

“Frequent and Recurrent Emergency Department Visits: A State Level Analysis for Maryland, 2017-2019”

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Abstract

Background

Frequent or repeat ED visits make up over 20% of the total ED visits, while frequent users constitute up to 8% of all ED users. While some studies have analyzed ED encounters over a single healthcare system, a single year or a condition, this study examines frequent and recurrent ED utilization for the state of Maryland over three years.

Methods

Using 2017–2019 State Emergency Department Databases (SEDD), we conducted bivariate and multivariate analyses and identified patient/community level characteristics associated with frequent (> 4 visits/year) and recurrent frequent ED users (two and three consecutive years) in Maryland.

Results

Of the total 5,331,843 ED visits, frequent visits were 24.4% (1,301,301) while frequent users made up 7.16% (234,973) of all ED users. Females [OR = 1.30, 95% CI 1.24, 1.36] and patients aged 21–44 [OR = 2.41, 95% CI 2.24,2.60] were more likely to visit the ED recurrently than males, children and adolescents respectively. Compared to those with private insurance and no chronic conditions, Medicaid beneficiaries were 2.41 (95% CI 2.24,2.60) and those with multiple chronic conditions was 2.34 [95% CI 2.14,2.54] times more likely to be recurrent frequent ED users respectively. The NH Blacks were 26% [95% CI 1.25,1.28] more likely to be frequent users than NH White patients while those from the lowest income quartile were 69% [95% CI 1.66,1.71] and 33% [95% CI 1.21,1.46] more likely to be frequent and recurrent frequent ED users compared to the highest income quartile. Compared to residents of large metropolitan areas, patients from micropolitan areas were 43% [95% CI 1.38,1.48] while those living further from an ED were 9% [95% CI 1.09, 1.10] were more likely to be frequent ED users.

Conclusions

Frequent and recurrent frequent ED users in the state of Maryland were associated with being female, 21–44 years old, NH Black, Medicaid beneficiaries, with multiple chronic conditions and reside in a lower income zip code. Frequent ED users were also more likely to reside micropolitan areas, and further from an ED facility. We propose recommendations to stakeholders to invest in care coordination and IT infrastructure, and expand community access to outpatient care.

Introduction

Recent data suggests that Emergency Department visits (ED) in the United States have risen faster than its population growth [1]. Some studies [2, 3] have further pointed out to higher volumes of ED visits seen among the Medicaid expansion states as compared to non-Medicaid expansion states [4]. Although EDs are primarily designed to treat acute, urgent and life-threatening conditions, they are increasingly being utilized for non-urgent medical conditions by certain segments of the population such as Medicaid beneficiaries and the uninsured [1]. There is a subgroup of ED patients deemed as “frequent users” (> 4 visits/year) that account for up to 8% of all ED patients, but contribute to 21–28% of ED visits [5]. Frequent ED utilization for non-urgent medical conditions is inefficient and costly [6]. It overcrowds EDs taking time away from more urgent conditions and frequent users average cost EDs significantly higher – more than 10 times that of non-frequent users [7].

Previous literature has identified patient characteristics associated with frequent ED use [8–11]. Frequent or recurrent ED visits were associated with being younger, of female gender [9], being uninsured or publicly insured, having a higher severity of medical condition or more chronic conditions, or living in deprived neighborhoods [11]. Additionally, proximity to the ED was found to be associated with frequent ED use by these studies. While previous studies have examined frequent ED visits by patient characteristics across a single institution [11, 12], a single year [11], a single medical condition [10], this study examines frequent and recurrent ED visits’ data for the entire state of Maryland over a three-year time period.

Maryland is a diverse state, both ethnically and socially. Non-Hispanic Blacks make up approximately 30% of Maryland’s population, and comprise a disproportionate share of ED users with Medicaid coverage [13]. Since 2014, Maryland is one of the Medicaid expansion states that has witnessed an increase in the volume of ED visits and specifically among its NH Black population [14]. Our primary aim of this study is to describe patient and community characteristics associated with frequent ED users and contrast it with non-frequent ED users for the entire state of Maryland. In addition, the study also examines characteristics associated with recurrent frequent users in two-years (2017–2018) and three-years (2017–2019) time frames.

Data And Methods

Data Sources

We used the 2017–2019 Maryland’s State Emergency Department Databases (SEDD) [15] for this study. The SEDD are a visit-level set of longitudinal state-specific emergency department databases that includes all emergency department visits in the state that do not result in an admission. It includes patient identifier numbers that enabled us to identify the frequent and recurrent ED users. Hospitals were identified with a hospital identification number that was also the Medicare Identification Number. We excluded all visits that occurred outside Maryland and visits that did not contain a patient identification. The databases include all patients, regardless of payer, which allowed us to provide a more comprehensive view of the frequent and non-frequent ED visits for the state of Maryland. The study was

approved by Marymount University's Institutional Review Board (IRB) under exempt category and data user agreement was completed by the researchers who handled and analyzed the data. The study was also deemed exempt from review by the ethics committee. All data in this study was anonymized, and hence no informed consent was necessary.

Data variables and definitions

Frequent and recurrent user: We defined frequent ED users as those with 4 or more visits per year, a definition that is widely used in previous studies [5, 8, 12]. A recurrent user was defined as one who was a frequent user in two subsequent years (Time period 1: 2017–2018) and three years (Time period 2: 2017–2019). While the initial database was at the visit level, we identified all frequent users who visited the ED in Maryland more than four times a year for each year – 2017, 2018 and 2019.

Socio-economic and demographic characteristics: We considered the following characteristics for each patient: (1) Age (< than 20-year-old, 21 to 44, 45 to 64, and 65 and older); sex (female, male) (3) payer (private insurance, Medicaid, Medicare, and self-pay/uninsured); (4) race/ethnicity (NH White, NH Black, Hispanic, and others); location (large central and fringe metropolitan area (central and fringe counties > = 1 million pop), medium and small metropolitan area (counties with population ranging between 50,000 and 250,000), micropolitan area (10,000–50,000), and non-core or rural areas). The *Charlson Comorbidity Index* was generated based on 17 chronic conditions, allowing us to group the cumulative weights into a three-category *Grouped Charlson Comorbidity Index* (GRPCI) [16]. Using the GRPCI, patients were classified into three categories: no chronic condition, one chronic condition, two or more chronic conditions. The hospital ID was matched with the publicly available Hospital Compare [17] hospital data to obtain the locations of ED facilities. Using patient zip codes and the hospital addresses, we estimated the straight line distance from a patient's residential zip code to the hospital. Charges associated with the primary diagnosis for each patient treated and released by the ED were recorded.

Methodology

We conducted bivariate analysis and compared patient and community level characteristics associated with frequent and non-frequent ED users in Maryland. We also compared the groups of recurrent frequent users in the two time periods. Descriptive statistics of average and total charges associated with the top ten diagnoses linked with frequent visits were reported. All methods were performed in accordance with the relevant guidelines and regulations.

Transformation of visit level to patient level

Since SEDD data is at visit level, we transformed it to patient level data by year. Categorical variables including age, sex, and ethnicity/race were assumed to remain unchanged during a given year. Continuous variables (distance, total charge) were averaged across all three years for each patient. For other categorical variables that can potentially vary in a year such as day of the visit, payer type, location, comorbidity index, and income, we computed fractions for each response category, for example, a patient

received a fraction of 0.75 for weekday, and 0.25 for weekend representing 75% and 25% of frequent visits on weekday and weekend respectively. Missing data was dropped and excluded from the analysis.

Three models of multivariate logistic regression analyses were estimated. Model 1 estimated the likelihood of the patient and community level characteristics being associated with frequent and non-frequent users. Models 2 and 3 estimated the likelihood of patient and community level characteristics being associated with recurrent and non-recurrent frequent users during two time periods, 2017–2018 and 2017–2019 respectively. Standard errors were adjusted for heteroscedasticity. All statistical analyses were performed using Stata 16 [18]. All estimates were reported at 95% level of significance, unless otherwise specified.

Results

Of the total 5,331,843 ED visits during 2017–2019 in Maryland, frequent visits made up 24.40% (1,301,301) of all visits while frequent users made up 7.16% (234,973) of all ED users. For each of the following variables, missing observations were dropped: 0.0022% of all observations for age; 0.014% for race; 0.0037% for location; 0.63% for income; 4.77% for distance; 2.06% for charge. In 2017, 7.43% were frequent ED users, compared to 7.18% in 2018 and 6.88% in 2019. Among the frequent users, there were 19,160 (10.22%) that reported recurring ED visits in 2017 and 2018 and 9,177 (4.90%) in 2017, 2018, and 2019. Figure 1 presents a chart depicting the top 10 ICD-10 diagnoses that account for frequent visits in the ED in Maryland during 2017–2019. The top ten primary diagnoses included chest pain (2.71%, 35,251), other chest pain (2.34%, 30,371), abdominal pain (1.86%, 24,249), upper respiratory infection (1.84%, 23,895), Urinary tract infection (1.64%, 21,394), headache (1.59%, 20,649), asthma (1.38%, 17,959), low back pain (1.15%, 14,917), nausea with vomiting (1.05%, 13,667) and viral infection (0.93%, 12,146).

ED charges associated with frequent visits

The total charges associated with all frequent visits in Maryland during 2017–2019 were \$1.61 billion and the top ten diagnoses had total charges of \$282 million. Table 1 breaks down the average and total charges associated with the top ten diagnoses of frequent ED visits identified earlier. With an average charge of \$1,941 [95% CI, 1,920-1,962] and \$2,039 [95% CI, 2,016 – 2,061] respectively, chest pain and other chest pain diagnoses were the top two diagnoses that collectively made up \$130 million of the total charges. While charges associated with frequent abdominal pain visits made up \$30.33 million [95% CI 29.89–30.77] of the total charges, urinary tract infection (\$26.16 mil, 95% CI 25.76–26.57), headache (\$20.67 mil 95% CI 20.35–20.98) and unspecified asthma with acute exacerbation (\$ 20.48 mil 95% CI 20.09–20.87) collectively exceeded \$40 million. Lastly, nausea with vomiting (17.92 mil 95% CI 17.60-18.23), acute upper respiratory infection (15.22 mil 95% CI 15.04–15.40) and viral infection (9.32 mil 95% CI 9.18–9.46) contributed to \$42.46 million.

Table 1
Charges of the top ten diagnoses of frequent visits, 2017–2019 SEDD

Diagnosis	Avg Charge per visit* [95% CI]	Total ED charge [in million]
Chest pain	1,941 [1,920-1,962]	68.41 [67.66–69.16]
Other chest pain	2,039 [2,016 - 2,061]	61.92 [61.23–62.60]
Unspecified abdominal pain	1,250 [1,232-1,269]	30.33 [29.89–30.77]
Acute upper respiratory infection	637 [630–645]	15.22 [15.04–15.40]
Urinary tract infection	1,223 [1,204-1,241]	26.16 [25.76–26.57]
Headache	1,001 [986–1016]	20.67 [20.35–20.98]
Unspecified asthma with acute exacerbation	1,140 [1,119-1,162]	20.48 [20.09–20.87]
Low back pain	798 [783–814]	11.91 [11.68–12.14]
Nausea with vomiting	1,311 [1,288-1,333]	17.92 [17.60-18.23]
Viral infection	768 [756–779]	9.32 [9.18–9.46]
Total	1,316 [1,310-1,323]	282,35 [280,93–283,78]
*– All charges are in current US dollars,		

Bivariate Analysis:

Frequent and non-frequent ED users

Of the total 3,279,651 ED users, we estimated 234,973 (7.16%, 95% CI 7.14–7.19) frequent ED users and 3,044,678 (92.84%, 95% CI 92.81–92.86) non-frequent ED users during 2017–2019 (Table 2). The distribution of frequent and non-frequent ED users was statistically significant by sex, age, and race. Female patients accounted for 59.88% [95% CI, 59.69–60.08] of all frequent ED users, in contrast with 54.71% [95% CI, 54.65–54.77] of non-frequent users. Majority of the frequent ED users (42.86%, 95% CI 42.66–43.06) were between 21 and 44 years of age compared to 32.98% [95% CI, 32.93–33.03] for non-frequent users. While 54.16% [95% CI, 53.96–54.36] of frequent users were NH Black in contrast with 39.73% [95% CI, 39.67–39.78] of NH Black non-frequent users.

Table 2

Patient and community level characteristics of frequent and non-frequent ED users, 2017–2019

PATIENT AND COMMUNITY LEVEL CHARACTERISTICS	Non-frequent ED users [%, 95%CI]	Frequent ED users [% , 95%CI]	P-value*
Total	92.84 [92.81–92.86] (3,044,678)	7.16 [7.14–7.19] (234,973)	
Sex			< 0.000
Male	45.29 [45.23–45.34]	40.12 [39.92–40.32]	
Female	54.71 [54.65–54.77]	59.88 [59.69–60.08]	
Age group			< 0.000
0–20 years	25.77 [25.72–25.82]	18.58 [18.42–18.73]	
21–44 years	32.98 [32.93–33.03]	42.86 [42.66–43.06]	
45–64 years	24.26 [24.21–24.30]	25.02 [24.84–25.19]	
65 and over	16.99 [16.85–17.03]	13.55 [13.41–13.69]	
Race			< 0.000

*- Chi-square test was run for constant categorical variables [sex, age-group and race] and t-tests were run for the proportions estimated for each categories of categorical variables that were averaged over the study period.

** In 2017, 2018 and 2019, the first quartile corresponded to income below \$60,999, \$66,1999 and \$69,999, respectively. In 2017, the second quartile corresponded to income between \$61,000 and \$76,499 66,200-\$81,299 in 2018 and \$70,000–85,299 in 2019. The third quartile corresponded to income between \$76,500 and \$98,499 in 2017, \$81,300-\$103,299 in 2018, and \$85,300-\$110,099 in 2019. Fourth quartile corresponded to income above \$98,500 in 2018, \$103,300 in 2018, and \$110,100 in 2019.

PATIENT AND COMMUNITY LEVEL CHARACTERISTICS	Non-frequent ED users [%, 95%CI]	Frequent ED users [% , 95%CI]	P-value*
NH White	44.74 [44.68–44.79]	37.10 [36.91–37.30]	
NH Black	39.73 [39.67–39.78]	54.16 [53.96–54.36]	
Hispanic	9.41 [9.37–9.44]	5.44 [5.35–5.54]	
NH Other	6.13 [6.10–6.16]	3.29 [3.22–3.37]	
Payer			
Private	38.67 [38.61–38.72]	18.11 [17.97–18.25]	< 0.000
Medicaid	29.33 [29.29–29.38]	51.98 [51.79–52.17]	< 0.000
Medicare	22.07 [22.02–22.11]	23.67 [23.51–23.84]	< 0.000
Other	9.93 [9.89–9.96]	6.23 [6.16–6.30]	< 0.000
Location			
Large central and fringe metros	86.14 [86.10-86.17]	83.25 [83.10-83.39]	< 0.000

*- Chi-square test was run for constant categorical variables [sex, age-group and race] and t-tests were run for the proportions estimated for each categories of categorical variables that were averaged over the study period.

** In 2017, 2018 and 2019, the first quartile corresponded to income below \$60,999, \$66,1999 and \$69,999, respectively. In 2017, the second quartile corresponded to income between \$61,000 and \$76,499 66,200-\$81,299 in 2018 and \$70,000–85,299 in 2019. The third quartile corresponded to income between \$76,500 and \$98,499 in 2017, \$81,300-\$103,299 in 2018, and \$85,300-\$110,099 in 2019. Fourth quartile corresponded to income above \$98,500 in 2018, \$103,300 in 2018, and \$110,100 in 2019.

PATIENT AND COMMUNITY LEVEL CHARACTERISTICS	Non-frequent ED users [%, 95%CI]	Frequent ED users [%, 95%CI]	P-value*
Medium and small metros	11.02 [10.99–11.06]	13.00 [12.87–13.13]	< 0.000
Micropolitan areas	0.99 [0.98–1.01]	1.67 [1.62–1.73]	< 0.000
Non-core areas	1.66 [1.65–1.67]	2.08 [2.02–2.13]	< 0.000
GRPCI (Grouped Charlson Comorbidity Index)			
No chronic condition	77.21 [77.16–77.25]	66.77 [66.63–66.93]	< 0.000
One chronic condition	15.91 [15.88–15.95]	21.40 [21.29–21.52]	< 0.000
Two or more chronic condition	6.88 [6.85–6.90]	11.82 [11.71–11.92]	< 0.000
Median Household income**			
First Quartile	33.53 [33.48–33.58]	48.16 [47.97–48.35]	< 0.000
Second Quartile	26.41 [26.36–26.46]	24.03 [23.87–24.18]	< 0.000
Third Quartile	22.32 [22.27–22.36]	18.01 [17.87–18.15]	< 0.000

*- Chi-square test was run for constant categorical variables [sex, age-group and race] and t-tests were run for the proportions estimated for each categories of categorical variables that were averaged over the study period.

** In 2017, 2018 and 2019, the first quartile corresponded to income below \$60,999, \$66,1999 and \$69,999, respectively. In 2017, the second quartile corresponded to income between \$61,000 and \$76,499 66,200-\$81,299 in 2018 and \$70,000–85,299 in 2019. The third quartile corresponded to income between \$76,500 and \$98,499 in 2017, \$81,300-\$103,299 in 2018, and \$85,300-\$110,099 in 2019. Fourth quartile corresponded to income above \$98,500 in 2018, \$103,300 in 2018, and \$110,100 in 2019.

PATIENT AND COMMUNITY LEVEL CHARACTERISTICS	Non-frequent ED users [%, 95%CI]	Frequent ED users [%, 95%CI]	P-value*
Fourth Quartile	17.74 [17.69–17.78]	9.80 [9.69–9.91]	< 0.000
Mean Distance traveled	6.84 miles [6.83–6.85]	6.15 miles [6.13–6.18]	< 0.000
Average Charge	\$1,164.81 [1,163.22-1,166.41]	\$1,208.68 [1,205.21-1,212.15]	< 0.000
Weekend			
Yes	27.30 [27.26–27.34]	26.38 [26.32–26.45]	< 0.000
No	72.69 [72.66–72.74]	73.61 [73.55–73.68]	< 0.000
*- Chi-square test was run for constant categorical variables [sex, age-group and race] and t-tests were run for the proportions estimated for each categories of categorical variables that were averaged over the study period.			
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Over half of the frequent users were insured by Medicaid (51.98%, 95% CI 51.79–52.17), as opposed to 29.33% [95% CI, 29.29–29.38] of non-frequent users. Non-frequent ED users were mainly insured by private insurance (38.67%, 95% CI 38.61–38.72). In contrast with 83.25% [95% CI, 83.10-83.39] of frequent users, 86.14% [95% CI, 86.10-86.17] of non-frequent users lived in the large central and fringe metropolitan area.

A higher share of frequent ED users had one or more chronic conditions than non-frequent users (33.22% compared to 22.79%). While 48.16% [95% CI, 47.97–48.35] of frequent users belonged to the lowest income quartile of the estimated median household income for Maryland, only 33.53% [95% CI, 33.48–33.58] of non-frequent users belonged to the same quartile. Frequent users (6.15 miles, 95% CI 6.13–6.18) lived closer to the hospital than non-frequent users (6.84 miles, 95% CI 6.83–6.85). The average charges for frequent and non-frequent users reported a statistically significant difference (\$1,208.68 and

\$1,164.81 in current US dollars respectively). Over 72% of the frequent and non-frequent users used the ED on a weekday.

Recurrent and non-recurrent ED users in 2017–2018 and 2017–2019

Among the 187,391 unique frequent users, there were 19,160 (10.22%) that visited the ED in two subsequent years (time period 1: 2017–2018) and 9,177 (4.90%) during all three years, (time period 2: 2017–2019). The distribution of recurrent and non-recurrent frequent ED users differed by sex, age, and race at 95% I.o.s (Table 3). As compared to 36.34% [95% CI 35.66–37.02] male patients, 63.66% [95% CI, 62.98–64.34] females visited the ED frequently in time period 1. Consistently, while 34.64% [95% CI, 33.67–35.62] male frequent users visited the ED in time period 2, 65.36% [95% CI, 64.38–66.33] female frequent users were recurring patients during all three years. When compared across age and racial groups, 47.95% [95% CI, 47.25–48.66] of recurrent patients in time period 1 were between 21–44 years, while 41.06% [95% CI, 40.82–41.29] were non-recurrent frequent users. Almost half (48.36%, 95% CI 47.33–49.38) of the recurrent frequent ED users during time period 2 were between 21–44 ages (compared to 41.42%, 95% CI 41.19–41.65 for non-recurrent frequent users). Over half, 57.54% [95% CI, 56.84–58.24] of recurrent frequent ED users in 2017 and 2018 were Black, compared to 52.62% [95% CI, 52.38–52.86] for non-recurrent frequent users. Similar data were reported for recurring visits in 2017, 2018 and 2019 (59.03%, 95% CI 58.02–60.03, and 52.82%, 95% CI 52.58–53.05, for recurrent and non-recurrent users respectively).

Table 3

Characteristics of recurrent and non-recurrent frequent users in Maryland, SEDD 2017–2019.

Visits in 2017 [n = 191,212]	Visits in 2018		P-value	Visits in 2018 and 2019		P-value
	[% , 95%CI]			[% , 95%CI]		
% of patients [No.]	Non-recurrent	Recurrent		Non-recurrent	Recurrent	
Total	89.78 [89.64–89.91] 168,231	10.22 [10.09–10.36] 19,160		95.10 [95.00–95.19] 178,214	4.90 [4.80–4.99] 9,177	
Sex			< 0.000			< 0.000
Male	41.41 [41.17–41.64]	36.34 [35.66–37.02]		41.21 [40.98–41.44]	34.64 [33.67–35.62]	
Female	58.59 [58.36–58.83]	63.66 [62.98–64.34]		58.79 [58.56–59.02]	65.36 [64.38–66.33]	
Age group			< 0.000			< 0.000
0–20 years	20.81 [20.61–21.00]	12.08 [11.63–12.55]		20.44 [20.25–20.63]	9.72 [9.13–10.34]	
21–44 years	41.06 [40.82–41.29]	47.95 [47.25–48.66]		41.42 [41.19–41.65]	48.36 [47.33–49.38]	
45–64 years	23.37 [23.17–23.58]	29.68 [29.04–30.33]		23.61 [23.41–23.80]	31.99 [31.05–32.95]	
65 and over	14.76 [14.59–14.93]	10.28 [9.86–10.72]		14.53 [14.37–14.70]	9.93 [9.33–10.56]	
Race			< 0.000			< 0.000
*- Chi-square test was run for constant categorical variables [sex, age-group and race] and t-tests were run for the proportions estimated for each categories of categorical variables that were averaged over the study period.						

Visits in 2017 [n = 191,212]	Visits in 2018 [% , 95%CI]		P-value	Visits in 2018 and 2019 [% , 95%CI]		P-value
NH White	37.55 [37.32–37.78]	36.88 [36.19–37.56]		37.55 [37.32–37.77]	36.23 [35.25–37.22]	
NH Black	52.62 [52.38–52.86]	57.54 [56.84–58.24]		52.82 [52.58–53.05]	59.03 [58.02–60.03]	
Hispanic	6.15 [6.03–6.26]	3.24 [2.99–3.50]		6.01 [5.90–6.13]	2.64 [2.33–2.98]	
NH Other	3.68 [3.59–3.77]	2.34 [2.14–2.57]		3.62 [3.53–3.70]	2.10 [1.83–2.42]	
Payer						
Private	19.94 [19.77–20.12]	13.26 [12.84–13.67]	< 0.000	19.66 [19.50–19.83]	11.40 [10.84–11.96]	< 0.000
Medicaid	49.83 [49.61–50.05]	57.49 [56.86–58.12]	< 0.000	50.20 [49.99–50.42]	58.45 [57.54–59.37]	< 0.000
Medicare	23.35 [23.16–23.54]	24.84 [24.26–25.42]	< 0.000	23.35 [23.16–23.54]	26.50 [25.64–27.35]	< 0.000
Self-pay/No-charge	6.87 [6.79–6.97]	4.41 [4.22–4.59]	< 0.000	6.79 [6.70–6.87]	3.65 [3.42–3.89]	< 0.000
Location						
Large central and fringe metros	83.52 [83.35–83.69]	82.10 [81.57–82.63]	< 0.000	83.43 [83.26–83.60]	82.27 [80.51–83.03]	< 0.01

*- Chi-square test was run for constant categorical variables [sex, age-group and race] and t-tests were run for the proportions estimated for each categories of categorical variables that were averaged over the study period.

Visits in 2017 [n = 191,212]	Visits in 2018 [% , 95%CI]		P-value	Visits in 2018 and 2019 [% , 95%CI]		P-value
Medium and small metros	12.70 [12.54–12.85]	14.02 [13.54–14.50]	< 0.000	12.77 [12.62–12.92]	14.09 [13.40–14.78]	< 0.01
Micropolitan areas	1.71 [1.65–1.77]	1.68 [1.50–1.85]	0.7165	1.72 [1.66–1.77]	1.52 [1.29–1.76]	0.1514
Non-core areas	2.07 [2.00–2.14]	2.21 [2.00–2.41]	0.1970	2.08 [2.02–2.15]	2.12 [1.83–2.40]	0.8376
GRPCI						
No chronic condition	68.97 [68.80–69.15]	60.57 [60.05–61.08]	< 0.000	68.66 [68.49–68.83]	57.56 [56.81–58.30]	< 0.000
One chronic condition	20.04 [19.90–20.17]	25.23 [24.83–25.63]	< 0.000	20.26 [20.13–20.39]	26.55 [25.98–27.12]	< 0.000
Two or more chronic condition	10.99 [10.87–11.11]	14.21 [13.83–14.58]	< 0.000	11.08 [10.97–11.20]	15.89 [15.33–16.45]	< 0.000
Median Household income						
First Quartile	46.70 [46.48–46.93]	51.33 [50.69–51.97]	< 0.000	46.89 [46.68–47.11]	52.76 [51.84–53.68]	< 0.000
Second Quartile	24.22 [24.04–24.41]	24.03 [23.52–24.53]	0.4959	24.23 [24.05–24.41]	23.65 [22.94–24.37]	0.1574
Third Quartile	18.49 [18.32–18.66]	16.70 [16.25–17.15]	< 0.000	18.42 [18.25–18.58]	16.21 [15.58–16.84]	< 0.000

*- Chi-square test was run for constant categorical variables [sex, age-group and race] and t-tests were run for the proportions estimated for each categories of categorical variables that were averaged over the study period.

Visits in 2017 [n = 191,212]	Visits in 2018 [% , 95%CI]		P-value	Visits in 2018 and 2019 [% , 95%CI]		P-value
Fourth Quartile	10.58 [10.44–10.71]	7.94 [7.61–8.28]	< 0.000	10.46 [10.33–10.60]	7.38 [6.91–7.84]	< 0.000
Weekend						
Yes	26.36 [26.27–26.44]	26.50 [26.33–26.67]	0.296	26.36 [26.28–26.45]	26.56 [26.34–26.78]	0.2994
No	73.64 [73.55–73.73]	73.50 [73.33–73.67]	0.296	73.64 [73.55–73.72]	73.44 [73.22–73.66]	0.2994
Average Charge	\$1,201.59 [1,197.24-1,205.93]	\$1218.03 [1,208.05-1,228.01]	0.015	\$1,200.10 [1,195.93-1,204.28]	\$1,264.79 [1,250.77-1,278.80]	< 0.000
Average Distance	6.30 miles [6.27–6.33]	5.80 miles [5.73–5.88]	< 0.000	6.28 miles [6.24–6.31]	5.67 miles [5.57–5.77]	< 0.000
*- Chi-square test was run for constant categorical variables [sex, age-group and race] and t-tests were run for the proportions estimated for each categories of categorical variables that were averaged over the study period.						

Majority of the recurrent frequent users were insured by Medicaid. Over half (57.49%, 95% CI 56.86–58.12) of recurrent frequent users in 2017 and 2018 reported to have Medicaid, compared to 49.83% [95% CI, 49.61–50.05] for non-recurrent frequent users. Consistently, Medicaid patients accounted for 58.45% [95% CI, 57.54–59.37] of recurrent users in 2017, 2018 and 2019. Residents of large central and fringe metro areas accounted for 82.27% [95% CI, 80.51–83.03] of recurring frequent users in 2017, 2018 and 2019 (compared to 83.43%, 95% CI 83.26–83.60, for non-recurring users). Similar results were found for recurrent frequent users in 2017 and 2018. Over a quarter (25.22%, 95% CI 24.83–25.63) of recurrent frequent users in 2017 and 2018 had a single chronic condition (20.04%, 95% CI 19.90-20.17, for non-recurring patients). Similar shares were reported for recurrent patients in all three years (26.55%, 95% CI 25.98–27.12, and 20.26%, 95% CI 20.13–20.39). Most recurrent frequent users belong to the lowest income quartile (51.33%, 95% CI 50.69–51.97, in time period 1, and 52.76%, 95% CI 51.84–53.68, in time period 2). The average visit charge for a recurrent frequent user \$1,264.79 [95% CI, 1,250.77-1,278.80] in time period 2 was higher (and statistically significant) from that of a non-recurring frequent user (\$1200.10, 95% CI 1,195.93-1,204.28). A recurrent frequent user traveled 0.5 and 0.6 miles lesser than a non-recurrent frequent user in period 1 and 2 respectively.

Multivariable Analysis

Results of the multivariate logistic regressions are presented in Table 4. Model 1 compared frequent ED users to non-frequent ED users, while Models 2 and 3 compared recurrent frequent ED users to non-recurrent users in 2017–2018 and 2017–2019 respectively.

Table 4

Logistic Regression Results, Factors associated with frequent and recurrent ED users, 2017–2019.

	Model 1: All frequent users	Model 2: Recurrent frequent users in 2017 and 2018	Model 3: Recurrent frequent users in 2017, 2018 and 2019.
Comparison Group:	Non-frequent user	Non-recurrent frequent user	Non-recurrent frequent user
Total Sample Size (n)	3,279,651	187,391	187,391
Sex			
Male	Reference	Reference	Reference
Female	1.16 (1.15, 1.17)	1.22 (1.18, 1.25)	1.30 (1.24, 1.36)
Age group			
0–20 years	Reference	Reference	Reference
21–44 years	2.04 (2.02, 2.07)	1.99 (1.90, 2.09)	2.41 (2.24, 2.60)
45–64 years	1.49 (1.47, 1.52)	1.79 (1.69, 1.89)	2.19 (2.01–2.38)
65 and over	0.79 (0.78, 0.81)	0.75 (0.69, 0.82)	0.80 (0.71, 0.90)
Race			
NH White	Reference	Reference	Reference
NH Black	1.26 (1.25, 1.28)	1.05 (1.01, 1.08)	1.08 (1.03, 1.13)
Hispanic	0.70 (0.69, 0.71)	0.65 (0.59, 0.71)	0.60 (0.52, 0.68)
NH Other	0.69 (0.67, 0.70)	0.74 (0.67, 0.82)	0.72 (0.62, 0.84)
Payer			
Private	Reference	Reference	Reference

Note: Values in bold indicate results that are not statistically significant

	Model 1: All frequent users	Model 2: Recurrent frequent users in 2017 and 2018	Model 3: Recurrent frequent users in 2017, 2018 and 2019.
Medicaid	4.03 (3.98, 4.08)	2.00 (1.90, 2.11)	2.41 (2.24, 2.60)
Medicare	2.75 (2.71, 2.80)	2.09 (1.96, 2.23)	2.62 (2.39, 2.86)
Others	1.21 (1.18, 1.23)	0.77 (0.69, 0.86)	0.65 (0.55, 0.78)
Location			
Large central and fringe metros	Reference	Reference	Reference
Medium and small metros	1.06 (1.05, 1.07)	1.09 (1.04, 1.14)	1.07 (1.00, 1.14)
Micropolitan areas	1.43 (1.38, 1.48)	0.91 (0.81–1.03)	0.78 (0.65, 0.93)
Non-core areas	0.97 (0.94, 1.00)	1.02 (0.92, 1.14)	0.93 (0.80, 1.09)
GRPCI			
No chronic condition	Reference	Reference	Reference
One chronic condition	1.79 (1.77, 1.81)	1.94 (1.85, 2.04)	2.20 (2.06, 2.35)
Two or more chronic condition	2.73 (2.69, 2.78)	1.95 (1.83, 2.08)	2.34 (2.14, 2.54)
Median Household income			
Fourth Quartile	Reference	Reference	Reference
Third Quartile	1.29 (1.27, 1.31)	1.15 (1.08, 1.24)	1.19 (1.08, 1.32)
Note: Values in bold indicate results that are not statistically significant			

	Model 1: All frequent users	Model 2: Recurrent frequent users in 2017 and 2018	Model 3: Recurrent frequent users in 2017, 2018 and 2019.
Second Quartile	1.33 (1.12, 1.36)	1.25 (1.17, 1.34)	1.31 (1.19, 1.43)
First Quartile	1.69 (1.66, 1.71)	1.23 (1.15, 1.31)	1.33 (1.21, 1.46)
Weekend			
No (0)	Reference	Reference	Reference
Yes (1)	1.02 (1.00, 1.02)	0.90 (0.84, 0.96)	0.87 (0.80, 0.94)
Logged average distance	1.09 (1.09, 1.10)	1.01 (0.99–1.03)	1.03 (1.00, 1.05)
Year			
2017	Reference	–	–
2018	0.96 (0.95, 0.97)	–	–
2019	0.93 (0.92, 0.94)	–	–
Note: Values in bold indicate results that are not statistically significant			

Compared to males, women were 1.16 times [95% CI 1.15,1.17] more likely to be frequent users. They were also 30% [95% CI 1.24,1.36] more likely to be recurrent frequent ED users than male frequent users in time period 2. While patients aged 21 to 44 were twice more likely to visit the ED frequently as compared to children and adolescents (0–20 years), they also were 2.41 [95% CI 2.24,2.60] times more likely to be recurrent frequent users more than younger frequent users. NH Black ED users were 26% [95% CI 1.25,1.28] more likely to be frequently seen by an ED healthcare worker than NH White patients. Compared to NH White frequent ED users, NH Black frequent ED users were 8% [95% CI 1.03,1.13] more likely to be seen recurrently through 2017 to 2019.

Patients insured by Medicaid were 4 times [95% CI 3.98,4.08] more likely to be frequent ED users, compared to privately insured patients. They were also 2.41 times more likely to be recurring ED users (95% CI 2.24–2.60) while Medicare patients were 2.75 times [95% CI 2.71,2.80] more likely to be recurrent frequent ED users. Compared to residents of large central and fringe metropolitan areas, patients from micropolitan areas were 43% [95% CI 1.38,1.48] more likely to be frequent ED users, however less likely to

be recurrent frequent users in time period 2 [OR = 0.78, 95% CI 0.65,0.93]. A patient with two or more chronic conditions was 2.73 times [95% CI 2.69,2.78] more likely to be frequently seen at the ED than patients with no chronic condition. Consistently, these patients were also 2.34 times [95% CI 2.14,2.54] more likely to be recurrent ED users than those with no chronic condition. Patients who belonged to the lowest income quartile were 69% [95% CI 1.66,1.71] more likely to be frequent ED users than patients who belonged to the highest income quartile. They were also 33% [95% CI 1.21,1.46] more likely to be recurrent frequent patients, compared to frequent users of the highest income quartile. When compared to non-frequent users, frequent users were 9% [95% CI 1.09, 1.10] more likely to use the ED as the distance to the ED from their residence increased. Patients visited the ED in 2018 and 2019 less often than in 2017.

Discussion

This study estimated the volume and proportion of frequent and recurrent ED users by patient and community level characteristics for the state of Maryland using administrative SEDD dataset across 2017–2019. Of the total 5,331,843 ED visits in Maryland, frequent visits made up 24.4% (1,301,301) of the visits while frequent users made up 7.16% (234,973) of all ED users. Among the frequent users, there were 19,160 (10.22%) recurrent ED users in 2017 and 2018 and 9,177 (4.90%) in 2017, 2018, and 2019. The adjusted logistic regression models indicate that frequent and recurrent ED users are associated with being female, 21–44 years old, NH Black, Medicaid beneficiaries and with two or more chronic conditions. Frequent ED users were also associated with lower income, living in medium/small metro areas and micropolitan areas and those living further from an ED facility.

Our study findings are comparable to other studies. When defined as 4 or more ED visits annually, frequent users and visits accounted for 4.4-8% of all ED patients and 21–28% of all ED visits respectively based on a systematic review study (2010) [5]. Frequent users of the ED in Maryland accounted for 7.2% of the all ED users, while frequent visits accounted for 24.4% of the total visits. Consistently, studies found women, 25–44 ages, NH Black, having Medicaid or Medicare insurance, or sicker populations to be frequent or recurring ED users [5, 9]. Contrary to previous studies [8, 10], frequent ED users were more likely to be living further from an ED in Maryland. Concomitantly, frequent ED users were more likely to be residing in micropolitan areas or smaller towns adjacent to metropolitan areas. Consistent to a prior study [19] that found a greater degree of rurality associated with ambulatory care sensitive conditions (ACSHs) across eight states in the US, one plausible explanation of this finding could be that residents from micropolitan areas in Maryland do not have an easy access to community providers, leading to a higher reliance on the EDs.

Prior studies found preponderance of exacerbation of chronic diseases such as asthma/chronic obstructive pulmonary disease, mental health diagnoses, and dental complaints to be strong predictors of frequent ED visits [5, 9, 20]. In a study involving low income mothers and their children in an inner city in Maryland, a study [20] pointed out to psychological stress and deplorable housing conditions critical factors to explore among frequent ED users. Similar to prior studies [21], we found four of the top ten diagnoses of frequent ED visits to be related to pain, specifically chest, abdominal, and low back pain.

Chest pain was the top diagnosis that contributed to over \$130.3 million in charges, followed by abdominal and upper respiratory infection (~\$46 million). Majority of the frequent ED users (92.96%) were treated and released might be further indicative of the fact that these could be treated in an outpatient setting by a provider in the community at a much lesser cost such as an urgent care clinic or a primary care physician office. In 2019, while an average lower-acuity visit to an ED cost \$1,716, it cost \$178 in an urgent care center [22]. Diverting volumes of frequent ED users into an outpatient community setting may not only be cost-effective but also make EDs less crowded and more efficient to handle more severe cases.

When compared by payer type, frequent/recurrent ED users were four times more likely to be Medicaid beneficiaries in contrast with non-frequent users. While this is consistent with previous studies [23], that have found frequent users to be disproportionately insured by public programs, it is noteworthy that Maryland is one of the states that have expanded Medicaid in 2014 [24]. Prior studies have demonstrated that Medicaid expansion states have seen decreases in self-pay visits and increases in Medicaid visits, suggesting that once uninsured individuals have gained insurance through Medicaid [25]. This plausibly points out to challenges faced by Medicaid beneficiaries in gaining access to a physician in the community due to factors such as long waits for appointments with physicians, physicians not accepting Medicaid patients due to low reimbursement rates, or inability to access a physician due to lack of means of transportation [26].

Our study points out that 24.4% of the overall ED visits are made up by frequent users, while frequent or recurrent users are significantly more likely to report multiple chronic conditions. It is well known that those with multiple chronic conditions are one of the target populations for effective care coordination and individualized care plans [12]. While some EDs in the state of Maryland have effectively managed care-coordination by hiring dedicated staff, others need to invest more in care coordination [27]. Additionally, providing ED patients with both information and immediate access to primary care can help to avoid repeat ED visits for follow-up care. Federal and state policies such as expanding the availability of nurse practitioners and telehealth primary and specialty care can help mitigate barriers to outpatient care access. In the long run, newer delivery models such as accountable care models can be considered to reduce over-utilization of EDs for preventable care encounters, while simultaneously improving ED operations and lowering the costs of care [27].

Information sharing through adoption of information technology and development of robust electronic health record systems can be another effective strategy to reduce frequent ED use [12]. A robust interoperable IT infrastructure is one that connects patient records across the hospital and the primary care settings [28]. Under this system, every time a patient goes to the ED, the PCP would receive an electronic update and a summary of their hospital care. For this system to work effectively, hospitals would need to invest in interoperable technology, and also require patients to be registered with a single primary care provider.

There are several limitations of this study. One of the main limitations of this study was the use of the administrative data that included only patients that visited the EDs. Due to the nature of the data, we were not able to determine if these patients had access to a primary care provider. Our study is limited to the state of Maryland and therefore our findings may not be generalizable to other states of the U.S. Future research should be targeted on examining the specific barriers faced by frequent users in accessing healthcare services in the community. Further research to examine if there are specific barriers associated with primary care availability, out-of-office hours, or limited transportation would be helpful in alleviating some of the obstacles faced by frequent users.

Conclusion

In conclusion, frequent and recurrent frequent ED users in the state of Maryland were associated with being female, 21–44 years old, NH Black, Medicaid beneficiaries and with two or more chronic conditions. Frequent ED users were associated with being low income and living closer to an ED facility. We recommend strategies for hospitals such as investments in care coordination and individualized care plans especially for those with multiple chronic conditions. Investments in information technology such as robust electronic health record systems could help in reducing frequent ED visits. At a policy level, expanding the availability of nurse practitioners and telehealth primary and specialty care can help mitigate barriers to outpatient care access for specific populations, such as Medicaid beneficiaries. Finally, from a population health perspective, newer delivery models such as accountable care organizations and medical homes can serve better in coordinated care for vulnerable populations.

Declarations

Ethics approval and consent to participate

The study was approved by Marymount University's and University of South Dakota's Institutional Review Board (IRB) under the exempt category. The study was also deemed exempt from review by the ethics committee. All data in this study was anonymized, and hence no informed consent was necessary. This status also required the completion of the Collaborative Institutional Training Initiative (CITI). Data user agreements and training courses were also completed by the researchers who handled and analyzed the data as required by the Healthcare Cost and Utilization Project (HCUP).

Consent for publication

Not applicable.

Availability of data and materials

The data that support the findings of this study are available from the Healthcare Cost and Utilization Project (HCUP). Restrictions apply to the availability of these data, which were used under license for the

current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of the Healthcare Cost and Utilization Project (HCUP).

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

These are the contributions of the authors according to CRediT (Contributor Roles Taxonomy):

1. Conceptualization: UK, ABA. 2. Data curation: UK; SCT 3. Formal analysis: UK, DT; SCT 4. Funding acquisition: N/A 5. Investigation: UK, ABA; 6. Project administration: UK, JGS; 7. Methodology: UK, ABA, DT; SCT 8. Resources: UK, JGS; 9. Software: UK, DT; 10 Supervision: UK; 11. Validation: UK, ABA; SCT 12. Visualization: UK, ABA, DT; 13. Writing-original draft: UK, ABA, DT, JGS; SCT 14. Writing, review and editing: UK, ABA, DT, JGS. SCT. The authors read and approved the final manuscript.

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Figures

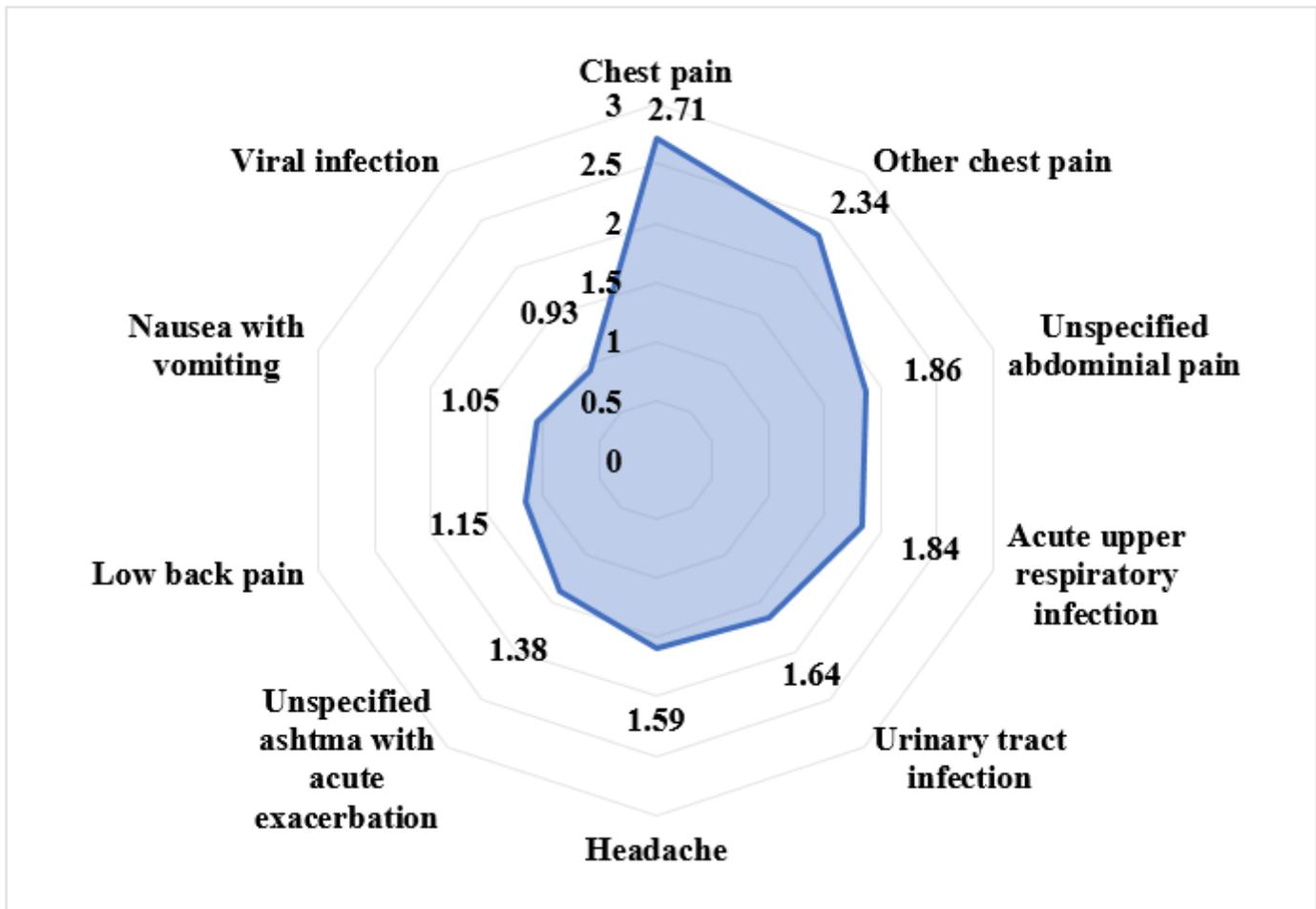


Figure 1

Top ten diagnoses associated with frequent visits in Maryland EDs, 2017-2019

Supplementary Files

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