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Association of office-based provider visits with emergency department utilization among publicly insured stroke survivors

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ABSTRACT

Objective: To evaluate the association between visits to office-based providers and Emergency Department (ED) utilization among stroke survivors.
Methods: We analyzed 12-years of data representing a weighted sample of 3,317,794 publicly insured US adults aged ≥18 years with stroke, using the Medical Expenditure Panel Survey Household Component (MEPS-HC), 2003–2014 dataset. We used a negative binomial regression model that accounts for dispersion to estimate the association between office-based and ED visits controlling for covariates. We used a multivariate logistic regression model to identify independent predictors of ED visits.
Results: Annual mean (SD) ED visits and office based visits for publicly insured stroke survivors were 0.60 (1.10) and 12.2 (19.9) respectively. Each unit increase in office based visits was associated with a 1% increase in ED visit (p = 0.008). Being unmarried (adjusted OR = 1.26; 95% CI: 1.015–1.564) and having several comorbidities (adjusted OR = 1.93; 95% CI: 1.553–2.412) were associated with a higher likelihood of at least one ED visit. The odds for an ED visit for individuals aged 45–64, those aged 65 years and above, and those with a college or higher level of education were respectively 34% (OR = 0.66; 95% CI: 0.454–0.965), 52% (OR = 0.48; 95% CI: 0.330–0.701), and 36% (OR = 0.64; 95% CI: 0.497–0.834) lower than their counterparts.
Conclusions: Contrary to our expectations, there was a direct relationship between ED visits and office base visits among U.S. stroke survivors. This finding may reflect the difficulties associated with managing stroke survivors with multiple co-morbidities or complex psycho-socio-economic issues.

1. Introduction

Stroke is the 5th leading cause of mortality and a major cause of adult disability; consequently, the medical cost of stroke is high. For instance, direct stroke costs are projected to nearly triple between 2012 and 2023, reaching $184.13 billion. By in large, population aging and improved acute care account for this rise [1,2]. To curb this trend, more emphasis will need to be placed on optimizing chronic care management by improving regular office-based provider visits, and minimizing the need for interval or frequent emergency department (ED) visits. Publicly insured individuals including stroke survivors are frequent ED services utilizers [3] and their number is projected to increase with the implementation of the Affordable care act signed into law in 2010 [4]. For example, nearly three out of four patients with ischemic stroke vising the ED are publicly insured [5,6]. In the same line, national dataset analyses suggest that between 2006 and 2014, ED visits with stroke increased by 25%; an increase that was particularly high among Medicaid beneficiaries [7]. Despite the high volume of ED utilization by publicly insured stroke patients and the growing number of stroke survivors, to the best of our knowledge, data analyzing the relationship between office-based provider visits and ED encounters among stroke survivors are scanty. Using recent data from the largest nationally representative survey in the United States, we tested the hypothesis that ED utilization and office-based visits by stroke survivors are inversely related.

2. Methods

2.1. Data source and sample population

In this analysis, we used the Medical Expenditure Panel Survey Household Components (MEPS-HC), initiated in 1996. Briefly, each

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year, a new panel of around 15,000 sample households is selected. Data can be analyzed at either the person or the event level. MEPS is a large-scale survey of families and individuals, their medical providers, and employers across the United States. Households selected for each panel of MEPS-HC is a subsample of households participating in the previous year's National Health Interview Survey (NHIS) conducted by National Center for Health Statistics. The NHIS sampling frame provides a nationally representative sample of the US civilian noninstitutionalized population with oversampling of Blacks and Hispanics. Data obtained from the surveys must be weighted to produce national estimates [8,9].

Information on the MEPS-HC is collected by self-report, and a sample of medical providers is contacted by telephone to obtain information that household respondents cannot accurately provide. This part of the MEPS is the Medical Provider Component (MPC) collecting data on dates of visit, diagnosis and procedure codes, charges and payments. MEPS-MPC is a follow-back survey that collects data from a sample of medical providers and pharmacists. In addition to household component (HC) data, MPC data are collected for a sample of office-based visits and ED visits in order to verify and supplement date obtained from household interviews. The survey is designed in such a way that the MPC improves the overall quality of MEPS utilization [8,9]. Diagnoses coded according to ICD-9-CM (International Classification of Disease, Ninth Revision, Clinical Modification) are also collected as part of the MPC [9]. We merged 12-year pooled data (2003–2014) in order to ensure a sufficient sample size of publicly insured individuals with stroke. In this study, we analyzed a sample of 4705 (weighted population representing 3,317,794) publicly insured adults with stroke.

MEPS condition files merges self-reported conditions into three digit ICD-9-CM codes. Stroke was identified based on ICD-9-CM codes (431, 433, 434, 436, and 438) or self-report. Self-reported stroke was based on “yes” response to the following question: “Have you ever been told by a health professional that you have had a stroke or transient ischemic attack (mini stroke)?” [9]. The public insurance category includes individuals who were covered by Medicare, Medicaid, or other public hospital/physician programs [8]. The complex survey design accounts for the sampling weights, clustering and stratification design in order to allow generalizations for the US population [8].

2.2. Variables of interest

2.2.1. Dependent variable

The dependent variable in this study was annual emergency department visits, which represent a count of all ED visits reported for the survey 2003/14. We generate two dependent variables from the count data for ED visits, a binary variable (zero vs any positive visits) and continuous variable.

2.2.2. Primary independent variable

The primary independent variable was annual office-based provider visit for the survey 2003/14, which we treated as a continuous variable.

2.3. Covariates

Sociodemographic and comorbidities were included in the analysis because they also affect healthcare utilization. Age, sex, race/ethnicity, education, census region, income, marital status, Charlson Comorbidities index (CCI) and year category were included. The following age (in years) categories were included: 18–45, 46–64, and ≥ 65 years. We coded marital status into three groups: married, non-married (Widowed/Divorced/separated), and never married. We defined income level as a percentage of the poverty level and grouped it in to four categories: poor (< 125%), low income (125% to < 200%), middle income (200% to < 400%) and high income (≥ 400%). Charlson Comorbidities Index (without stroke) was adopted from D'Hoore [10]. The CCI was grouped into three categories: 0, 1 and ≥ 2.

Table 1
The proportion of population characteristics among adults with stroke and publicly insured (n = 4705, N = 3,317,794).

Variables	Percentage (%)
Age category	
Age 18–44	5.4
Age 45–64	25.7
Age 65–85	68.9
Gender	
Male	43.7
Female	56.3
Race/ethnicity	
Non-Hispanic White	68.2
Non-Hispanic Black	16.7
Hispanic	9.8
Others	5.3
Marital status	
Married	37.6
Non-married[a]	53.2
Never married	9.2
Education category	
< High School	17.3
High School	48.9
College or more	33.8
Census region	
Northeast	16.5
Midwest	20.1
South	40.8
West	22.6
Income category	
Poor income	37.9
Low income	24.1
Middle income	23.7
High income	14.3
Charlson Comorbidity Index	
0	31.4
1	14.7
≥2	53.9
Usual Source of Care	
Yes	95.0
Year category	
Year 2003/06	24.4
Year 2007/10	35.0
Year 2011/14	40.6
Utilization	
ED visit mean (S.D)	0.60 (1.10)
Office based visit (SD)	12.2 (19.9)

N - weighted sample size; n - unweighted sample size; %, weighted percentage.
[a] Non-married stands for widowed/divorced and separated.

2.4. Analyses

Data were analyzed using descriptive statistics to estimate the population characteristics and mean of healthcare visit among adults with stroke and public insurance (Table 1). The association between demographic characteristics and ED visits was estimated using unadjusted logistic regression and expressed as odds ratio (OR) at 95% Confidence Interval (CI) (Table 2). ED visits counts ranged from 0 to 12. As 65% of the sample had zero visit and the variance exceeds the mean, we used a negative binomial regression to estimate the association between office based visit on ED utilization (Table 2) [11]. Independent predictors of “ED visit” accounting for extraneous confounders were depicted in a forest plot diagram (Fig. 1). For interpretation, we use the odds ratio coefficient of the logistic regression. In order to test the adequacy of the model, we applied the F-adjusted mean residual goodness-of-fit. After fitting the logistic regression models, taking the survey design into account, the F-adjusted mean residual goodness-of-fit suggested no evidence of lack of fit [12]. We used the link test (a diagnostic test that accounts for complex survey design) to examine the model specification error and found no evidence of model specification error in the models [11].

Table 2
Unadjusted association: factors associated with the likelihood of ED visit among adults with stroke.

Variables	Unadjusted odds-ratio	95% CI	P-value
Office visit	1.010***	1.005–1.015	< 0.001
Age 18–44 (Ref.)			
Age 45–64	0.826	0.606–1.126	0.227
Age 65–85	0.536***	0.401–0.716	< 0.001
Male (Ref.)	–	–	
Female	1.145	0.980–1.338	0.087
Non-Hispanic White (Ref.)	–	–	
Non-Hispanic Black	1.286**	1.088–1.521	0.003
Hispanic	1.010	0.801–1.272	0.932
Others	0.877	0.622–1.236	0.455
Married (Ref.)	–	–	
Non-married	1.327**	1.099–1.603	0.003
Never married	1.484**	1.109–1.986	0.008
< High School (Ref.)	–	–	
High school	0.840	0.663–1.064	0.149
College or more	0.682**	0.539–0.864	0.002
Northeast (Ref.)	–	–	–
Midwest	1.127	0.823–1.545	0.453
South	0.971	0.733–0.1.285	0.839
West	0.968	0.698–1.342	0.847
Poor income (Ref.)	–	–	
Low income	0.780*	0.639–0.952	0.015
Middle income	0.667***	0.541–0.822	< 0.001
High income	0.708*	0.536–0.934	0.015
Charlson comorbidity index			
0 (Ref.)			
1	1.899***	1.443–2.500	< 0.001
≥ 2	1.731***	1.440–2.081	< 0.001
Usual source of care			
No (Ref.)	–	–	
Yes	0.786	0.580–1.065	0.121
Year 2003/06 (Ref.)	–	–	
Year 2007/10	0.943	0.751–1.184	0.614
Year 2011/14	0.986	0.788–1.233	0.903

Primary outcome variable in this model is ED visit.
* Level of significance p < 0.05.
** level of significance p < 0.01.
*** level of significance p < 0.001.

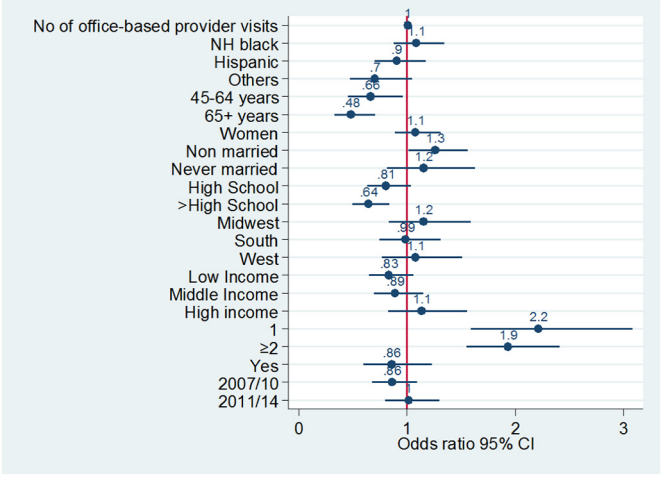

Fig. 1. Multiple Logistic Regressions: factors associated with the likelihood of any ED visit. Odds ratio for the association of each variable with ED visits are indicated on top of each horizontal line. A positive association occurs for odds ratio > 1 with horizontal line not crossing the vertical red line. A negative association is achieved when the odds ratio < 1 and the vertical line does not cross the vertical red line. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

We performed all analyses at the person-level using STATA 14 [13]. Level of significance was set at p < 0.05 level.

3. Results

3.1. Population characteristics

Out of 98, 260 publicly insured U.S adult participants included in the final analysis, 4705 (4.8%) had stroke representing a weighted US population of 3,317,794 (Table 1). Nearly seven out of ten publicly insured stroke survivors were aged 65 years or above. The annual mean ED visit and office based visit for publicly insured stroke survivors were 0.60 and 12.2, respectively.

3.2. Unadjusted association of ED visits with socio-demographic characteristics and comorbid conditions

Each office-based visit was associated with 1% (OR = 1.010; 95% CI: 1.005–1.015) more ED visit (Table 2). The following variables were associated with a lower likelihood of ED visits: Age (Elderly vs. young, OR = 0.536; 95% CI: 0.401–0.716), level of education (college educated or more vs. less than high school, OR = 0.682; 95% CI: 0.539–0.864), income level (low income vs. poor income, OR = 0.780; 95% CI: 0.639–0.952, middle income vs. poor income, OR = 0.667; 95% CI: 0.541–0.822, high income vs. poor income, OR = 0.708; 95% CI: 0.536–0.934). Non-Hispanic Black participants were more likely to visit the ED (OR = 1.286; 95% CI: 1.088–1.1.521). Similarly, marital status i.e. non-married and never married had a higher likelihood of visiting the ED (OR = 1.327; 95% CI: 1.099–1.603 and OR = 1.484; 95% CI: 1.109–1.986 respectively). Finally, participants with medical comorbidities visited the ED at a higher rate than those without comorbidities (OR for CCI = 1: 1.899; 95% CI: 1.443–2.500 and that CCI ≥ 2: 1.731; 95% CI: 1.440–2.081).

3.3. Independent predictors of ED utilization by publicly insured stroke survivors

Table 3 presents the adjusted negative binomial model estimating the incremental effect of office-based visit and other covariates on ED visit. On average, a unit increase in office-based visit was associated with 0.004 (95% CI: 0.002–0.006, p < 0.001) more ED visits. Elderly participants, Hispanic, participants with a college or higher level of education, had respectively 0.362 (95% CI: -0.566 – -0.159), 0.114 (95% CI: -0.225 – -0.002), and 0.205 (95% CI: -0.348– -0.062) less ED visit. On the other hand, those who were not married had 0.192 (95% CI: 0.079– -0.305) more ED visits. Similarly, participants with a CCI of one had 0.436 (95% CI: 0.218–0.655) and those with a CCI of two or more had 0.340 (95% CI: 0.217–0.463) more ED visits.

We used a forest plot multivariable logistic regression to predict ED visits, adjusting for relevant covariates and time (Fig. 1). For a unit increase in office based visit, we observed about 1% increase in ED visit (OR = 1.01; 95% CI: 1.002–1.015, p = 0.008). Compared to the reference group, the odd for ED visit among non-married, those with a CCI of one, and those with a CCI of ≥2 were respectively 26% (OR = 1.26; 95% CI: 1.015–1.564), 121% (OR = 2.21; 95% CI: 1.015–1.564), and 93% (OR = 1.93; 95% CI: 1.553–2.412). Compared with young individuals (aged 18–44 years), the odd for an ED visit for patients aged 45–64 was 34% (OR = 0.66; 95% CI: 0.454–0.965) lower while that of participants aged 65 was 52% (OR = 0.48; 95% CI: 0.330–0.701) lower. Participants with a college or higher level of education were 36% (OR = 0.64; 95% CI: 0.497–0.834) less likely to visit the ED.

4. Discussion

In this retrospective analysis of the largest nationally representative

Table 3
Adjusted negative binomial model: incremental effects of office based visit and demographic characteristics on the level of ED visit among adults with stroke.

Variables	Incremental effect	95% CI	P-value
Primary independent variable			
Office visit	0.004***	0.002–0.006	< 0.001
Covariates			
Age 18–44 (Ref.)			
Age 45–64	−0.188	−0.389– 0.012	0.066
Age 65–85	−0.362***	−0.566 to −0.159	< 0.001
Male (Ref.)	–	–	
Female	−0.002	−0.094–0.088	0.951
Non-Hispanic White (Ref.)	–	–	
Non-Hispanic Black	−0.009	−0.102– 0.082	0.836
Hispanic	−0.114*	−0.225 to −0.002	0.045
Others	−0.158*	−0.288 to −0.028	0.017
Married (Ref.)	–	–	
Non-married	0.192**	0.079–0.305	0.001
Never married	0.088	−0.066– 0.243	0.261
< High School (Ref.)	–	–	
High school	−0.113	−0.249–0.021	0.100
College or more	−0.205**	−0.348 to −0.062	0.005
Northeast (Ref.)	–	–	–
Midwest	0.049	−0.082–0.180	0.464
South	−0.006	−0.119–0.106	0.911
West	0.048	−0.089–0.185	0.492
Poor income (Ref.)	–	–	
Low income	−0.016	−0.121– 0.089	0.765
Middle income	−0.028	−0.123– 0.065	0.548
High income	0.060	−0.091– 0.212	0.435
Charlson comorbidity index			
0 (Ref.)			
1	0.436***	0.218–0.655	< 0.001
≥2	0.340***	0.217–0.463	< 0.001
Usual source of care			
No (Ref.)	–	–	
Yes	−0.063	−0.225–0.097	0.437
Year 2003/06 (Ref.)	–	–	
Year 2007/10	−0.067	−0.172–0.036	0.204
Year 2011/14	0.027	−0.083–0.137	0.480

Primary outcome variable in this model is ED visit.
* Level of significance $p < 0.05$.
** level of significance $p < 0.01$.
*** level of significance $p < 0.001$.

survey in the United States spanning a 12-year period, we found that the mean annual office-based providers' visits were nearly 20 times higher than ED visits. Contrary to our expectations, there was a direct relationship between ED visits and office base visits among U.S. stroke survivors; having more office-based visits was not associated with less ED visit, albeit with heterogeneity among certain pre-specified groups.

Our findings suggest that publicly insured stroke survivors use ED at an inordinate proportion. In general, publicly insured individuals experience more hurdles to timely access primary care providers. For instance, in a US nationally representative sample of 230,000 individuals, Medicaid beneficiaries reported twice as many barriers to timely primary care visit as privately insured individuals. Some of the barriers included inability to get through on telephone, obtain appointment soon enough, long wait in the physician's office, and limited clinic hours (lack of transportation). These barriers are associated with increased ED utilization [14,15]. Very few studies have looked at the volume of stroke-related ED visits. Extant studies have focused on acute ischemic stroke and have suggested a high ED utilization rate by stroke patients [4,5]. For example, using the 2010–2013 data from the Nationwide Emergency Department Sample, Stunz et al. concluded that between 26.4 and 27.0 visits per 10,000 populations per year in the US were due to acute ischemic strokes [5].

We are not aware of any study that has examined the volume of ED visits by publicly insured stroke survivors. Our study is novel as it has provided to the best of our knowledge, for the first time, nation-wide estimates of the mean annual ED visits by stroke patients and analyzes its association with office-based visits. Available estimates show that in the general population, publicly insured individuals utilize ED at a disproportionately higher rate [16,17]. For instance, among Medicaid beneficiaries, the mean ED visits was estimated at 1.7 based on 2009 MEPS data [17]. We reported an even lower rate over a period of 12 years using the same database. The mean annual ED visit by stroke survivors was 0.60.

Our hypothesis that more office-based visits would be associated with fewer ED visits was based on an assumption that during office-based visits, stroke survivors undergo a health evaluation that includes among others a review of their stroke risk factors, an estimation of their risk of stroke recurrence, and evaluation of the risk of stroke recurrence, counseling, and medication reconciliation. An office-base visit may also be the platform where stroke survivors undergo screening for medical, psychiatric, and social comorbidities, which are common among stroke survivors [18,19]. The lack of an association between more office-based providers' visits and lower ED utilization suggests that some factors not captured in the current study, may influence the relationship between these two parameters. Patients discharged home after stroke often face multiple complex medical and non-medical issues, which may be interrelated. It may be challenging to comprehensively address those issues during office visits. Indeed, a conceptual model hypothesizes that integrating the healthcare system (including office-base provider visits), community health workers and the community is paramount in improving risk factors control among stroke survivors [20]. Furthermore, the content of each visit may influence its quality and possibly decrease the number of ED visits. In line with this assumption, in a nationally representative sample of US adults aged 18 years or older, providing counseling and ensuring that patients were taking appropriate medications improved the quality of visits [21]. In the current study, some characteristics were associated with a higher likelihood of ED visits. Non-married participants were more likely to visit the ED. This finding, alongside the positive association between level of education and non-significant association of income level with ED visit suggest that socio-economic factors overall may influence the quality of office-based visits and their impacts on ED utilization. Patients who are more stable socio-economically are more likely to establish and maintain a long-lasting relationship with their primary care physician. The absence of a relationship with a regular doctor was associated with a 60% higher chance of visiting the emergency department for non-urgent cares [22]. Another factor that influenced ED visits in the current analysis was the number of comorbidities. A higher number of comorbidities was associated with an increased likelihood to have at least one ED visit. Participants who accumulate comorbidities are at increased risk of medical complications including stroke recurrence and therefore more likely to seek medical care [23]. Paradoxically, in the current study, older patients who typically have more comorbidities had a higher probability of ED visits compared to their younger counterparts further suggesting a true independent association of comorbidities with ED visits risk. In a study of Medicaid beneficiaries, Widmer et al. found that older patients had a higher probability of ED visits than younger participants in the general population [17]. The authors explained their findings in part by the inverse association between literacy and age. Older individuals may encounter barriers in understanding educational tools and information related to their medical conditions and treatments [17,24]. The association of level of education on ED utilization was verified in the current study as those who achieved at least a college level of education were 36% less likely to visit the ED. It is not clear why old stroke patients would be less likely to utilize the ED than younger stroke individuals.

This study has limitations. First, the use of a top down approach did not allow us to analyze the association between ED visits and office-based providers' visits in specific groups including by stroke subtypes. In MEPS, self-reporting was used to diagnose stroke and some comorbidities. It is however unlikely that this has resulted in significant

bias since this approach has been validated in prior large-scale epidemiological studies [25,26]. Second, the nature of the database did not allow us to analyze coordination of care between the ED and primary care providers. Stroke survivors in addition to their residual neurological impairment also have chronic conditions all of which require a complex coordination of care. Finally, we were not able to analyze the quality of care received at the physician's office as well as in the Emergency department. It was also not possible to analyze the pattern of disposition by insurance status following an ED visit as well as the influence of the community and caregivers on these visits. Despite these limitations, our study has several strengths. MEPS data are nationally representative and contain validated standardized and rigorously collected information. We covered a 12-year period including the most recent years of data collected in the survey, therefore providing updated and generalizable conclusions. The strengths of our conclusions also rely on robust statistical methods to analyze the association between office-based visits and ED visits controlling for multiple sociodemographic and standardized comorbidity index.

In conclusion, in this nationally representative sample of US, publicly insured adults stroke survivors spanning a 12-year periods, we found that a greater number of office-based visits was not associated with less ED utilization. Recent trends suggest that ED utilization by stroke survivors, particularly Medicaid beneficiaries are on the rise. In light of skyrocketing US healthcare costs ($2.59 trillion in 2010 and $3.33 trillion in 2016, increased by 28.5%) [27], innovative approaches are needed to maintain the viability of ongoing health programs. Greater efforts are needed to optimize the quality of office-based provider visits, minimize disease and treatment complications, and improve coordination of care between ED and office-based visits.

Disclosures

None.

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