urgent condition when compared to those with private insurance, which may be a confounding factor as individuals with Medicaid often present less urgent conditions than those with private insurance. Capp et al.'s (2014) study found that the rate of acuity perceived by the patient was higher than previously reported at 65% although this study was limited to those who were discharged. This finding is most likely a reflection of the patient's knowledge of what is and what is not an emergency. While this may be a potential target to modify behavior of ED use, there are issues with interventions focusing on perceived urgency.

Capp et al. (2014) said that patients will pursue emergency services whenever they perceive that there is a medical emergency, and it is their right to do so. To further complicate the issue, Adams (2013) states that often patients who are given a low-acuity diagnosis have symptoms that are present with more serious conditions such as chest pain. At the University of Pittsburgh Medical Center (UPMC), a comment made by Dr. DeGregorio during the ED Diversion Campaign's creation was "to make clear we are not discouraging the ED for true emergencies" (personal communication, January 15, 2018). This is the issue with targeting knowledge about the difference between a perceived and a true emergency. Essentially, this would be a very difficult factor on which to intervene because without the expertise provided by ED doctors, the blurry line between a true emergency and a "false alarm" could be interpreted incorrectly, leading to disaster.

2.3.2   Access Issues

As mentioned earlier, one of the main reasons that individuals go to the ED rather than primary care is a lack of access to primary care. In fact, 78.9% of the adults within the US cited access issues as a reason for seeking ED care over other types (Capp et al., 2014). The first example of an access issue is that of convenience. The ED is open 24/7 whereas primary care closes. Regardless if an individual has a primary care physician (PCP), patients will often use the ED for a variety of reasons including the perceived urgency of their health issue and the convenience of being able to access acute, unscheduled healthcare 27/4 (Griffey, Kennedy, McGowan, Goodman, & Kaphingst, 2014). Capp et al. (2014) agree; almost 50% of patients in their study said that the doctor's office was not open at the time of the medical issue. Most patients do not think that their doctor will be able to see them after hours, whereas the ED is open 24 hours a day (Glaseroff,

2011). Patients perceive the ED as a high-quality setting with the same diagnostic and treatment capabilities as a PCP, but in a faster and more convenient setting (Glaseroff, 2011). The barrier of time of issue could be a modifiable factor in the usage of the ED. Even when people do manage to make it to a primary care setting during their hours, their insurance may not provide access to that doctor (Smulowitz et al., 2013).

Another issue of access is transportation. According to Capp et al. (2016), 45.9% of their study's participants said that the ED is the closest provider to them. For those who lack transportation, the ED is convenient option for health care. Most people who mentioned transportation as an issue lived within walking distance of the ED. In the Capp et al. (2016) study, participants said it was easier to call an ambulance and go to the ED than to take several buses to get to their doctor's office. Participants also stated that while Medicaid will pay for cabs, it takes too much time and is sometimes not an option for urgent appointments (Capp et al., 2016).

Finances are another barrier that the ED can circumvent. EDs are required by law to provide medical services to anyone regardless of their ability to pay (Smulowitz et al., 2013). In this regard, EDs have become the "safety net" of the health care system for patients with no other source of care. Some lawmakers have considered the possibility of denying reimbursement for nonurgent ED visits, but this has been unsuccessful in the past. With limited access to primary care physicians and specialists, there is no reason to think that denying reimbursement would drastically impact ED use among the Medicaid population (Adams 2013).

2.3.3 ED Revisits

Not only does the ED get crowded from nonurgent patients from time to time, but it also has a lot of revisits, when an individual goes to the ED and then returns for the same issue. These return

visits strain an ED that may be overburdened already (Duseja et al., 2015). Revisits can be previously planned follow-up appointments for the progression of symptoms or disease, but they can also be caused due to the lack of a follow-up appointment at primary care (Duseja et al., 2015).

The concerns over costs, crowding, and wasting resources has led organizations to prioritize the reduction of preventable revisits (Duseja et al., 2015). Duseja et al. (2015) conducted a study to check for ED visits or hospital admissions after an index ED visit. They used states and years that were available from the State Emergency Department Databases (SEDD) and State Inpatient Databases (SID). The states included Arizona, California, Florida, Nebraska, Utah, and Hawaii. Their primary outcomes were daily and cumulative revisit rates and the costs associated with these revisit rates over the first 30 days. However, they focused on revisit rates over the first three days and costs associated with those (Duseja et al., 2015).

The overall revisit rate within the first three days after the index case was 8.2% with 29% resulting in an admission (Duseja et al., 2015). Thirty-two percent of individuals revisited a different hospital than the index ED. Over half, 52%, of all revisits within three days were a return visit to the same ED, followed by a discharge. The highest revisit rate within the 30 days was on day one (2.7%), with 37% of revisits leading to an admission. After 30 days, the overall return rate was 19.9% and 28% of those revisits occurred at a different hospital or institution than the index case (Duseja et al., 2015).

Revisits varied depending on ethnicity, age, and insurance type. Native Americans had the highest revisit rate, 12.1%, and Asian Americans had the lowest revisit rate, 7.3%. Regarding age, those 18-44 years had the highest revisit rate, 8.2% (Duseja et al., 2015). Men had higher revisit rates, 8.9%, than women, 7.8. Patients with Medicaid and self-pay had the highest revisit rates, 10.1% and 9% respectively. Also noted in the Duseja et al. (2015) study is that public hospitals had the highest revisit rate, at 9.0%. Smaller hospitals with fewer than 100 beds had revisit rates

that were slightly higher than larger hospitals with revisit rates of 8.4% to 8.1% respectively (Duseja et al., 2015).

Duseja et al. (2015) found in their study that individuals with diagnoses of skin and subcutaneous tissue infections had the highest revisit rate, but that makes sense as some patients would be on a treatment plan that takes multiple steps to fully resolve their infection. The second highest revisit rate was due to abdominal pain, at 9.7%. A majority, 89%, of the revisits had the same primary diagnosis as the index visit (Duseja et al., 2015). See Table 3.

Table 3. Three-Day Revisit Rates for 10 Most Common Diagnoses Among Index ED Visits

Primary Diagnosis	ED Encounters, n	ED Revisits, n	Revisit Rate, All Types, %
Sprains and strains	3,164,750	117,096	3.7
Abdominal Pain	2,838,196	275,305	9.7
Superficial injury, contusion	2,667,339	133,367	5.0
Nonspecific chest pain	2,155,158	120,689	5.6
Back problems	2,004,182	156,326	7.8
Open wound	1,793,901	136,336	7.6
Headaches	1,652,6697	1,437,823	8.7
Skin infections	1,628,045	376,078	23.1
Other upper respiratory infections	1,553,462	76,120	4.9
Urinary tract infections	1,513,275	104,416	6.9

(Adapted Duseja et al., 2015)

Nearly one out of every 12 ED cases that were discharged had a revisit in the six states that they studied (Duseja et al., 2015). Duseja et al. (2015) said, "risk-adjusted revisit rates were examined at the diagnosis and state levels. An emphasis was placed on Florida, which was the only state with complete cost data 4.1% of the patients had a revisit within three days, accounting for 30.3% of costs for all the index cases (Duseja et al., 2015). Within 30 days, revisits had cost Florida 117% of all index ED costs. Florida had the highest risk-adjusted revisit rate for skin and

subcutaneous tissue infections (24.8%), whereas Hawaii had and Nebraska (10.6% [CI, 9.2% to 12.1%]) had lower rates" (p. 754). Figure 2 shows that revisit rates vary drastically state to state, and condition to condition.
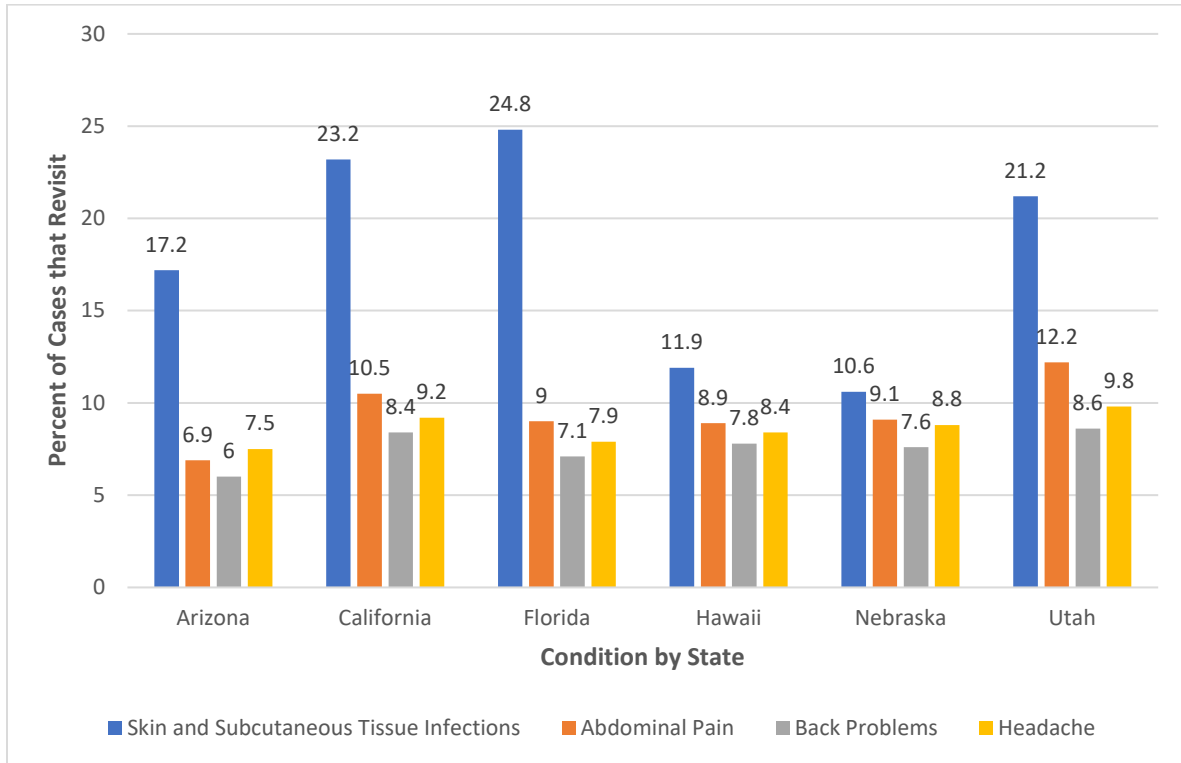
(Adapted Duseja et al., 2015)

Figure 2 Risk-Adjusted Rates of All ED Revisits Within 3 Days, by State

This study did have some limitations. Their data were based on information from only six states and do not capture out-of-state revisits. Therefore, the true numbers of revisits may be even higher. The chance of random error was very low because the sample size consisted of 21.6% of the entire nation's population. Also, their study used costs only from Florida. Florida's costs are usually higher than other states so they used revisit costs as a percentage of index costs rather than crude costs. (Duseja et al., 2015).

2.4 ED DIVERSION CAMPAIGNS

2.4.1 Ineffective Methods

Many strategies have been attempted to divert individuals away from the ED with varied success. Managing patients who come into the ED, making the process of getting patients through the ED more efficiently, and getting more patients out can relieve the ED crowding. One strategy that has been attempted repeatedly but has not worked is to put up additional barriers to receiving care, or denying payment after receiving care (Adams, 2013). On the other hand, providing insurance coverage is unlikely to divert a large number of people from the ED because of the previously mentioned barriers they face accessing care (Adams, 2013).

One way to handle crowding in the ED is to divert ambulances that bring patients to them. Ambulance diversion (AD) reduces the number of patients coming to the ED, which in theory relieves ED crowding, especially because patients in ambulances are usually in worse condition than those who come to the ED on their own (Kao, Yang, & Lin, 2015). Warner et al. (2015) compared hospitals across the nation to explore interventions aimed at reducing crowding, and they found that more crowded hospitals are more likely to admit elective cases, instead of diverting them. Multiple studies have been done trying to maximize the effectiveness of AD, because if done improperly, it can actually worsen the emergency care in a certain region (Kao, Yang, & Lin, 2015).

Kao, Yang, and Lin (2015) created a computer simulation to test what would happen with differing AD rules to determine the optimal policy for AD. Their study uses what they refer to as the crowdedness index (CI), which they define as "the current loading of an ED compared to the full capacity of an ED" (Kao, Yang, & Lin, 2015, p. 2). The current loading of an ED means the

medical resources currently being used including staffing, beds, and equipment. As such, the full capacity of an ED is when all beds and observation areas are completely occupied, and the acuity of patient severity is at its average rate. The regional crowdedness index (RCI) is the sum of the regions EDs (Kao, Yang, & Lin, 2015). Another term that Kao, Yang, and Lin use is diversion status, meaning the hospital is currently in the process of diverting ambulances.

It is generally unacceptable to divert ambulances with high acuity levels patients while accepting patients with low severity conditions (Kao, Yang, & Lin, 2015). Kao, Yang, and Lin (2015) made four different simulations based on four different rules. The first rule was that patients are diverted equally, but to larger EDs, or EDs with more medical resources. Implementing this rule led to severe crowding in the simulated region's largest ED (Kao, Yang, & Lin, 2015).

Rule two was that patients are diverted in equal numbers to any other ED regardless of their available resources (Kao, Yang, & Lin, 2015). Diverting patients equally leads to crowding of the smallest ED in the region. Neither rule one nor rule two requires coordination among EDs, but neither is ideal as they both lead to overcrowded EDs (Kao, Yang, & Lin, 2015).

The third rule of Kao, Yang, and Lin's (2015) study was that patients were to EDs not currently in the diversion status. This essentially mimics rule two, with the omission of excluding hospitals that are currently in the diverting status. If all EDs are requesting diversion, then no patient will be diverted (Kao, Yang, & Lin, 2015). This rule was expected to have better outcomes, and this was confirmed by comparing the RCIs. This led to all EDs being less crowded, but not significantly.

Rule four is that patients who could be treated in a primary care setting are diverted to any ED; essentially this is the same as rule two, but applies only to nonurgent patients (Kao, Yang, & Lin, 2015). A simulation combining rules three and four showed that EDs with fewer resources became more crowded (Kao, Yang, & Lin, 2015). To improve this, the rule was tweaked so that

nonurgent patients would be diverted to EDs that were not in a diversion status. Combining rule three and the updated rule four led to a significant drop in the RCI that was maintained throughout the day. The simulation showed that all EDs operated below or at full capacity and no overcrowded situations occurred (Kao, Yang, & Lin, 2015).

This study (Kao, Yang, & Lin, 2015) has shown that with coordination and communication among a region's EDs, crowding can be reduced. Blindly diverting nonurgent patients does not help reduce crowdedness, but diverting them with strong communication between hospitals can result in a significant reduction. This method works only if there were enough room at other EDs to accept diverted patients, but as previously mentioned, preventing two to three admissions can lead to a significant decrease in the amount of inpatient capacity increasing which relieves boarding (Kelen et al., 2016). On the negative side, a crowded ED may increase the time that it takes for a patient to get a time sensitive treatment, and the method of AD leads to a longer period of waiting for a doctor's treatment (Warner et al., 2015).

Another method of ED diversion is to use predictive modeling to reduce the congestion by making AD decisions after using an algorithm that notices trends that will most likely repeat themselves (Xu & Chan, 2016). It is well documented that EDs have seasonal patterns of use, as well as high utilization in the middle of the day (Xu & Chan, 2016). By implementing this information, AD can address the anticipated crowdedness of the ED. To also compensate for predicted crowdedness, staffing can be adjusted so more personnel are available during the busiest hours (Xu & Chan, 2016). The issue with this type of intervention is that decisions are based on hypotheses, which can be incorrect.

As previously mentioned, Warner et al. (2015) compared the number and type of interventions being conducted at EDs and considered which EDs were more crowded. The National Hospital Ambulatory Medical Care Survey's (NHAMCS) data from the period of 2007-

2010 were analyzed The NHAMCS is conducted annually by the National Center for Health Statistics and it is a stratified, probability sample that includes data from roughly 108,000 ED visits during this three-year period (Warner et al., 2015).

Each intervention deployed during this time frame was either an ED or a hospital level intervention depending on the primary focus of deployment (Warner et al., 2015). The number of hospital level interventions increased from 2007-2010, but the change in interventions among ED-level interventions was not significant. A full-capacity protocol, or a protocol where patients waiting to be admitted are transferred to inpatient areas including inpatient hallways, had the largest increase in utilization from 21% of EDs in 2007, to 45.6% of EDs in 2010. The main question of the study was how the interventions in the most crowded EDs compare to those in the least crowded EDs. Warner et al. (2015) used median ED length of stay as a measurement for ED crowding. The EDs were divided into quartiles with quartile one being the most crowded, and quartile four being the least crowded (Warner et al., 2015). Table 4 describes each of the interventions, and Table 5 compares each category of intervention with a comparison of the four quartiles Warner et al. (2015).

Table 4. Description of the ED Crowding Interventions Evaluated

Interventions at the Emergency Department Level	
Bedside registration	Moves full patient registration from arrival in the ED to the bedside while patients are awaiting test results. This allows rapid placement of patients into an ED bed and parallel processing and can decrease waiting times and length of stay (LOS).
Electronic dashboard	Use of a centralized electronic tracking system to monitor patients in the ED to improve flow and decrease waiting times by making patients and processes visible to all ED providers.
Computer-assisted triage	Use of electronic algorithms to increase the reliability of triage decisions that can reduce LOS and shorten time to treatment.
Zone nursing	Localizes all of a nurse's patients into one geographic area, so that less time is spent traveling between patients
Fast track	Having a separate area for patients with minor illness or injury allows resources to be best matched to patients' needs and can improve flow and decrease LOS.
Increased ED treatment spaces	Increasing the number of ED beds initially reduces crowding but eventually leads to increased crowding
Physical expansion of ED	Expanding space to match ED volume must be accompanied by appropriate staffing to be effective.
ED observation unit	Allows extended observation, diagnosis, and treatment of patients who do not require admission, which can reduce the number of short-stay admissions and the strain from inpatient boarding.
RFID tracking	Tagging patients with RFID allows their location to be tracked in the ED to improve patient safety and throughput.
Interventions at the Hospital Level	
Bed census availability	A system that makes the ED staff aware of the hospital capacity and number and type of available beds for admitted patients.
Avoid elective admissions during diversion	Ambulance diversion occurs when the ED is too crowded to accept new patients. This policy cancels or delays accepting patients with elective conditions by diverting them to other hospitals
Pooled nursing	Supplemental nursing staff on a flexible schedule who work depending on patient volume and staffing need.
Bed czar	One person whose job is to manage the bed use for the entire hospital to match bed availability with patient need. The person is responsible for the timely transfer of ED patients to inpatient beds.
Interventions at the Hospital Level	
Full-capacity protocol	A protocol to move admitted patients from the ED to inpatient areas to spread out the burden of boarded patients. This is not associated with harm to patients and is aligned with patients' preferences to board in inpatient areas instead of in the ED.

Table 4 Continued

Board patients in inpatient hallways	A policy to move admitted patients from the ED to hallways in the inpatient units instead of boarding them in the ED. This is one component of the full-capacity protocol.
Separate operating room for ED cases	Dedicating an operating room with adequate surgical staffing to ED cases.
Surgical schedule smoothing	Reducing artificial variable patient flow by planning surgical schedules to match availability of inpatient beds, including scheduling elective surgeries six or seven days a week (as opposed to five or fewer) and scheduling high-intensity surgeries throughout the week.

(Adapted Warner et al., 2015)

Table 5. Emergency Department (ED) And Hospital Crowding Interventions Implemented by US Hospitals as of 2010, By Median ED Length-Of-Stay

	All	Quartile 1	Quartile 4
Interventions at the ED level			
Bedside registration	79.20%	75.70%	81.10%
Electronic dashboard	51.9	16.4	75.3
Computer-assisted triage	49.3	29.7	70.4
Zone nursing	44.6	22.3	62.4
Fast track	39.7	30.8	67
Increased ED treatment spaces	23.6	17.3	30
Physically expanding ED	23.1	18.9	30.1
ED observation unit	21.1	18.4	29.6
RFID tracking	20.7	19	15.9
Mean no. of ED-level interventions	3.53	2.48	4.62
Interventions at the hospital level			
Bed census availability	83.40%	86.70%	89.20%
Avoid elective admissions during ambulance diversion	79.2	94.1	71.5
Pooled nursing	60	57.1	64.7
Bed czar	59.2	41	66
Full-capacity protocol	45.6	41.8	38.3
Board patients in inpatient hallways	23.8	24.3	15.7
Separate operating room for ED cases	4.8	0	7
Surgical schedule smoothing	4.6	1.1	6
Mean no. of hospital-level interventions	3.02	2.58	3.15
Mean no. of interventions	6.6	5.1	8

(Adapted Warner et al., 2015)

Warner et al. (2015) also calculated the percentages of Medicaid, black, and Hispanic patients seen at each hospital and created quartiles among these to determine if EDs had create population specific interventions. There was a significant increase in the number of interventions at EDs with a higher proportion of black (highest quartile had 6.6 interventions compared to 5.6 among the lowest percentile) and Hispanic patients (7.3 among the highest quartile and 6.1 among the lowest quartile). However, there was no significant increase in the number of interventions by hospital region or proportion of Medicaid patients (Warner et al., 2015). There were more interventions targeting crowding at the quartile one hospitals compared to the quartile four hospitals. See Figure 3.
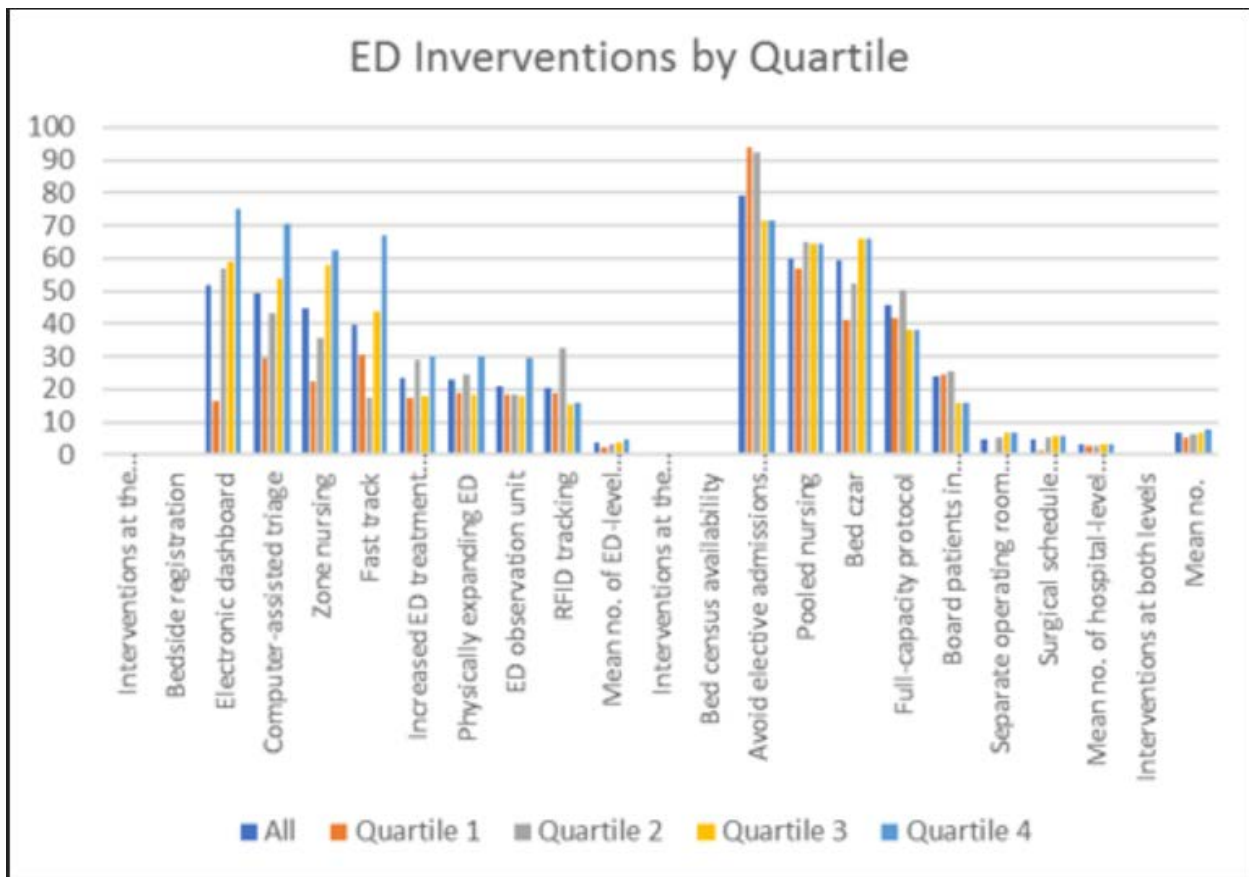
(Adapted Warner et al., 2015)

Figure 3. ED and Hospital Crowding Interventions Implemented, Overall and By Quartile

Despite the increased number of interventions at crowded hospitals, a large number of the most crowded hospitals did not adopt more effective interventions. Many of the quartile one hospitals did not adopt practices that are easy and cheap to implement, including surgical smoothing or implementing a full-capacity protocol (Warner et al., 2015). The surgical smoothing or the full-capacity protocol only require a change in administrative protocols to take advantage of the framework already established by the ED (Warner et al., 2015).

2.4.2   Successful Methods

Interventions targeted toward frequent ED users have historically decreased ED visits effectively overall (Moe et al., 2017). Interventions focused on frequent users using primary care instead of the ED has more often led to an increase of primary care visits compared to a decrease of ED visits. This result may be due to the linking of individuals to primary care (Moe et al., 2017). One intervention in particular focused on linking patients who were using the ED to a primary care setting.

Roughly 20 million children each year visit the pediatric emergency department (PED), but unlike adults, they do now make decisions about what happens as a result to a health incident (Sturm, Hirsh, Weselman, & Simon, 2014). The use of the PED for nonurgent care is documented in the literature, and some studies suggest that up to 50% of these visits are for nonurgent complaints (Sturm et al., 2014). The most frequent factors that led to nonurgent use of the PED were that the doctor's office was closed, the perceived acuity of their child's symptoms was high, they were sent to the PED by their doctor, the PED was closer and faster than primary care, and parents were unaware of what to do when their doctor's office was closed (Sturm et al., 2014). A

triage line that has a nurse referring possible ED patients to a second physician-based triage level

reduced referral rates to the ED up to 77% (Sturm et al., 2014).

Sturm et al.'s (2014) study involved enrolling patients into an educational program that

encouraged accessing a PCP before going to the PED. All enrolled patients completed a survey

that measured knowledge prior to the PED, barriers that prevented them from obtaining timely

care from their PCP, and satisfaction with the access to their PCP (see Table 6). People in the

study's intervention arm received laminated one-page handouts that were developed with input

from their PCP. These handouts went over hours and location, scope of practice, and the steps that

patients should take to address medical concerns (Sturm et al., 2014). The study's control arm was

managed with routine care and were given normal discharge instructions from the PED. Future

visits to local PEDs and primary care settings for both acute and nonacute visits were tracked with

an electronic health record at a six-month and a 12-month interval (Sturm et al., 2014).

Table 6. Survey Responses at Study Baseline

Survey Question	Percentage
Know way to contact PCP after hours	54
If know how to contact medical advice, attempted to do so	36
If contacted PCP, primary reason for coming to PED	
Could not get PCP appointment soon enough	46
PCP advised to come to PED	28
If did not contact PCP, primary reason for coming to the PED	
Thought the problem was an emergency	53
Emergency room care more convenient	20

(Open Access, Sturm et al., 2014)

Only 36% of patients knew how to seek medical advice from a nurse or doctor when their

PCP was closed so that they could determine if their issue required emergency care (Sturm et al.,

2014). The level of satisfaction with access to a PCP did not change within the six-month period; however, the percentage of those knowledgeable about finding care after their PCP closed increased by 17%. At six months, there was no significant differences for PED visits between the control and intervention groups, but that changed upon the 12-month follow-up (see Table 7). There was a significant decrease in use of the PED for nonurgent issues, but the number of urgent issues did not change significantly (Sturm et al., 2014).

Table 7. Pediatric Emergency Department Follow-up at 6 and 12 Months

	Percent of Control	Percent of Intervention	P-Value (<.05 is significant)
Low acuity follow-up			
6 months	18.4%	12.8%	.14
12 months	54.2%	42.7%	.047
High acuity follow-up			
6 months	10.7%	13.4%	.56
12 months	45.1%	45.1%	.53

(Open Access, Sturm et al., 2014)

There were significant increases in the rate of sick visits at primary care settings among the intervention group. The intervention group recorded 139 sick visits during the follow-up period compared to 109 sick visits among the control group (Sturm et al., 2014). An issue with interventions that aim to divert individuals from the ED to a PCP is that they are often not sustainable, but this intervention was able to address that by providing the laminated intervention sheet. After six months, 85% of patients reported that they still had the form, and 84% of patients reported that it was still helpful (Sturm et al., 2014).

Policymakers should focus on modifying access issues, one of the main drivers of ED overuse, as well as strategies that increase availability of alternative sites of care (Capp et al., 2016). A study (Adams, 2013) in Washington state looked at how to best access care. The physicians started using electronic medical records to share patient information with health professionals at the ED to reduce barriers to patient education, allowing for a better overall experience (Adams, 2013). The ED and physicians embraced this willingly, and within the first six months there was a reported savings of 10% in Medicaid fee for service, or roughly $31 million (Adams, 2013).

The number of people using the ED for dental-related problems has been increasing since 2000-2010 among the population ages 21-34 (Nasseh, Vujicic, & Romaine, 2014). Roughly $2.1 billion was spent treating these dental visits in the US. Diverting those dental issues to an urgent dental office could save the healthcare system up to $1.7 billion (Nasseh et al., 2014). A Virginia program diverts ED patients to a special urgent dental care clinic located within the hospital; ED visits for dental issues decreased by more than 52% during the first year of the pilot program (Nasseh, et al., 2014). An ED in Maryland calculated that if it used the same intervention, it could save $4.37 million each year just among the Medicaid population (Nasseh, et al., 2014).

2.5   TEXT MESSAGE CAMPAIGNS

2.5.1   Text Messaging as a Communication Channel

Text message campaigns are an innovative communication strategy that can be used to contact patients. They are low cost; Arora et al. (2015) found that the cost associated with using the text message platform in an intervention to increase attendance at doctor appointments was $0.12 per text, and a total of $0.48 per patient. Patients were not responsible for paying this fee, but would face a $0.20 fee associated with receiving each text message if they did not have messaging as a part of their cell phone plan, so the maximum cost they would pay would be $0.80 (Arora et al., 2015).

Doh and Roaf (2017) found that when looking at effectiveness in reaching health plan members, text messages are 30 times more effective than mail, seven times more effective than interactive voice responses, and three times more effective than email. O'Leary et al. (2015) state

that the reach rate of text messages is 84%, but Doh and Roaf found that the reach rate was 99%. Regardless, it is much higher than the 13.2% reach rate associated with interactive voice responses. Ninety one percent of individuals who were texted stated that the messages improved their knowledge of the health plan's services (mPulse, 2016). Not only is texting effective at reaching members, but nearly the entire US population has a cell phone (Pew Research Center, 2018). See Table 8.

The Federal Communications Commission (FCC) is the governing body for text message campaigns (Federal Communications Commission, 2018). One rule established by the FCC is that text message campaigns must include written consent for participants (Federal Communications Commission, 2018). Even if someone signs a form consenting to be contacted for one reason, they cannot be texted unless the purpose directly relates to the reason for consent (Federal Communications Commission, 2018). An example is when an individual has surgery and signs a consent to be contacted by UPMC about follow-up for that surgery, then all text messages must directly relate to the surgery and what was consented for. Another rule is that there must be a clear method for participants to opt out of the texting campaign. This is most commonly done by an individual replying "stop" to a text message campaign (Federal Communications Commission, 2018).

Table 8. Percent of US adults who own the following devices

	Any cellphone	Smartphone	Cellphone, but not smartphone
Total	95%	77%	17%
Men	95%	80%	16%
Women	94%	75%	19%
Ages 18-29	100%	94%	6%
30-49	98%	89%	9%
50-64	94%	73%	21%
65+	85%	46%	40%
White	94%	77%	17%
Black	98%	75%	23%
Hispanic	97%	77%	20%
Less than high school graduate	90%	57%	33%
High school graduate	92%	69%	24%
Some college	96%	80%	16%
College graduate	97%	91%	6%
Less than $30,000	92%	67%	25%
$30,000-$49,999	98%	82%	15%
$50,000-$74,999	98%	83%	15%
$75,000+	98%	93%	5%
Urban	96%	83%	13%
Suburban	94%	78%	16%
Rural	91%	65%	26%

(Open Access, Pew Research Center, 2018)

Text messages must be a certain number of characteristics. The study conducted by Arora et al. (2013) had a character limit of 160. This may vary, but there is a limit of characters that must be maintained during a text message campaign.

2.5.2   Successful Strategies

An example of this strategy is a study on improving vaccination rates among adolescents (O'Leary et al., 2015). Parents of adolescents who needed at least one vaccination received actionable text

messages about scheduling an appointment (O'Leary et al., 2015). The text messages said, "we show [first name] is due for a [vaccine OR checkup or vaccine and checkup]. REPLY 1 for us to call you to schedule, 2 if you will call us, or STOP to end messages [practice name and phone number]" (O'Leary et al., 2015, p. 4). If the parents replied with a one or two, then they would be scheduled to get a vaccination. The results showed a significant increase in all vaccinations except for the meningococcal conjugate vaccine booster shot (O'Leary et al., 2015).

The use of personalized text messages was the focus of a study on medication adherence (Prayaga et al., 2018). Between 50% to 60% of chronically ill patients do not take their medications as prescribed, and the cost of medication related hospitalizations is over $100 billion each year (Prayaga et al., 2018). Some of the main driving factors that lead to nonadherence include side effects, price of the drug, lack of perceived benefits, and forgetting to refill a prescription. Digital health has historically had a hard time accessing the elderly, even those who are considered tech-savvy (Prayaga et al., 2018). Seventy percent of the individuals who were surveyed believe that it is worthwhile to refill prescriptions electronically, but only 46% said they could do it. Less than 35% of the seniors who were surveyed reported having a smartphone, but 78% of them had a cell phone that was capable of texting (Prayaga et al., 2018).

The study (Prayaga et al., 2018) consisted of 88,340 California Medicare adherent and nonadherent patients. The control group was 76,068 individuals who received only usual care including phone calls, the intervention group consisted of 12,272 adults who received text messages that allowed them to digitally renew their prescription (Prayaga et al., 2018). The intervention group got a series of text messages that reminded them they were due for a refill, a request for their date of birth to verify their identity, and then the choice of actionable options related to their medication. These options included refilling their prescription, speaking to pharmacists about side effects, stating that the medication was not helping them, having other

concerns that would require follow-up, or opting out. Upon receiving a response to refill the medication, the pharmacist would inform the patient when it would be ready for pick up (Prayaga et al., 2018).

The refill dialogue text messages went out at 10:00 AM every Wednesday and Thursday (Prayaga et al., 2018). If the patient did not respond to the original text message, they would receive a reminder text message two-hours later, and then another 24 hours from the original message (Prayaga et al., 2018). Refill activity spiked immediately after the initial message was sent out at hour zero, the two-hour reminder, and the 24-hour reminder as shown by Figure 4. The intervention group had medication refill rates 14.07% higher than the usual care control group, which was statistically significant. Feedback from patients was very favorable with five patients expressing positive feedback for everyone providing negative feedback (Prayaga et al., 2018).
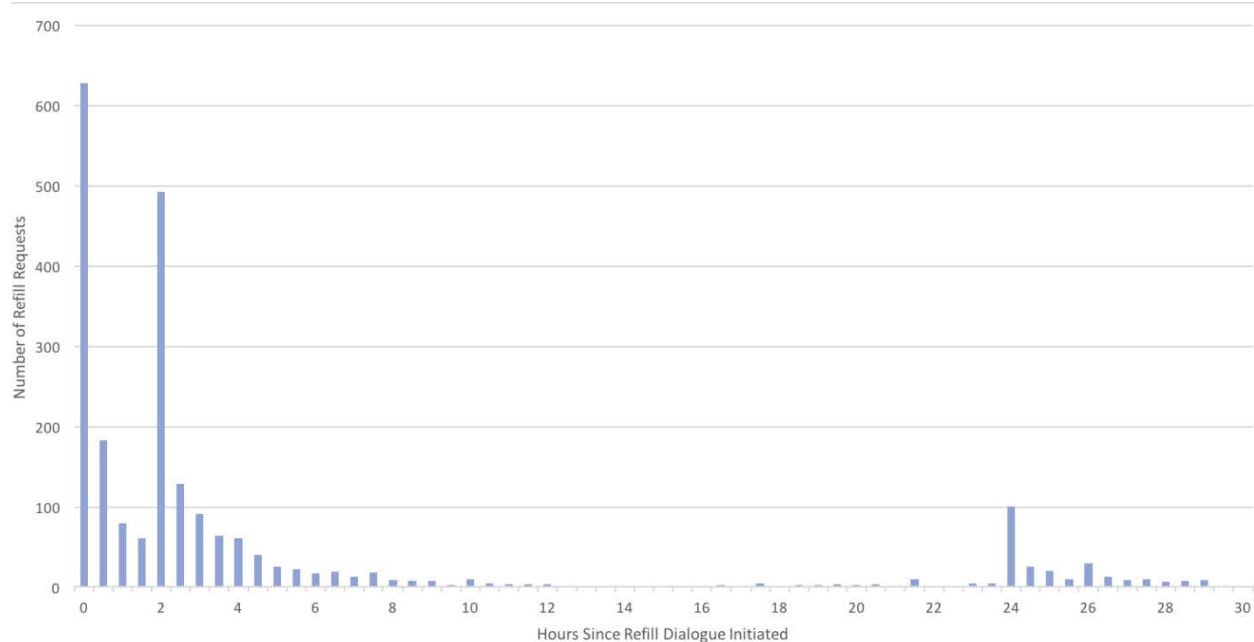
(Open Access, Prayaga et al., 2018)

Figure 4. Refill requests by hour from initial reminder

2.5.3   Unsuccessful Methods

Text message campaigns have many benefits, but there can be some drawbacks as well that one may not see in other channels of communication. Raven, Kotchko, and Gould (2013) state that text messages are ineffective at changing behavior when the messages are soft appeals dissuading a behavior. Texts may be ineffective when stressing that there is a personal relationship between the individual and the sender, if the individual does not perceive the relationship to exist. Text messages are not effective when stating that the overuse of a resource is taking it away from those who need it. Likewise, stating that an individual's behavior is wasting tax payer dollars does not lead to an effective text message. Text messages suggesting that members may be overreacting to non-emergent issues or suggesting that the EDs are for life threatening conditions and lifesaving

care does not have an impact. Some studies have found that the use of please and thank you makes little difference (Doh & Raof, 2017).

Even if every person's cell phone number is accurately recorded, some individuals will not get the text messages. There is a fail rate associated with text messages.

3.0   METHODS

3.1   SEARCH LOG AND INCLUSION STRATEGY

The method for obtaining literature to complete this thesis is as follows. The search engines Google Scholar and PubMed were used.

Results were limited to being within the time frame of the last five years, or 2013-2019. The method of selecting literature was to include was to read the title, followed by abstract, and then the full article. Articles were eliminated if they did not relate to the topic of interest. An inclusion criterion that further filtered the articles is that the geographical location of the article must be in either the United States or Canada. The term ED was used interchangeably with "emergency" in order to account for the term "emergency room" and to differentiate from education. The searches were broad to reduce the chance of missing a major topic. If the focus of the article was on ED patients that were texting while driving, it was not included. The most relevant or best match feature was used to increase chances of a relevant article appearing first. 163 articles title's, 25 abstracts, and 18 articles were read. Four articles were included. See Table 9.

Table 9. Search log by database, search terms, and results

Database	Search Terms	Results
Google Scholar	ED AND texting AND campaign AND Diversion	2,210
Google Scholar	Emergency AND texting AND campaign AND Diversion	1,580
Google Scholar	ED AND texting AND campaign AND Diversion -Driving	849
Google Scholar	Emergency AND texting AND campaign AND Diversion -Driving	482
PubMed	ED AND texting AND campaign AND Diversion	0
PubMed	ED AND texting AND Diversion	3
PubMed	Emergency AND texting AND Diversion	4
PubMed	(((((texting) AND text message) AND SMS)) AND (((ED) OR ER) OR Emergency)	223

4.0   RESULTS

4.1   ED TEXT MESSAGE DIVERSION

There are many preventable reasons why individuals often visit the ED. As discussed previously, one of those is that individuals do not attend follow-up appointments after being treated in the ED (Arora et al., 2015). Adherence with follow-ups may improve health outcomes and reduce the likelihood that person ends up back in the ED for the same reason of the original visit (Arora et al., 2015). Missed appointments result in inefficiencies within the health care system, delays in treatment, and an increased use of the ED which is a more expensive option (Arora et al., 2015). The main causes that individuals have for missing a follow-up appointment is that there was confusion regarding the date, time, or location of a scheduled appointment, which leads to the appointment being forgotten (Arora et al., 2015).

Strategies such as case management, mailed reminders, and phone calls have improved attendance rates at follow-up appointments, but these are expensive and laborious. To deliver an intervention to populations that revisit the ED, the solution must be sustainable, scalable, effective, cheap, technologically simple, and acceptable by both health care providers that are delivering the intervention and the patients receiving the intervention (Arora et al., 2015). Text messages meet the qualifications of being simple, cheap, and effective. Providing reminders of appointments potentially addresses the most important factors related to appointment adherence (Arora et al., 2015). Arora et al.'s (2015) study took place at an ED in Los Angeles, California and randomized participants into a text message intervention arm and a usual care control group arm (Arora et al., 2015). Patients received a text message seven days, three days, and 24 hours before their scheduled

follow-up appointment These texts contained the time, date, location, and the clinic's name. Each text message that was sent was personalized to the corresponding patient. An example would be "USC: Hi Jane, please remember you have an appointment tomorrow Feb 10 at 2 pm with general medicine at 1200 State Street. Please arrive 15 minutes early." (Arora et al., 2015, p. 32-33).

The baseline rate of missed appointments was roughly 30% (Arora et al., 2015). Arora et al. (2015) predicted that there would be an increased attendance of 10%, but the increase was only 8.1%. The rate of the intervention group's rate of attendance was 70.2% and the control group was 62.1%. The text message campaign focusing on reducing forgetfulness did increase attendance for follow-up appointments after an ED visit, but the results were not as successful as was desired (Arora et al., 2015).

McInnes et al. (2014) launched a text message based intervention that was aimed at appointment adherence among the homeless to prevent the utilization of the ED. The homeless use the ED three times more often and are hospitalized four times more often than the general population, so they are a very at-risk population (McInnes et al., 2014). Despite substantial outreach efforts, the rate of the homeless missing appointments is high. Like the previously mentioned intervention, this one aimed at reducing forgetfulness among participants (McInnes et al., 2014).

Two messages were sent five and two days before their appointment. The messages said "Remember: Friday May 24 at 8:30 AM you have an appointment at Providence VA. If you have questions or to cancel call 401-273-xxxx. Thanks" (McInnes et al., 2014, p. S589). The participants did not mind that the messages did not state which doctor or clinic was to be used. In fact, since the messages were not personalized, they had no concerns about their confidential information being read by others (McInnes et al., 2014).

Comparing the results of the intervention to the baseline results, McInnes et al. (2014) found that there were positive trends in nearly all the primary and secondary outcomes. The number of cancelled appointments, the primary outcome, was reduced by 16 which is a 30% change. The secondary outcomes including no-shows, emergency room (ER) visits, and hospitalizations were all impacted by the intervention (see Table 10). It was calculated that by preventing the annual rate of 2.08 cancellations per year, 1.95 no-shows, and 3.25 ED visits, the savings would be between the wide range of $2.8 million to $116.2 million per year (McInnes et al., 2014).

Table 10. Utilization change pre- versus postintervention

Result	Preintervention Frequency	Postintervention Frequency	Cost Associated with Result
Patient Appointment Cancellation	53	37	$198
Visit No-shows	31	25	$198
ED Visits	15	5	$791
Hospitalizations	3	0	Varies

(Adapted McInnes et al., 2014)

One study (Arora, Peters, Burner, Lam & Menchine, 2013) focused on positively impacting patients via text message. This study had 128 adults with varying levels of poorly controlled diabetes who attended the Los Angeles County Hospital of the University of Southern California's ED. Sixty-four patients were placed into the text message intervention arm and the remaining 64 were placed into a control arm that is usual care. The participants received two text messages each day at 9 AM and 5 PM for six-months. The text messages contained information that targeted knowledge gaps and areas of specific interest such as symptoms of low blood glucose and health

food choices (Arora et al., 2013). The text messages were divided into four categories with varying frequencies (see Table 11).

Table 11. TExT-MED messages and frequency

Type of Text Message	Text Message Details	Frequency of Text Message
Educational or motivational	Health education messages targeting treating diabetes, watching for symptoms of adverse health outcomes, and social support	1 per day
Medication reminders	A message to increase medication adherence	3 per week
Health living challenges	Provided patients with a goal for the day	2 per week
Trivia	Questions about diabetes. The answer was sent out an hour after the initial trivia message	2 per week

(Adapted Arora et al., 2013)

The primary result of the study's text message campaign, the reduction of decreasing blood glucose by 1.05%, was not significant (Arora et al., 2013). One significant change was the number of patients who used emergency care. Only 35.9% of the intervention group used emergency care compared to the 51.6% of the control group (Arora et al., 2013).

Another study (Raven et al., 2013) was aimed at preventing individuals from attending the ED while dealing with nonurgent conditions This intervention used 14 different messages to encourage members to contact their PCP before making an ED visit (Raven et al., 2013). Each text message was analyzed to determine which one had the highest probability of influencing a UPMC member to visit the PCP prior to an ED visit (Raven et al., 2013). The study found that 72% of frequent users could be influenced to contact their PCP before their next ED visit. Only one message showed promise in changing ED behaviors, the first message in Table 12.

Table 12. Text message likelihood to visit PCP

Text Message Content	Change in likelihood to Visit PCP
Waiting in line at the ED in the middle of the night is a hassle—especially if you're not sure you even need to be there. Use your PCP's 24-hour on-call number to speak to your doctor or one of their colleagues and find out if you really need to go to the ED. It will save you time and stress.	0.29
We know that sometimes you or your child needs medical advice right away. That's why you can call your PCP 24 hours a day and get good advice about whether you need to go to the ED or whether you should go to your PCP as soon as you can.	0.15
Your PCP knows you and your family best, and they can often address your problems more quickly and completely than the ED can since they know you and your medical history better. Your doctor cares about your family and can give you the close personal care you and your family deserve.	0.13
For routine checkups, colds, and minor problems, your PCP's office has the proper medical equipment and can send you for tests at other locations when you need them. We know it's sometimes easier to go to the ED where everything is in 1 place, but rest assured your doctor will only send you for testing when absolutely necessary and you can usually get the tests you need that same day or the next day.	0.05
Your doctor is working to improve wait times by implementing a new computer system that will lessen the time you have to fill out paperwork and get you in to see your doctor right away. Paperwork is a headache, and now with this new system, you'll only need to provide your name and insurance card.	0.03
Everyone knows that the ED is for emergencies, and using it for routine checkups, colds, and other minor problems keeps the ED crowded, making it harder for people with severe injuries and illnesses to get the life-saving care they need. Seeing your PCP for non-emergency care makes sure that those who need life-saving treatment will never have to wait.	0.01
When it comes to your family and your children, wouldn't you want to take your loved ones to be seen by someone you and your family are comfortable with? If your child is sick or in pain, it's always better to go see a familiar face rather than a stranger.	0.01
Your PCP is available by phone when you need your medical questions answered in a timely manner or are unclear about whether to come in for a visit or not. Since your doctor knows you and your family best, it's a good idea to speak to them first before heading to the ED.	0.00
Your PCP knows you best. Call them the next time you're thinking of going to the ED to find out if they can get you the help you need quicker, without having to spend all night waiting in line at the ED.	0.00

Table 12 Continued		
Message	Rank	B-incr. likelihood to Visit PCP
Your doctor knows you best, and everyone knows that when it comes to caring for you and your family it's best to have someone who knows you, and who you know too. Seeing your PCP is the smart choice for your family.	10	0.00
We all know that it's sometimes easier to just go to the ED when you or your child needs to see a doctor rather than wait for an appointment with your PCP, but the truth is, seeing your PCP is often the smarter choice. You get more personal attention as you're not seeing him in a busy ED, and you can also take the time to ask all the questions you need to make sure you understand what's going on.	11	-0.01
When you or your child is sick, your PCP knows what to do because they know you and your family's medical history. Before you rush off to the ED to get examined by someone that has never met you or your child, call your doctor first to make sure it isn't something they can handle sooner.	12	-0.01
When it comes to you and your children, you want to make sure that they receive the best, most caring treatment when they're ill. Who better to address your family's medical needs than your PCP?	13	-0.07
There are always false alarms, and it can be better to call our 24-hour hotline before you rush off to the ED, just to be sure. Our trained nurses and physicians can tell you within a matter of minutes whether you have an emergency on your hands, or something that can wait until morning.	14	-0.13

(Adapted Raven et al., 2013)

5.0   DESCRIPTION OF UPMC ED DIVERSION

UPMC is based out of Pittsburgh, Pennsylvania. UPMC is both a payer and a provider meaning that they offer health insurance and they have hospitals. During the summer of 2017, UPMC's Population Health and Engagement Optimization (PHEO) worked on creating its own text message based ED diversion campaign. Beginning with research by Dr. Nick DeGregorio, PHEO staff conducted an in-depth literature review focusing on barriers that prevent people from using their PCP and the drivers that encourage people to use the ED rather than other services. This literature review showed that people use the ED because they believe it is more convenient than primary or urgent care, they did not follow up their emergency room visit with their PCP and ended up back for the same cause, or that they could not get to their doctor's appointment due to transportation, forgetfulness, or other minor causes.

To address the needs of these individuals, PHEO created 150 text messages (Appendix B). PHEO worked with the management at UPMC, and decided to focus on five main categories of messages: UPMC Anywhere Care, the UPMC 24/7 Nurse Line, transportation, seeing a PCP, and follow-up appointments. UPMC Anywhere Care is an alternative to an ED visit because it allows a member to video chat with a doctor in real time. Similarly, the 24/7 Nurse Line is an option for members to call a nurse to discuss medical issues any time of the day. Seeing a PCP was finding a nearby PCP or how convenient it can be to see a PCP rather than go to the ED. Transportation was addressing the geographical barriers one might face making the ED more convenient via the Medical Assistance Transportation Program. Follow-up stressed the importance of following up any ED visit with a PCP to prevent a revisit.

Targets for the text messages are 2,600 UPMC members with Medicaid as their primary insurance and 479 UPMC members within the special needs program (SNP), who had a TracFone. TracFones are cell phones that are provided by UPMC to some of their members. By accepting a TracFone from UPMC, a member gives UPMC consent to enroll them into any text message campaign. The 2,600 members were assigned randomly to three different groups of text message topics. One study arm consisted of 866 members getting text messages about Anywhere Care and the UPMC 24/7 Nurse Line. The second arm consisted of 866 members getting text messages about their PCP, transportation, and follow-up appointments. The third arm consisted of 866 members getting all five categories of messages. Each arm was subdivided into two groups that would receive messages at different frequencies. The literature review did not reveal a recommended frequency, so PHEO decided to randomly assign members to one group that receives text messages twice a week and the other group four times a week. Because of the small number in the SNP group, those individuals would get all five categories three times per week. Figure 4 in Appendix A illustrates the division of the UPMC members into the arms and groups.

Researching the members that had TracFones showed that relatively few of them were frequent ED users. Only 1,508 members had been to the ED three times or more within the last 12 months (see Table 13). This changed the goals of the intervention from only diverting individuals away from the ED, to including encouragement of behavior changes that would eventually lead to not going to the ED and to measure their knowledge from the beginning of the campaign compared to the end.

Table 13. TracFone Members and UPMC Resource Utilization

| Last 12 months | | ED Visits | Utilization per 1000 | PCP | | | | SPEC | | |
Number of ED Visits	Count of Members with TracFone			PCP Members	PCP Visits	PCP Services	Service Utilization per 1000	SPEC Members	SPEC Visits	Utilization per 1000
1	4,037	4,037	614.5	2,132	7,601	36,507	5,556.7	2,018	10,283	1,565.2
2	1,556	3,112	473.7	875	3,437	15,130	2,302.9	895	4,873	741.7
3	663	1,989	302.7	411	1,984	8,974	1,365.9	409	2,728	415.2
4	335	1,340	204.0	224	1,160	4,482	682.2	230	1,505	229.1
5	197	985	149.9	140	801	3,459	526.5	143	1,044	158.9
6+	313	2,661	405.0	238	1,502	6,069	923.8	249	2,213	336.8

| Urgent Care | | | Retail Clinic | | | Anywhere Care | | |
Urgent Care Members	Urgent Care Visits	Utilization per 1000	Retail Clinic Members	Retail Clinic Visits	Utilization per 1000	Anywhere Care Members	Anywhere Care Visits	Utilization per 1000
564	943	143.5	124	151	23.0	0	0	0.0
233	393	59.8	40	50	7.6	0	0	0.0
109	198	30.1	38	43	6.5	0	0	0.0
57	109	16.6	12	15	2.3	0	0	0.0
27	54	8.2	6	7	1.1	0	0	0.0
72	184	28.0	13	15	2.3	0	0	0.0

Currently no members with a TracFone have used UPMC Anywhere Care. The Nurse Line and transportation can be measured by cross referencing the member's information against the people that utilize these resources. The gain of knowledge about these resources including a PCP and follow-up will be measured via a pre-test post-test that will be texted to the members at the beginning of the campaign as well as the end. The final outcome measure will be the amount of people that opt-out of the campaign. This can be measured by counting the number of people that text the keyword for opting out. While not expecting a significant decrease in the number of individuals that visit the ED due to the low number of frequent users with TracFones, the rate of ED utilization will still be tracked to determine if this campaign has any effect.

The ED diversion campaign first focused on reducing ED use with perceived acuity and convenience of accessing care. By getting a medical professional's opinion about whether a person's situation deems an ED visit necessary, the number of ED visits could decrease. Without trying to reinvent the wheel, UPMC already has two resources that can allow a member to quickly communicate with either a doctor or a nurse. The 24/7 Nurse Line and UPMC Anywhere Care both allow an individual to speak with a medical professional anywhere, anytime. This ease of access makes using the ED less convenient than using these digital resources; in fact, a direct comparison between these resources and the ED was mentioned in some of the text messages. One text message states "Would you rather wait 30 minutes or more for a doctor in the ER or 6 minutes without leaving home? Download the UPMC Anywhere Care app today."

Triage is an excellent way to either educate the member on the best course of action or refer them to the ED. By speaking with a nurse, the member can swiftly get medical advice on if their current situation is dire enough to require emergency care. If members do in fact utilize the UPMC 24/7 Nurse Line while facing a medical dilemma, it should reduce the number of members

who go to the ED. Another focus of the text message campaign was to get members to enroll in UPMC Anywhere Care, and then instruct them how to use it. By getting a physician's advice before visiting the ED, PHEO was hopeful that there would be reduction like Sturm et al.'s (2014) 77% decrease in referral rates comparing doctors to nurses. However, if all members that are uncertain if they were facing an emergency or not were referred to the ED by either a nurse or physician, the rates of ED use would likely drop.

The next focus of the campaign was to reduce barriers for individuals accessing primary care. One the themes was finding a member a PCP or telling that member to contact them with health questions. The next was transportation because as Capp et al. (2014) state, most of the people who say transportation is an issue live within walking distance of the ED. Medicaid provides transportation through the Medical Assistance Transportation Program. Members can call the provided phone number and transportation to and from their doctor's appointment via bus, car, or a lift equipped van for those with disabilities. By providing free rides, PHEO hopes to alleviate the geographic barriers behind primary care access.

Follow-up with a doctor is the final theme of the text message campaign. Following up with a PCP after an ED visit is crucial because of a revisit rate of roughly 20% after 30 days (Duseja et al., 2015). PHEO created text messages that told members to talk to their PCP about any ED trip. By following up with a PCP after an ED visit, the rate of revisits should drop. Some of the text messages also put convenience into the follow up text messages, (e.g. "Visiting your Primary Care Practitioner after an ER visit can help you recover, preventing another ER visit, and save you time."

Currently, the text messages are being reviewed for approval. A list of all the approved text messages as of April 4th, 2018 is in Appendix B.

6.0   CONCLUSION

EDs are being overused and misused, and this leads to many issues including crowding and financial issues. Crowding can impact the flow of patients to other hospitals in the region with AD, spread the burden of overuse, and have health impacts on patients who need time-sensitive treatments. Financially, the ED is not a cost-effective place to get primary care treatment as many frequent users utilize it. The ED costs roughly 5% of the entire national health expenditure which is roughly $131 to $136 billion annually (Lee et al., 2013).

The main reasons for overuse can be summed up into three categories. The first category is that people perceive their current situation to require emergency care when often it could be treated in a primary care or urgent care setting. Some people face barriers accessing primary care including geographic distance from primary care settings, convenience, and the PCP's hours of operation. Finally, a lot of revisits add to the overuse issue that is facing ED.

Different interventions aim to divert individuals away from the ED. Some of these are successful and others are not. Some of the studies were reactive to a crowded ED and others proactive. It is not just the number of interventions that are conducted, but the effectiveness of that intervention that matters (Warner et al., 2015). Interventions that are focused on diverting frequent users to primary care settings have historically been effective (Moe et al., 2017).

Text messages are an exciting channel that are effective and cheap. There are certain rules to using text messages such as obtaining consent and providing participants a way to opt out of the campaign. Multiple studies have shown that they are an effective channel to communicate. It is best to have short, direct message that people can act on. One unsuccessful method is to tell the participants that the company behind the intervention cares for them (Glaseroff, 2011).

Texting to reduce the number of individuals using the ED has shown remarkable promise. Multiple studies have been done and were able to increase the number of individuals who attend primary care or reduce the number of individuals who go to the ED without being referred by medical staff. Some studies focused on reminder messages that would try to persuade the patient to go to their appointment as forgetfulness is a major cause of missed appointments (McInnes et al., 2014). These studies had some form of success, significant or not, which demonstrates that texting can be an effective channel to divert people from the ED.

UPMC created an ED diversion text message program that was originally aimed at preventing individuals from using the ED and the primary outcome was a reduction of ED use. Upon further inspection of the target population, it was decided that there were not enough frequent users among the group to really see a large reduction in ED visits. The focus was changed to increase the use of resources that would relieve some of the barriers that are frequently faced. These resources include the UPMC 24/7 Nurse Line, UPMC Anywhere Care, UPMC PCP's for both primary care and following up after an ED visit, and the Medical Assistance Transportation Program. The campaign should be launching soon, as it is currently in the lasts steps of being reviewed for approval.

6.1   LIMITATIONS

A major limitation is that this intervention is based at an individual level. Some of the drivers of ED overuse are at a systemic level, so these cannot be solved but only partially alleviated by using the resources that UPMC provides. Therefore, this intervention may not reduce the rate of ED use that could result from an intervention that targets these systemic level issues.
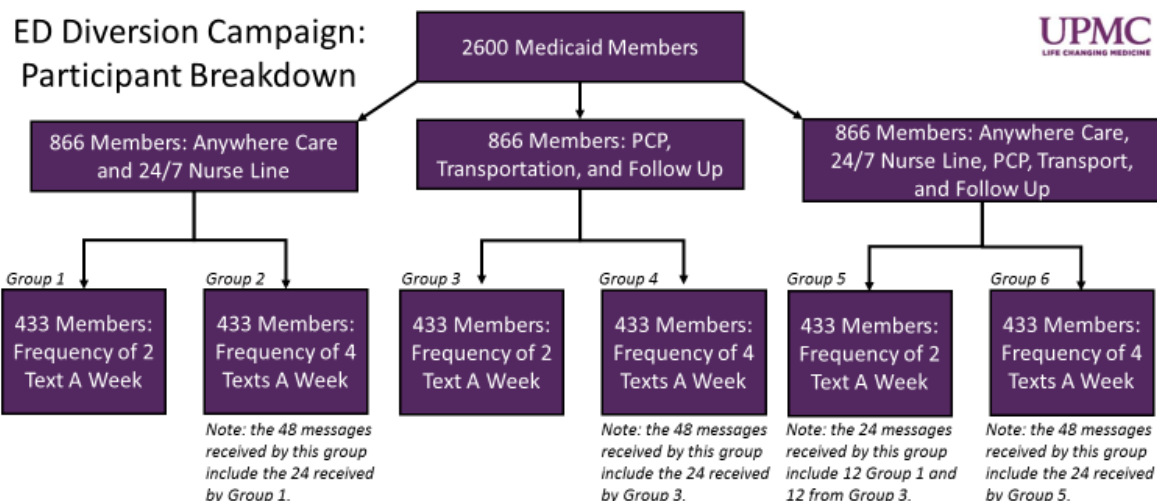
57

The participants were not involved in the design of this intervention. Usually involving the participants in the design of the study has many benefits including the intervention is tailored more to the target population, there is more buy in, and certain barriers identified from the literature may not be present. On the other hand, there may be barriers that are unique to the Pittsburgh region that prevent individuals from accessing other sources of care.

The context for individuals making decisions to go to the ED can be complex. The reasons that someone may choose to go to the ED could be based on socioeconomic, cultural, or limitation factors. It can be difficult to properly target the motivation that causes an ED visit when it is not necessary. This intervention tried to take this into account, but may not be accurate of what is present within the target population.
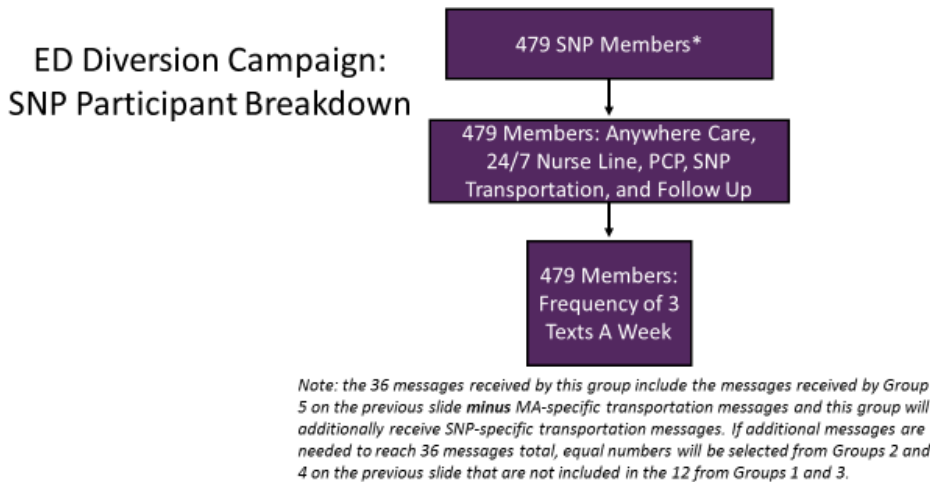
6.2   CLOSING STATEMENT

Texting is such an exciting channel to use because it can be applied to almost any topic. Texting is cheaper and more effective than many other communication channels. The ED is quite expensive and is not the optimal setting of care for non-emergency conditions. If text message campaigns are successful, funds can be used to support other programs and may shift patterns of care into more optimal models. While texting is an incredible technology, none of this would have been possible without the incredible staff at UPMC that assisted in developing this text message campaign. Steve Jobs once said "technology is nothing. What's important is that you have a faith in people, that they're basically good and smart, and if you give them tools, they'll do wonderful things with them" (Brainy Quotes, n.d).

Figure 5. ED Diversion Campaign Participant Breakdown

APPENDIX B: UPMC TEXT MESSAGE BANK

Type	Message
24/7 Nurse Line General	We get you need medical advice once your Primary Care Practitioner goes home. Call the 24/7 Nurse Line at 1-866-918-1591 with your member ID card handy!
24/7 Nurse Line General	Don't want to waste time at the Emergency Room? Call the 24/7 Nurse Line at 1-866-918-1591 & see if the ER trip is worth it! Please have your Member ID.
24/7 Nurse Line General	Do you have a question about your health? Call the 24/7 Nurse Line at 1-866-918-1591! Have your UPMC for You member ID ready to go.
24/7 Nurse Line General	Have a medical question but your doctor's office is closed? Call the 24/7 Nurse Line at 1-866-918-1591 for an answer! Have your member ID card handy!
24/7 Nurse Line General	Any time, any place, a UPMC nurse can answer your questions. Call the 24/7 Nurse Line at 1-866-918-1591. TTY users should call toll-free 1-866-918-1593.
24/7 Nurse Line General	The 24/7 Nurse Line will answer your question whether it's noon or midnight! Have your member ID ready for the best use of your time! 1-866-918-1591
24/7 Nurse Line General	Did you know that here at UPMC, our nurses are available to take your call 24/7? Call 1-866-918-1591. TTY users should call toll-free 1-866-918-1593.
24/7 Nurse Line General	Have a sick child? Call the 24/7 Nurse Line at 1-866-918-1591! TTY users should call toll-free 1-866-918-1593
24/7 Nurse Line General	Feeling sick? Call a UPMC nurse 24/7 for free! 1-866-918-1591. TTY users should call **toll-free** 1-866-918-1593
24/7 Nurse Line General	Did you know that you can call a UPMC nurse 24/7 with any health concerns? Call 1-866-918-1591. TTY users should call toll free 1-866-918-1593
24/7 Nurse Line General	Sickness doesn't fit into your schedule. That's why the UPMC MyHealth 24/7 Nurse Line is here for you anytime of day or night. Call 1-866-918-1591.
24/7 Nurse Line General	Call a nurse for medical answers 24/7 at 1-866-918-1591. TTY users should call toll-free 1-866-918-1593.

24/7 Nurse Line General	Not sure if you need the Emergency Room? Call the 24/7 Nurse Line at 1-866-918-1591 and ask a nurse! Have your member ID card handy!
24/7 Nurse Line General	Is it after hours and you need health care? Call the UPMC MyHealth 24/7 Nurse Line, at 1-866-918-1591, to speak with a nurse anytime.
24/7 Nurse Line General	Next time you have a health concern, you can talk with a nurse at UPMC 24/7 by calling 1-866-918-1591. TTY users should call toll-free 1-866-918-1593.
24/7 Nurse Line General	Our nurses are ready for your call 24/7! Call the Nurse Line at 1-866-918-1591! TTY users should call toll-free 1-866-918-1593.
24/7 Nurse Line General	Where do you go for care when you're sick? If you aren't sure, call UPMC MyHealth 24/7 Nurse Line at 1-866-918-1591 to learn more.
24/7 Nurse Line General	If you have a health question, call the 24/7 Nurse Line at 1-866-918-1591 to get the answers you need! TTY users should call toll-free 1-866-918-1593
24/7 Nurse Line General	If you ever need medical advice, don't hesitate! The 24/7 Nurse Line is available to you at 1-866-918-1591! Have your member ID ready!
24/7 Nurse Line General	Did your child get hurt/sick? Call the 24/7 Nurse Line and find out the next step! To speed up the process, have your member ID ready! 1-866-918-1591
24/7 Nurse Line General	Not sure what is best for your health? Get your member ID card and call the 24/7 Nurse Line at 1-866-918-1591! They will give you needed health advice!
24/7 Nurse Line General	Getting sick doesn't fit in your schedule. Call the 24/7 Nurse Line at 1-866-918-1591 and figure out whether you need that ER trip!
24/7 Nurse Line General	UPMC MyHealth 24/7 Nurse Line can help you find out where you should get care and answer health questions. Call 1-866-918-1591 for this and more.
24/7 Nurse Line General	Not sure where you should go to get health care? Call the UPMC MyHealth 24/7 Nurse Line at 1-866-918-1591 to get the answers!
Answer--Anywhere Care	B. Use an app. UPMC AnywhereCare lets you see and talk to a UPMC doctor on your computer or mobile device. Enroll at http://bit.ly/2eJ2jbJ.
Answer--Follow Up	C. You leave the ER with a treatment plan. Calling your Primary Care Practitioner can make sure that you are on the right track towards recovering.
Answer--Nurse Line	C. A UPMC nurse. The 24/7 Nurse Line is always there to take calls about any medical worry. Call 1-866-918-1591 TTY users call toll-free 1-866-918-1593

Answer--PCP	B. A Primary Care Practitioner will get to know you and your health concerns. Make a plan with your PCP to stay healthy and avoid health emergencies
Answer--Transportation Enrollment	A. The Transportation Program (MATP) can help you with free travel to doctors' visits. Find contact information here: http://bit.ly/2uHpARO
Anywhere Care Enrollment	Have you heard about UPMC Anywhere Care? You can get health care without leaving home and signing up is easy. http://bit.ly/2eJ2jbJ
Anywhere Care Enrollment	Signing up for UPMC AnywhereCare is easy! Just go to this link http://bit.ly/2eJ2jbJ, and click "Sign Up Now" to get started.
Anywhere Care Enrollment	Got a cold? You can stay in bed and get health care. UPMC AnywhereCare app gives you access to health care providers right from your mobile phone.
Anywhere Care Enrollment	Please sign up for UPMC Anywhere Care so you can video chat a doctor. Don't wait until you're sick to sign up! http://bit.ly/2eJ2jbJ
Anywhere Care Enrollment	Want to video chat with a provider to get health care? With UPMC Anywhere Care you can! Sign up here! http://bit.ly/2eJ2jbJ
Anywhere Care General	Not sure if your computer can run UPMC AnywhereCare? Figure out if you're ready with "Test My Computer" so there is no waiting while you're sick!
Anywhere Care General	UPMC AnywhereCare is a quick way to get care for colds, coughs, rashes and more. It usually takes less than 10 minutes!
Anywhere Care General	All you need for UPMC AnywhereCare is to create an account, and a device with a camera such as a webcam or mobile device's camera http://bit.ly/2eJ2jbJ
Anywhere Care General	Too busy to go to the doctor? Wish you could bring the doctor to you? With UPMC Anywhere Care you can get health care from home.
Anywhere Care General	Skip the waiting room with UPMC AnywhereCare. Next time you're sick, get care for your non-emergency symptoms by visiting http://bit.ly/2hL6ILM
Anywhere Care General	What do sore throats, pink eye and colds all have in common? You can get health care without leaving home! Visit http://bit.ly/2hL6ILM today.
Anywhere Care General	Would you rather wait 30 minutes or more for a doctor in the ER or 6 minutes without leaving home? Download the UPMC AnywhereCare app today.
Anywhere Care General	Got a cold? You can stay in bed and get health care. UPMC AnywhereCare app gives you access to health care providers right from your mobile phone.

Anywhere Care General	Sore throat, pink eye, urinary tract infections, and colds can be treated right from your phone with UPMC AnywhereCare! http://bit.ly/2hL6ILM
Anywhere Care General	Are you going to go to the ER for a cold? Why? UPMC AnywhereCare is quick and you can stay in your house! Install the app or go to http://bit.ly/2ui7xR4
Anywhere Care General	UPMC AnywhereCare is a helpful app that allows you to see a UPMC doctor on your computer or mobile device.
Anywhere Care General	UPMC AnywhereCare will tell you how many patients are ahead of you with a message below the provider's photo.
Anywhere Care General	Need health care after hours? UPMC AnywhereCare providers are here for you right from your smartphone, tablet, or computer – 24/7! http://bit.ly/2hL6ILM
Anywhere Care General	Want to see a health care provider from the comfort of your own home? Click "Sign Up Now" to register for UPMC AnywhereCare.
Anywhere Care General	Any prescriptions that are recommended by a UPMC AnywhereCare provider can be picked up at a participating pharmacy of your choice.
Anywhere Care General	Got a cold? You can see a doctor, get a prescription, and get better without leaving home. Visit http://bit.ly/2hL6ILM for more information.
Anywhere Care General	Consult a health care provider online! UPMC AnywhereCare brings health care to you with video chat on your mobile device, tablet or computer.
Anywhere Care General	Talk face to face with a UPMC provider right from your smartphone with UPMC AnywhereCare. Download the app from **the** Google Play or the iTunes store.
Anywhere Care General	UPMC AnywhereCare is an app that allows you to video chat with a health care provider. It's perfect for a sinus infection or sore throat.
Anywhere Care General	You can use UPMC AnywhereCare if you are an adult or if your child is 3-17 years old!
Anywhere Care General	UPMC Anywhere care can only be used only when you are in Pennsylvania. If you are outside of the state, it is not available.
Follow-Up General	If you have recently been to the ER, contact your Primary Care Practitioner and let them know what happened.
Follow-Up General	For the best health results, be sure to call your Primary Care Practitioner after an ER trip! They will make sure you are on track to recovery.
Follow-Up General	The next step to recovery after an ER trip is to call your Primary Care Practitioner. They will make sure that you recover quickly.
Follow-Up General	After an emergency, the last thing you want is to be back in the ER. Call your Primary Care Practitioner to fully recover, preventing a second ER visit.

Follow-Up General	Your Primary Care Practitioner needs to know if you went the ER. Give them a call after your ER visit so that you can get healthy again.
Follow-Up General	Visiting your Primary Care Practitioner after an ER visit can help you recover, preventing another ER visit, and save you time.
Follow-Up General	The ER may give you a plan to treat a condition, but your Primary Care Practitioner should be the one who makes sure the plan is the best it can be.
Follow-Up General	If you do not recover from the problem that sent you to the ER, you might be right back in the ER later. Call your Primary Care Practitioner for care
Follow-Up General	Sometimes an ER's treatment plan won't be exactly what you need. Call your Primary Care Practitioner to confirm you're on the right track.
Follow-Up General	Did you know that something as simple as calling your Primary Care Practitioner after an ER trip leads to a better recovery? Give them a call.
Follow-Up General	Are you forgetting or too busy to follow your ER treatment plan? Call your Primary Care Practitioner for help in recovery.
Follow-Up General	Want to check if your treatment plan is going well? After a trip to the ER, call your Primary Care Practitioner.
Follow-Up General	Some medical conditions require a long treatment to be better managed, so make sure to contact your Primary Care Practitioner after an ER visit.
Follow-Up General	After an ER visit, contacting your Primary Care Practitioner is important so that you can continue to get treatment if needed.
Follow-Up General	No one likes being sick or hurt. If you went to the ER, call your Primary Care Practitioner so you can get back to being healthy. They can help you.
Follow-Up General	It can take a while to recover from an ER trip. Check in with your Primary Care Practitioner to make sure that you're on track.
PCP Enrollment	Do you know who your Primary Care Practitioner is? Find out here: 1-800-286-4242, TTY users should call toll-free 1-800-361-2629!
PCP Enrollment	Did you know that you have a Primary Care Practitioner for your next appointment? Call 1-800-286-4242 to find out who.
PCP Enrollment Follow up	TTY users should call toll-free 1-800-361-2629.
PCP General	There is a much shorter wait at your Primary Care Practitioner office compared to the Emergency Department and they know your health history.

PCP General	You're at your healthiest getting preventative care. Go see your Primary Care Practitioner and start living healthy today!
PCP General	Next time you are sick, schedule an appointment with your Primary Care Practitioner!
PCP General	Have you met your Primary Care Practitioner yet? We can help you find a way to and from any appointment you schedule with them.
PCP General	People who are more engaged with medical services have better health outcomes. Go see your Primary Care Practitioner and become healthier!
PCP General	One reason individuals miss their Primary Care Practitioner appointment is they forget about it. Don't be one of them, set a calendar reminder on your phone!
PCP General	Even if you consider yourself healthy you should see a Primary Care Practitioner regularly so they can catch disease before they show symptoms.
PCP General	When is your next Primary Care appointment? Forgot? Call UPMC For You at 1-800-286-4242 and find out! TTY users should call toll-free 1-800-361-2629
PCP General	Are you sick? Go see your Primary Care Practitioner and skip the wait of the ER!
PCP General	Besides true emergencies, your Primary Care Practitioner can best provide for all your care needs. Please see your PCP if it's not a true emergency!
PCP General	Good health isn't about living longer but having a better quality of life as you age. See your Primary Care Practitioner, start living healthier today!
PCP General	You only live once, so make sure you are healthy. Your Primary Care Practitioner is only a call away!
PCP General	Your Primary Care Practitioner is waiting, call UPMC For You's Health Care Concierge Team to schedule a hassle free appointment!
PCP General	While the ER may seem convenient, it actually takes longer to get the same treatment compared to seeing your Primary Care Practitioner.
Quiz Intro--**Anywhere Care**	Up for a CHALLENGE? See if you can answer this question about quick ways to access medical care.
Quiz Intro--**Follow Up**	Up for a CHALLENGE? See if you can answer this question about the best way to regain your health after a visit to the emergency room (ER)
Quiz Intro--**Nurse Line**	Up for a CHALLENGE? What do you know about ways to get help for your medical concerns? See if you can answer the following question.
Quiz Intro--**PCP**	Up for a CHALLENGE? See if you can answer this question about the best medical care

Quiz Intro-- **Transportation Enrollment for MA**	Up for a CHALLENGE? Answer this question about what to do when you don't have transportation to get to doctors' appointments.
Quiz--Anywhere Care	What is the fastest way to get health care for a sinus infection, cough, or other common condition? A. Go to the ER B. Use an app C. Call your PCP
Quiz--Follow Up	What's the best thing to do after you've been treated at the ER A. Follow the ER discharge plan B. Call your Primary Care Practitioner C. Both A and C
Quiz--Nurse Line	Who can you talk to <u>immediately</u> on an evening or weekend to get expert advice about a medical concern? A. Your PCP B. A doctor in the ER C. A UPMC nurse
Quiz--PCP	What is the best kind of doctor to see to help you stay healthy day-by-day? A. A heart doctor B. A primary care Practitioner C. An ER doctor
Quiz--Transportation Enrollment	What's the best thing to do if you have no way to get to an appointment? A. Find a way to get there for free B. Don't go C. Call to cancel
Transportation Enrollment	Before you can use the Medical Assistance Transportation Program **(MATP)**, you must sign up. Find more information here - http://bit.ly/2uHpARO
Transportation Enrollment	The Medical Assistance Transportation Program **(MATP)** can help you get to your Primary Care Practitioner. Get your local contact at http://bit.ly/2uHpARO
Transportation Enrollment	Have you set up your Medical Assistance Transportation Program application? Find your local contact at http://bit.ly/2uHpARO
Transportation Enrollment	You can get paid for the gas used going to the Primary Care Practitioner. Visit the Medical Assistance Transportation Program http://bit.ly/2uHpARO

Transportation General	Get your gas paid for going to the Primary Care Practitioner. The Medical Assistance Transportation Program **(MATP)** will cover it. http://bit.ly/2uHpAR
Transportation General	Taking the bus to your Primary Care Practitioner? The Medical Assistance Transportation Program **(MATP)** can help! http://bit.ly/2uHpARO
Transportation General	If you're physically disabled, the Medical Assistance Transportation Program can get a van accessible for your needs! More here http://bit.ly/2uHpARO
Transportation General	Let the Medical Assistance Transportation Program pay for your car's gas so you can get to your next Primary Care appointment http://bit.ly/2uHpARO
Transportation General	If you do not have access to public transportation, the Medical Assistance Transportation Program will provide a ride including a lift equipped vans.
Transportation General	Click here to find out more about getting reimbursed for mileage via the Medical Assistance Transportation Program http://bit.ly/2uHpARO
Transportation General	Have an appointment with your Primary Care Practitioner? Get a free ride! Visit the Medical Assistance Transportation Program **(MATP)** bit.ly/2uHpARO

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