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Emergency Department Superusers:
An Analysis of the Highest Frequency Utilizers at an Urban County Hospital

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Abstract

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Often defined as at least 20 visits in a year, high frequency Emergency Department (ED) use accounts for less than one percent of ED patients but more than three percent of visits. Few studies have evaluated ED superuse patterns in a largely urban, county hospital setting. This study evaluated ED superusers at Grady Memorial Hospital, a large urban, public hospital in Atlanta, Georgia. Using the Theory of Planned Behavior, the objectives of this study were to describe the: (1) demographic characteristics of high ED utilizers at Grady in 2011, (2) ED visits of these patients, and (3) factors are associated with the highest number of annual ED visits in this population. Grady's electronic medical record was used to identify patients with at least 20 ED visits from January 1st to December 31st, 2011. Variables identified were patient age, sex, and insurance, and total number of ED visits in 2011, as well as insurance used per visit, mode of arrival, day of visit, triage acuity, chief complaint, ED length of stay (LOS), ED disposition, and hospital LOS if admitted. Frequency percents were calculated for each variable, and ANOVA testing was used to determine what factors were associated with more ED visits. Ninety-five superusers, or just 0.1% of all ED patients, were identified for 2011, accounting for 2,747 visits, or 2.5% of all visits. Superusers were largely male, middle aged, and publicly insured. Half arrived to the ED on their own, while 40% utilized ambulance transport. Patients tended to be mid- to lower acuity at triage, with a large proportion of pain-related and psychiatric complaints. Compared with the general Grady population, these patients had lower rates of admission, shorter hospital LOS, and longer ED LOS. Higher numbers of ED visits were associated with having Medicaid, walking in or using public transportation to get to the ED, low acuity at triage, hospital admission, and psychiatric complaints. Contrary to previous research, more than half of superusers in this study were publicly insured, and admission was associated with more ED visits.

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I. Introduction

Problem Definition

The issue of high emergency department (ED) utilization is rapidly becoming an issue of public health concern. More and more American citizens are choosing to receive care in EDs; from 1996 to 2006, the annual number of ED visits increased from 90 million to 119 million, or by 32 percent, while the number of hospital emergency rooms decreased from 4019 to 3833, reflecting an overall increase in number of visits per ED.[1] Even the recent passage of the Affordable Care Act, which will increase the number of Americans covered by insurance, could potentially overwhelm ED resources, as millions of Americans who have insurance but cannot obtain timely primary care appointments will seek care in the only medical facility that cannot turn them away. In order to allocate ED resources to the sickest patients who cannot effectively be cared for elsewhere, efforts should be made to identify those patients who can be safely managed outside the ED.

A recent systematic review of the literature on frequent ED users, widely defined as having four or more ED visits annually, found that this population comprises 4.5% to 8% of all ED patients but accounts for 21% to 28% of visits.[2] In Massachusetts alone, 1% of Massachusetts residents are defined as frequent ED users but are responsible for 18% of ED visits.[3] Efforts to target this population in mitigating the circumstances that result in an ED visit could effectively and efficiently result in copious resources saved for other patients.

Problem Justification

While heavy utilizers of the ED are often identified as a "problem" in United States healthcare, this population represents a medically and socially vulnerable group

that suffers from multiple complex and interdependent problems, including access to primary care and preventive services, inadequate social services, and disjointed service delivery.[4] Effective interventions to target this population starts with a nuanced understanding of their characteristics, the reasons why they seek care from the ED, and their larger socioeconomic constraints.

The highest frequency ED utilizers, who use the ED in excess of twenty times annually, serve as a particularly fertile population to explore interventions with, as curbing their visits can result in significant healthcare savings. This population is also starkly different from patients who use the ED less frequently, so effective interventions among this group should start with careful analyses of their characteristics, risk factors for extremely high ED usage, and their clinical outcomes.

Theoretical Framework

The Theory of Planned Behavior was used to guide this investigation. Proposed by Icek Ajzen, this behavioral theory names behavioral attitudes, subjective norms, and perceived behavioral control as key predictors of individual behavioral intentions and behaviors.[5] In general, the more positive that individuals' evaluations of behavior performance are, the more favorable their perceptions of social normative pressures are, and the greater their perceived behavioral control is in performing the behavior, the more likely they are to carry out a particular behavior.[5] Conversely, patients with higher rates of ED utilization will have poorer evaluations of reducing use, less favorable perceptions of normative pressures to do so, and less perceived behavioral control in decreasing ED visits.

Each construct was used to justify choice of variables available from the medical

record. Individual evaluations of visiting the ED can be affected by the characteristics of hospital visits, including triage acuity, which can affect ED length of stay (LOS), and hospital LOS if admitted. Perceptions of social normative pressures to reduce use can be affected by treatment from healthcare providers and reflected in patient disposition from the ED. Finally, perceived behavioral control in avoiding visits can be influenced by access to medical care, which is reflected by insurance, and ease in visiting the ED, reflected in the day of visit and mode of arrival. Behavioral control can also be affected by patient medical burden, demonstrated by ED chief complaint.

Objectives and Hypotheses

The objectives and corresponding hypotheses of this study were to:

Objective 1: Describe the demographic characteristics of high ED utilizers at Grady Memorial Hospital in 2011.

Hypothesis 1: High utilizers in this population will likely be males of varying age, the largest proportion of whom will be uninsured.

Objective 2: Describe the clinical visits of these patients, particularly their mode of arrival, triage acuity, chief complaints, rates of leaving before being seen, dispositions from the ED, and ED length of stays.

Hypothesis 2: The largest proportions of Grady ED superusers will arrive using ambulance transport, be assigned low triage acuity, present with chief complaints of psychiatric problems or substance abuse, have high rates of leaving without being seen, be discharged from the ED, and will have longer than average lengths of stay.

Objective 3: Determine what clinical factors are associated with the highest number of annual ED visits in this population.

Hypothesis 3: No insurance, arrival by ambulance, low triage acuity, discharge from the ED, and psychiatric or substance abuse chief complaints will be associated with more ED visits.

This information will be used to identify important relationships in this particular population and make recommendations for future interventions to improve patient care.

II. Literature Review

Introduction

A literature review was conducted to determine common characteristics of individuals who frequently use the ED. The literature summarized includes information regarding demographics, risk factors for high ED utilization, medical conditions that frequent users present with and those which they carry diagnoses of at baseline, and overall healthcare usage patterns. This literature review will also summarize high utilizers' perceptions of their ED visits, long-term patterns of high frequency ED usage, and effective and ineffective interventions to contain high utilization. Finally, the limited research on the highest frequency ED users will be summarized, followed by a summary of the literature about high frequency ED utilization and the rationale for this study.

Demographics

Research on high ED utilization has not supported widely held assumptions regarding the demographics and insurance status of high ED utilizers. The ED visit rate for blacks is almost double that of whites in all age groups (79.9%),[1] and African Americans are more likely to be frequent users than other ethnic groups.[6] However, in absolute numbers, sixty percent of high utilizers are white.[7] The age distribution is

bimodal with peaks in the 25 to 44 years and over 65 years groups.[3,8]

Contrary to many stereotypes, about 84% of frequent ED users have health insurance.[7] Although the uninsured make up 15% of frequent users,[6] 60% of frequent users are publicly insured by Medicare or Medicaid.[3] In fact, frequent users are more likely to have public insurance than private insurance or be uninsured.[9,10] However, ED expenses are a small percentage of total healthcare expenses by Medicaid beneficiaries, with monthly ED expenditures for Oregon Medicaid in 2002 representing only 6.8% of total medical expenses, and half of all ED costs attributed to just 3% of enrollees.[11]

Risk factors for High ED Utilization

Frequent users tend to have fragile social networks,[12] and are often single, unemployed, and live alone.[13,14] Frequent ED utilizers are also more likely than less frequent users to be impoverished[7] and homeless.[6] Patients with high rates of ED utilization have more stressors than nonfrequent users, reporting higher stress levels, less social support, and poorer general health; they are also more likely to screen positive for depression.[9] Patients who exhibit ED recidivism for injury-related complaints tend to be younger, of lower socioeconomic status, and are at increased risk of intentional injury.[15] A multivariate logistic regression analysis found that male gender, living alone, and greater numbers of functional problems were independent predictors of repeat ED visits during the three months following the initial visit among patients who were 75 years or older.[16]

Medical Conditions

The most common reason for presenting to the ED among high utilizers is for pain or pain-related conditions,[17] such as abdominal pain, headaches, chest pain, low

back pain, and lower extremity pain.[13] While only 4% of all high frequency use is mental health-related, and 3% is alcohol or drug-related,[17] when compared to non-frequent users, frequent users are more likely to be seen for alcohol-related complaints, exacerbations of chronic conditions such as sickle cell anemia, renal failure, and COPD, and less likely to visit for trauma.[6]

Frequent users tend have significant chronic medical conditions,[18] often qualifying their health as "poor" to "fair."[10] Almost three-fourths of frequent ED users have multiple chronic illnesses,[19] such as diabetes, cardiac, and respiratory conditions.[20] Even studies that have evaluated pediatric ED use have found that children with chronic wheezing disproportionately comprise the subgroup of children classified as frequent ED visitors.[21]

Frequent ED utilizers tend to be sicker than occasional users, with a 51% annual admission rate in a 5-year period,[6] and are six times more likely to have been hospitalized in the preceding three months.[22] Frequent ED users typically employ more ambulance transports and demonstrate greater ED mortality than occasional ED users.[23] One study that examined ED utilization patterns among patients with sickle cell disease found that high utilizers were more severely ill, with lower hematocrits, higher levels of pain, more frequent pain crises, and a lower quality of life.[24]

Patients with moderate to severe asthma are almost four times more likely to be frequent ED users compared to those with mild asthma, and even largely prefer the ED as their source of care, despite having a regular doctor.[25] In addition to severe chronic asthma, one study of adult asthma patients found that nonwhite race and public or no insurance were independent predictors for high ED use.[26]

Even patients suffering from chronic headaches were more likely to use the ED as their source of care if they reported more severe disability from their headaches and indicated that their headache negatively impacted their mood and daily activities compared to those without ED visits for headaches.[27] In addition to increased disease severity and elevated depression scores, one study found that patients who frequently visited EDs for headaches had lower socioeconomic status and tended to utilize the ED for other medical conditions in addition to headaches.[28]

The higher acuity among frequent ED users extends to psychiatric illnesses as well. One study that examined medical ED utilization patterns among uninsured patients with psychiatric disorders found that these patients are at increased risk of having multiple ED visits, particularly for those with either bipolar or psychotic disorders.[29] Patients with substance use and psychiatric disorders have significantly more ED visits than substance users without psychiatric illnesses; this relationship was strongest among those with cocaine disorders and alcohol dependence.[30]

Healthcare Utilization

Most heavy ED users visit no more than 2 EDs per year, with the majority of visits confined to a single hospital.[31] Those serial patients who visit at least five different EDs are more likely to be uninsured than other serial patients.[32] High utilizers who visit at least five EDs also had more pain-related complaints than those who visited less than five EDs, endorsing sprains, back problems, and headaches as their most frequent symptoms.[32]

Frequent users typically heavily utilize other components of the healthcare system,[2,33] with more than 80% of this population having a medical home.[7,17] Compared

to infrequent ED visitors, frequent users are more likely to have a primary care physician, and a greater proportion of frequent ED users have a primary care physician at the ED hospital.[9] Three-fourths of frequent ED users visit their primary physicians at least six times per year, and more than half visit their primary physicians at least 12 times per year.[34] Adults with at least three annual visits to doctors are more than five times as likely to be frequent ED users, compared with those without such visits to primary care providers, suggesting that this population of frequent users is a less healthy group that needs and uses more healthcare overall.[10]

Patients who identified the ED as their usual source of care as opposed to a primary care physician were more likely to report low income, refusal of care in an office or clinic previously, perceptions that an ED visit is cheaper than an office visit, and lack of chronic illness; however, 68% of regular ED users desired a physician as their regular source of care and 46% had unsuccessfully tried to get a primary care physician in the previous year.[35]

Patients with high rates of ED utilization also report more referrals to specialists than nonfrequent users (4 versus 1).[34] Frequent ED users are more likely than nonfrequent users to have early return ED visits, defined as a subsequent ED encounters within 72 hours of the initial visit.[36] High ED utilizers also have higher admission and mortality rates than nonfrequent ED users, further demonstrating their less healthy baseline.[37]

Patient Perceptions

Only 27% of frequent ED users claim difficulty in seeing a primary care physician; however, most (72%) believe their chief complaint is moderately or very

serious.[23] A qualitative study based on interviews with frequent ED users found that this population perceived their symptoms as a threat to life or personal autonomy, causing overwhelming anxiety that compels them to seek care through the ED.[38]

While many believe that high utilizers enjoy visiting the ED, frequent users display significantly lower satisfaction with emergency care than infrequent users, mostly due to discharge instructions and subjective waiting time.[39]

Long-term Patterns

Only a minority of this group remains frequent users long-term, with just over 28% to 38% of frequent users one year remaining to utilize the ED at high rates the next year.[3,6] However, after qualifying as a frequent ED user for 2 years, 56% of patients continued this pattern of high utililization.[6] Patients who remain high utilizers typically exhibit higher incidences of psychiatric diagnoses and substance abuse.[40]

Solutions

While high ED utilizers typically have adequate primary care, their medical complaints are not always appropriate for evaluation in a primary care clinic. A retrospective review of the 500 most frequent ED utilizers at an inner city adult teaching hospital found that most ED presentations were inappropriate for diversion to primary care, due to acuity level, time of visit, homelessness, pre-existing case management, primary psychiatric complaints, or altered levels of consciousness from drug and/or alcohol use.[41]

Case management programs that develop individualized care plans for high ED utilizers have shown to be effective in reducing the number of future ED visits and improving overall care for these patients.[42] In addition to reducing ED usage and costs,

case management is associated with reductions in psychosocial problems common to frequent ED utilizers, such as homelessness, alcohol abuse, lack of health insurance, and financial need, at a cost similar to that of usual care.[43] A San Francisco-based intervention that assigned frequent ED users to a case manager who coordinated crisis intervention, supportive therapy, arrangement of stable housing and financial entitlements, follow-up with primary care providers, harm reduction therapies, and referral to substance use treatment facilities resulted in decreases in future ED visits and costs; additionally, homelessness, alcohol use, and drug use decreased, linkage to primary care increased, and the program resulted in a net cost savings in overall hospital costs.[44] One intervention that offered homeless adults with chronic medical illnesses transitional housing after hospital discharge, followed by placement in long-term housing, resulted in fewer hospitalizations and ED visits over the next 18 months, compared with standard social work discharge planning.[45]

Coordinating primary care follow-up appears to be beneficial in reducing ED usage. Pediatric asthma patients who were frequent ED users received fewer medications and x-rays, and had fewer hospital admissions, ED visits, and clinic visits, as well as lower overall healthcare costs, after being assigned a primary care provider.[46] Another intervention that provided pediatric asthma patients with asthma education, treatment in an allergy clinic, and monthly contact with an asthma nurse resulted in fewer ED visits, less hospitalizations, and lower asthma healthcare charges compared with controls.[47]

Among adults, one intervention that provided transitional housing residents with on-site health assessments, education, and specialist referrals found that frequent ED use decreased over the following 18 months.[48] Another study evaluated the effect of the

Civilian Health and Medical Program of Uniformed Services Reform Initiative, finding that this initiative's improved access to outpatient care reduced ED usage and charges, largely among repeat ED users and patients with less severe illnesses.[49]

However, case management programs that do not address underlying social problems show limited success, as individualized care plans and case management for frequent ED users that only address management of common presenting complaints do not decrease future ED utilization.[50] Even case management programs that include medical social work, community referrals, referrals to primary care providers, and limitation of narcotic prescriptions but do not address underlying social issues show limited success in reducing ED visits.[51] Knowledge of suboptimal ED care does not act as a deterrent against repeat ED visits, as parents of frequent pediatric ED patients who received multiple letters emphasizing the value of continuous pediatric care and the lack thereof in the ED failed to show a decrease in their children's ED visits compared with parents who did not receive these letters.[52]

Highest Frequency ED Utilizer Characteristics

While a large body of literature has been devoted to high ED usage, relatively little work has been done examining the characteristics of superusers, who represent the very highest of ED utilization. Representing 3.6% of all ED visits in one study, highly frequent users have high rates of substance abuse, long histories of frequent ED use, and do not use other healthcare services proportionally more than frequent ED users, suggesting that the ED is their main source of care.[53] This population is quite different from other high-frequency users with less frequent annual visits; the highest-frequency users with 20 or more annual visits often are uninsured, have lower-acuity complaints,

lower admission rates, shorter lengths of stay, and lower hospital costs per visit.[54] A study of chronic ED visitors with at least one monthly ED visit found that these patients were largely single males on governmental aid who lived alone; most suffered from alcoholism, more than half carried a psychiatric diagnosis, and while most were transported by ambulance, the majority were discharged from the ED.[55]

Summary

Unlike common assumptions that frequent ED usage is perpetrated by uninsured minority patients, most frequent ED visits are attributed to white patients with insurance and high rates of healthcare and primary care utilization who are unable to receive timely care. These frequent users often have multiple chronic diseases resulting in high admission rates and considerable morbidity and mortality. Individuals with many visits to the same ED will typically present with a variety of complaints; those who visit multiple EDs tend to have a single complaint that is often pain-related. The individuals who exhibit the highest frequency ED use are largely uninsured, often carrying burdens of substance abuse and psychiatric diagnoses. Case management interventions that address underlying social issues have been the most successful in reducing repeated ED use, while patient diversions from the ED might not be appropriate considering the patients' medical complaints.

Study Rationale

The distinct difference between high ED utilizers and the highest frequency ED users, coupled with the limited information about these highest utilizers of the ED, led to the creation of this study, in an effort to better characterize the few individuals whose numerous stays resulted in the consumption of the most clinical resources in the ED.

Furthermore, no previous studies were identified that evaluated ED superusers at a largely urban, county hospital. Successful characterization of this particular population can result in the development of effective and safe interventions to contain such frequent visits in the future, and can help curb healthcare costs. This analysis aimed to better characterize high ED utilizers at an urban teaching hospital by assessing the prevalence of various demographic, clinical and ED usage characteristics among high ED utilizers and determining risk factors for high ED usage

III. Method

Description

This descriptive, cross-sectional study was based at Grady Memorial Hospital, a Level One trauma and public hospital that had 107,679 ED visits in 2011, accounted for by an estimated 93,062 patients. For the purposes of characterizing ED superusers at this particular hospital, we studied patients who presented to the ED at least twenty times in 2011, using previously used definitions of high frequency ED utilizers.

Participants

The target population was ED superusers, defined as those who visited the ED at least 20 times from January 1st to December 31st, 2011. These patients were identified by using the hospital medical record to determine annual visit frequency, and only including those patients with at least twenty visits in 2011. Patients were not excluded from the study for any reason.

Measures

We assessed frequencies of individual patient characteristics, including age, sex,

insurance status, most frequent chief complaint, number of ED visits in 2011, and total ED length of stay for 2011. We also evaluated factors specific to each visit, such as insurance used per visit, mode of arrival, day of arrival, priority assigned at triage, if the patient left prior to being seen by a physician, reason for ED visit, length of ED stay, and ED disposition. For those who were admitted, we assessed length of hospital stay. These items were chosen using the Theory of Planned Behavior, as they were readily obtainable from the EPIC chart and have yet to be characterized in this particular population.

Procedure

The study protocol was reviewed and approved by the Department of Emergency Medicine Research Committee, the Emory University Institutional Review Board, and the Grady Hospital Research Oversight Committee. Qualifying patients were identified using the EPIC electronic medical record, which was used to document virtually all patient visits to the ED in 2011. The Grady EPIC reporting team abstracted the requested variables and electronically delivered the data to the principal investigator in a password-protected Excel spreadsheet. Patient identifiers were removed by the reporting team prior to analysis by the study investigator, who was fully blinded to individual case identity. All study data was stored on the Emory School of Medicine server, using a password-protected computer in an office with a locked door.

Analysis

All statistical analyses were conducted using SPSS (version 20, Chicago, Illinois). Frequencies for each variable were calculated, comparing clinical characteristics of this population to available statistics for Grady ED patients in 2011. Factors associated with the highest number of annual ED visits were identified, using ANOVA and t-test

analyses. Standard assumptions for these tests were validated.

IV. Results

Objective 1: Describe the demographic characteristics of high ED utilizers at Grady Memorial Hospital in 2011.

Hypothesis 1: High utilizers in this population will likely be males of varying age, the largest proportion of whom will be uninsured.

Ninety-five patients visited the Grady ED at least 20 times in 2011, accounting for 2747 visits and averaging almost 29 visits each (SD=11.16). The most frequent visitor made 91 visits to the Grady ED that year. Age ranged from 20 to 78 years, averaging 47 years (SD=11.8), with a peak from ages 48 to 55. Most frequent visitors were male (n=67, 70.5%).

Most visits were billed to public insurance, with distributions of 36% Medicaid (n=974), 9% Medicaid or Social Security Income pending (n=237), 14% Medicare (n=383), and less than 1% Medicare managed care (n=23). Forty-one percent of visits (n=1126) were made by uninsured or self-pay patients.

Objective 2: Describe the clinical visits of these patients, particularly their mode of arrival, triage acuity, chief complaints, rates of leaving before being seen, dispositions from the ED, and ED length of stays.

Hypothesis 2: The largest proportions of Grady ED superusers will arrive using ambulance transport, be assigned low triage acuity, present with chief complaints of psychiatric problems or substance abuse, have high rates of leaving without being seen, be discharged from the ED, and will have longer than average lengths of stay.

Thirty-eight percent of visits were by patients who were brought in by ambulance (n=1,047), and 9% of patients were brought in by the police (n=233). Patients arrived on their own in half of all visits, with 32 percent of these visits as walk-ins (n=883), 8 percent by car (n=207), and 10 percent by public transportation (n=278).

Frequent use occurred most often on Saturdays (n=420, 15.3%) and Mondays (n=425, 15.5%), and happened least often on Fridays (n=350, 12.7%) and Wednesdays (n=354, 12.9%).

About half of all visits were triaged Level 3 (n=1384). Fifteen percent were Level 2 (n=409), and 10 visits were Level 1 (0.4%). Twenty-two percent of visits were Level 4 (n=616) and 251 were Level 5 (9.1%).

The most frequent chief complaint was chest pain (n=287, 10.4%), followed by alcohol intoxication (n=194, 7.1%), seizures (n=171, 6.2%), shortness of breath (n=140, 5.1%), and abdominal pain (n=124, 4.5%). Psychiatric evaluation (n=107, 3.9%) and suicidal (n=108, 3.9%) accounted for 7.8% of chief complaints.

Of these, 33% with shortness of breath were admitted (n=46), compared with 24% of patients with chest pain (n=68), 5% of patients who were intoxicated (n=9), 12% with seizures (n=21), and 16% with abdominal pain (n=20). Thirty-five percent of those who were suicidal or needing psychiatric evaluation were admitted or sent to the psychiatric ED (n=76).

High ED utilizers tended to visit the ED for the same reason. Seventy-eight (82%) had the same chief complaint recorded for at least 20% of their ED visits in 2011, and all high utilizers had the same top two chief complaints recorded for at least 20% of their annual visits. The most common frequent complaint among utilizers was chest pain

(n=19, 20%), followed by shortness of breath (n=11, 11.6%), alcohol intoxication (n=9, 9.5%), abdominal pain (n=7, 7.4%), suicidal (n=7, 7.4%), and psychiatric evaluation (n=5, 5.3%).

Fifteen percent of patients were admitted (n=407); one patient died in the ED. The majority of patients were discharged (n=1831, 66.7%), though this number likely includes those initially admitted to ED Observation. Sixteen patients were discharged to jail (0.6%). Sixty-seven patients left against medical advice (2.4%), and 40 eloped (1.5%). The ED disposition was not recorded for 247 patients (9%).

Patients who were admitted stayed an average of 3.4 days (SD= 5.35), with median stays at 2 days, and a maximum hospital stay of 52 days. ED length of stay ranged from 19 minutes to 38 hours and 46 minutes. Average length of stay was 9 hours (SD= 4.51).

Over all of 2011, total ED length of stay per patient ranged from 103 hours and 8 minutes to 631 hours and 17 minutes. Annual ED length of stay per patient averaged 260 hours and 5 minutes (SD= 110 hours 12 minutes). A Pearson correlation coefficient was used to assess the relationship between annual number of ED visits and total ED LOS, showing a statistically significant positive relationship between these two variables ($r=.886$, $p< .001$).

Objective 3: Determine what clinical factors are associated with the highest number of annual ED visits in this population.

Hypothesis 3: No insurance, arrival by ambulance, low triage acuity, discharge from the ED, and psychiatric or substance abuse chief complaints will be associated with more ED visits.

A statistically significant difference was observed in mean annual number of ED visits between different insurance types ($F=(4,2738)=33.35$, $p<.0001$). Tamhane post hoc tests suggest that the number of ED visits for those with Medicaid (mean=36.25; SD=21.16) and Medicaid/SSI pending (mean=37.42, SD=15.28) were significantly higher than the mean number of visits for those with Medicare (mean=27.93; SD=4.55; $p<.0001$), Medicare managed care (mean=24.0, SD=0; $p<0.001$), and self-pay (mean=31.63; SD=10.59; $p<0.001$). No statistically significant difference was observed in mean number of ED visits between patients with Medicare and Medicare/SSI pending.

Significant difference were found in mean annual number of ED visits by mode of arrival ($F=(4,2643)=50.64$, $p<.0001$). Tamhane post hoc tests demonstrate that the number of ED visits for those arriving by ambulance (mean=28.52;SD=8.31) was significantly lower than the mean number of visits for those arriving by car (mean=34.97; SD=15.75; $p<.0001$), police (mean=31.80, SD=10.34; $p<0.001$), public transportation (mean=37, SD=17.39; $p<0.001$), or walk-in (mean=37.62; SD=20.18; $p<0.001$). Those arriving by police car had significantly less annual ED visits than those arriving by public transportation ($p<0.001$) or as walk-ins ($p<0.001$).

Mean annual number of ED visits also differed by level of acuity at triage ($F=(4,2665)=14.04$, $p<.0001$). Tamhane post hoc tests show that the number of ED visits for triaged as level 5 (mean=39.46; SD=22.85) was significantly higher than the mean number of visits for those triaged as level 4 (mean=33.57; SD=15.68; $p=.002$), level 3 (mean=32.73, SD=14.31; $p<0.001$), or level 2 (mean=30.59, SD=12.21; $p<0.001$). Those triaged as level 2 had less annual visits than level 3 ($p=.028$) or level 4 ($p=.007$).

A statistically significant difference was observed in mean annual number of ED

visits between disposition from the ED ($F=(5,2494)=9.52$, $p<.0001$). Tamhane post hoc tests suggest that the number of annual ED visits for admitted patients (mean=38.02; SD=16.85) was significantly higher than the number of visits for those who left AMA (mean=32; SD=13.28; p=.02), were discharged home (mean=32.35, SD=14.86; $p<0.001$), or were discharged to 13B (mean=32.56, SD=16.30; p=0.029).

Differences in mean annual number of ED visits were found based on chief complaint ($F=(6,1197)=11.82$, $p<.0001$). Tamhane post hoc tests show that the number of annual ED visits for patients presenting for psychiatric evaluations (mean=36.40; SD=19.48) was the highest among frequent chief complaints, and was significantly higher than the number of visits for those who visited for alcohol intoxication (mean=29.26; SD=6.94; p=.007), shortness of breath or asthma (mean=26.23, SD=9.09; $p<0.001$), and seizures (mean=29.94, SD=8.43; p=0.031). Patients who visited for abdominal pain (mean=35.05, SD=17.82) had more annual visits than those who visited for alcohol intoxication (p=0.015). Patients who visited for shortness of breath or asthma had significantly less visits than all other frequent chief complaints, including abdominal pain ($p<0.001$), alcohol intoxication (p=0.004), chest pain (mean=31.20, SD=12.21, $p<0.001$), seizures (p=0.001), and suicidality (mean=31.23, SD=11.85, p=0.003).

V. Discussion

Findings for each Hypothesis

Objective 1: Describe the demographic characteristics of high ED utilizers at Grady Memorial Hospital in 2011.

Hypothesis 1: High utilizers in this population will likely be males of varying age, the

largest proportion of whom will be uninsured.

As hypothesized, this population of high ED utilizers was largely male, with a wide range of ages from 20 to 78, and a significant number of whom were covered by public insurance. These findings are consistent with previous literature, which shows that male gender is a risk factor for repeat ED visits among older patients.[16] Previous studies have shown that the age distribution in this population is bimodal with peaks in the 25 to 44 years and over 65 years groups.[3,8] However, this population demonstrated a more normally distributed adult population with a peak from ages 48 to 55 years.

Multiple studies have shown that the majority of frequent ED users have health insurance,[7] with 60% of frequent users having Medicare or Medicaid,[3] and the uninsured making up only 15% of frequent users.[6] However, the highest frequency users tend to be uninsured.[54] Fifty-nine percent of this population was publicly insured, compared to 41 percent who were non-insured, which is different from previous evaluations of ED superusers. Moreover, the Grady ED payor mix in 2011 was 62% self-pay, 13% Medicaid, and 12% Medicare, which represents different proportions than the superuser population.

Objective 2: Describe the clinical visits of these patients, particularly their mode of arrival, triage acuity, chief complaints, rates of leaving before being seen, dispositions from the ED, and ED length of stays.

Hypothesis 2: The largest proportions of Grady ED superusers will arrive using ambulance transport, be assigned low triage acuity, present with chief complaints of psychiatric problems or substance abuse, have high rates of leaving without being seen, be discharged from the ED, and will have longer than average lengths of stay.

About half of all superusers arrived to the ED on their own, either by walking in, car, or public transportation, while 38 percent arrived by ambulance. The remainder arrived by police car or mode of arrival was not documented. This significant proportion of ambulance transportation is reinforced in the literature, which shows that frequent ED users typically employ more ambulance transports than occasional ED users,[23] a finding that is amplified among the most frequent visitors.[55] Ambulance transport accounts for about 25% of ED patient visits at Grady, which is lower than the rate for the most frequent users.

Over thirty-one percent were triaged as level 4 or 5, while half of all visits were triaged Level 3. Previous research shows that the highest-frequency users with 20 or more annual visits tend to have lower-acuity complaints per visit.[54] Level 4 or 5 visits account for about 28% of ED visits at Grady, which is slightly lower than the proportion calculated among highly frequent ED users.

The most frequent chief complaint was chest pain, followed by alcohol intoxication, seizures, shortness of breath, and abdominal pain, psychiatric evaluation, and suicidal. Similar to our findings, previous literature shows that the most common reason for presenting to the ED among high utilizers is for pain or pain-related conditions,[17] such as abdominal pain or chest pain.[13] Only 4% of all high frequency use is mental health-related, and 3% is alcohol or drug-related,[17] which contrasts with the higher proportions witnessed in this population.

While fifteen percent of patients were admitted, two-thirds of patients were discharged. The admission rate in this sample was lower than the admission rate of 16.6% for the general Grady ED population for 2011. These findings are consistent with

previous literature showing that the majority of high frequency users are discharged from the ED.[55]

Patients who were admitted had average stays of 3.4 days, and median stays of 2 days. These stays were shorter than the average hospital length of stay of 5.8 days, which is consistent with the literature showing that ED superusers have shorter hospital lengths of stay than less frequent patients.[54] ED length of stay averaged 9 hours, which was longer than the average ED length of stay in 2011 of 8 hours and 3 minutes, and is also consistent with previous literature.[54]

Objective 3: Determine what clinical factors are associated with the highest number of annual ED visits in this population.

Hypothesis 3: No insurance, arrival by ambulance, low triage acuity, discharge from the ED, and psychiatric or substance abuse chief complaints will be associated with more ED visits.

Patients with Medicaid were more likely to have a greater number of ED visits in 2011 than those with Medicare or no insurance. This is similar to findings showing that most frequent users have public insurance.[3,9,10] One reason for this finding could be because ED utilization is higher among Medicaid beneficiaries with barriers to timely primary care than the privately insured.[56] However, these findings are different from previous literature that described the vast majority of highest frequency users with more than 20 annual visits as uninsured.[54]

Patients arriving by personal transport or police were likely to have more ED visits than those arriving by ambulance, and those who arrived by public transportation or walk-in had more visits than those who arrived by police. This finding is different from a

small study published in 1981 that found that the most frequent visitors largely arrived by ambulance.[55]

Patients who were triaged to lower acuity levels were more likely to have a greater number of visits than those with higher triage levels. This finding is consistent with previous work showing that frequent users tend to be triaged as lower acuity.[54]

Patients who were admitted had more 2011 visits than those who were discharged, left AMA, or sent to the psychiatric floor for evaluation. While previous literature has found that patients with frequent ED use, defined as greater than 5 visits per year, have more admissions than patients with infrequent ED visits,[6,22] the findings of this study are different from a previous analysis which found that patients with more than 20 annual ED visits were less likely to be admitted.[54]

The chief complaint with the highest associated number of ED visits was psychiatric evaluation, followed by abdominal pain. While pain-related complaints have typically been demonstrated as the most common reason for ED presentation,[17] uninsured patients with psychiatric disorders are at increased risk of multiple ED visits,[29] and greater numbers of functional problems and poor social support are predictors of repeat ED visits.[9,12,16]

Conclusions

This study has a number of conclusions regarding ED superusers. Superusers in this population were largely male, middle-aged, and a significant number of whom were covered by public insurance. About half of all superusers arrived to the ED on their own, while almost 40 percent arrived by ambulance. Superusers tended to be lower acuity, presenting for pain-related and psychiatric complaints. Most patients were discharged,

with lower rates of admission than that of the general Grady ED population. Those who were admitted had shorter hospital stays than average. Superusers tended to have longer than average ED length of stays. The highest number of ED visits was associated with having Medicaid, personal transport to the ED, lower acuity levels at triage, admission, and presentation for psychiatric evaluation.

While previous literature has demonstrated similar demographic information for frequency users, the characteristics of the highest frequency users has not been well documented, with few recent studies that compare the highest frequency ED patients to less frequent visitors.[53,54] In contrast to these studies, the Grady population of superusers demonstrated higher rates of insurance, which was largely through Medicaid, a larger proportion of males, and similar average ages. While previous studies have shown a large amount of ambulance transports among this population, those with the most visits actually tended to arrive on their own or by public transportation. Although this population tended to have lower rates of admission than other ED patients, those who were admitted tended to have the highest number of visits, which is different from previous findings in the literature. Finally, while pain-related complaints typically comprise the bulk of frequent visitors' chief complaints, those presenting for psychiatric evaluations tended to have the highest number of ED visits, which is different from previous research.

Strengths and Limitations

This study is one of the few reported analyses that offers insights into the population of ED users who are the highest frequency users. This population has not been well studied in the past, and the findings of this study are different from previous studies

characterizing this population as largely uninsured and with lower admission rates, particularly since this institution already has a significant number of uninsured patients.

This study has several limitations. The hospital from which data was taken was a large, urban, publicly funded hospital, and so findings might not be generalizable to other EDs in different areas of the country with different patient populations. Information was not available regarding primary care, and so analysis that related exhaustion of outpatient management options to ED use was not conducted. As this hospital primarily serves adults, only adults were identified for this analysis, limiting the generalizability of findings to pediatric populations. Finally, the time frame used, which assessed ED visit frequency based on the calendar year instead of following individual patients over an extended period, could have excluded patients that would have otherwise qualified for inclusion in this study.

Implications and Recommendations

This study has numerous implications for public health research and practice. First, while the uninsured made up a significant proportion of this population, most frequent users at this hospital were publicly insured. Also, admission was associated with more frequent ED visits, in contrast to previous studies. These findings could be due to a difference in populations between study sites, as this particular hospital population is largely indigent with poor access to primary care, in contrast with previous studies conducted at academic centers.[54-56] Furthermore, the findings of this study are more consistent with previous studies that evaluate frequent use rather than super use, particularly in patters of insurance coverage and admission rates. It is possible that poorer access to timely primary care that Grady patients have compared with other populations

could cause some patients with chronic medical problems who would otherwise be frequent users to, in this setting, be superusers. These patients, along with the uninsured and lower acuity patients described in prior research, could make up the population of superusers seen in this analysis. As such, future studies should relate frequent ED use to practice patterns in their particular institution rather than hard definitions.

Future research should further evaluate characteristics of the highest frequency of ED visitors to better characterize this population and design interventions that will enhance their medical care. Analyses can also include evaluations of patient follow-up with primary care, the costs associated with these frequent visits relative to the general ED population, and more qualitative research that assesses why this particular population chooses to utilize the ED so frequently. Future projects should be careful to distinguish ED superuse from frequent use, as these two populations have been shown to be different in the literature, and should compare the definitions of frequent use they employ with ongoing practice patterns at the particular institutions under study.

VI. Tables

Table 1. Characteristics of Frequent ED Patients (n=95)

	Number	Valid %
Sex		
Male	67	70.5
Female	28	29.5
Insurance		
Medicaid	33.15	34.9
Medicaid/SSI pending	7.55	7.9
Medicare	14.11	14.8
Medicare Managed care	0.96	1.0
Uninsured or self-pay	39.07	41.1
Auto insurance	0.12	0.1
Commercial non-contract	0.04	0.05
Frequent chief complaint		
Chest pain	19	20.0
Shortness of breath	11	11.6
Alcohol intoxication	9	9.5
Abdominal pain	7	7.4
Suicidal	7	7.4
Psychiatric evaluation	5	5.3

Table 2. Characteristics of High Frequency Patient ED Visits (n=2747)

	Number	Valid %
Insurance		
Medicaid	974	35.5
Medicaid/SSI pending	237	8.6
Medicare	383	13.9
Medicare managed care	23	0.8
Uninsured or self-pay	1126	41.0
Auto insurance	3	0.1
Commercial non-contract	1	<0.1
Mode of arrival		
Ambulance	1047	38.1
Walk-in	883	32.1
Public transportation	278	10.1
Car	207	7.5
Police	233	8.5
Flight	1	<0.1
Other	78	2.8
Not entered	20	0.7

Table 2 (continued). Characteristics of High Frequency Patient ED Visits (n=2747)

	Number	Valid %
Day of arrival		
Monday	425	15.5
Tuesday	408	14.9
Wednesday	354	12.9
Thursday	390	14.2
Friday	350	12.7
Saturday	420	15.3
Sunday	371	13.5
Not entered	29	1.1
Acuity at triage		
Level 1 (resuscitation)	10	0.4
Level 2 (emergent)	409	14.9
Level 3 (urgent)	1384	50.4
Level 4 (less urgent)	616	22.4
Level 5 (nonurgent)	251	9.1
Not entered	77	2.8
Left without being seen (LWBS)		
LWBS before triage	2	0.1
LWBS after triage	19	0.7
Chief complaint		
Chest pain	287	10.4
Alcohol intoxication	194	7.1
Seizure	171	6.2
Shortness of breath	140	5.1
Abdominal pain	124	4.5
Suicidal	108	3.9
Psychiatric evaluation	107	3.9
Disposition		
Admit	407	14.8
Left against medical advice	67	2.4
Discharge to jail	16	0.6
Died in ED	1	<0.1
Discharge	1831	66.7
Eloped	40	1.5
Left without being seen	21	0.8
Sent to clinic	1	<0.1
Admitted to psychiatric floor	114	4.1
Not entered	249	9.1

Table 3. Admissions per chief complaint (n is provided per complaint)

	Number (*n*)	**Valid %**
Admissions per chief complaint		
Chest pain	68 (*287*)	23.7
Alcohol intoxication	9 (*194*)	4.6
Seizure	21 (*171*)	12.3
Shortness of breath	46 (*140*)	32.9
Abdominal pain	20 (*124*)	16.1
Suicidal	44 (*108*)	40.7
Psychiatric evaluation	32 (*107*)	29.9

Table 4. Mean number of ED visits [1,2] (n=2747)

	Mean ED visits (SD)	**p**
Insurance		*<0.001*
Medicaid	**36.25 (21.16)**	
Medicaid/SSI pending	**37.42 (15.28)**	
Medicare	27.93 (4.55)	*<0.001*
Medicare managed care	24.0 (0.0)	*<0.001*
Uninsured or self-pay	31.63 (10.59)	*<0.001*
Mode of arrival		*<0.001*
Ambulance	**28.52 (8.31)**	
Walk-in	37.62 (20.18)	*<0.001*
Public transportation	37.0 (17.39)	*<0.001*
Car	34.97 (15.75)	*<0.001*
Police	31.80 (10.34)	*<0.001*
Acuity at triage		*<0.001*
Level 5 (nonurgent)	**39.46 (22.85)**	
Level 4 (less urgent)	33.57 (15.68)	*0.002*
Level 3 (urgent)	32.73 (14.31)	*<0.001*
Level 2 (emergent)	30.59 (12.21)	*<0.001*
Level 1 (resuscitation)	28.60 (11.71)	0.169
Disposition		*<0.001*
Admit or died in ED	**38.02 (16.85)**	
Left against medical advice	32.0 (13.28)	*0.02*
Discharge to home or jail	32.35 (14.86)	*<0.001*
Eloped	42.03 (12.32)	0.093
Left without being seen	34.14 (19.80)	0.999
Admitted to psychiatric floor	32.56 (16.30)	*0.029*

1. *Reference groups and values are bolded.*
2. *Significant p-values are italicized.*

Table 4 (continued). Mean number of ED visits [1,2] (n=2747)

	Mean ED visits (SD)	**p**
Chief complaint		*<0.001*
Psychiatric evaluation	**36.40 (19.48)**	
Chest pain	31.20 (12.21)	0.206
Alcohol intoxication	29.26 (6.94)	*0.007*
Seizure	29.94 (8.43)	*0.031*
Shortness of breath	26.23 (9.09)	*<0.001*
Abdominal pain	35.05 (17.82)	1
Suicidal	31.23 (11.85)	0.343

1. *Reference groups and values are bolded.*
2. *Significant p-values are italicized.*

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