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Consideration of Peripheral Artery Disease as an Ambulatory Care Sensitive Condition: Examining Incidence in U.S. Emergency Departments

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Abstract

Background: Peripheral artery disease (PAD) affects approximately 10% of the U.S. adult population. Those with lower income and education are more likely to develop PAD. The purpose of this study was to analyze the patient characteristics associated with PAD-related emergency department (ED) utilization.

Methods: The 2015 Nationwide Emergency Department Sample (NEDS) was used to model the incidence of PAD in U.S. emergency departments based on various patient demographic and socioeconomic data and the presence of diabetes.

Results: Results of multivariate logistic regression indicate that patients with PAD were significantly more likely to be older, male, a Medicare beneficiary, and have a lower household income. Patients with PAD were also significantly more likely to be hospitalized for longer lengths of time and have diabetes.

Conclusions: This study provides evidence of the disparities surrounding PAD management, access to care, and general population health. PAD management should be focused on targeted preventative interventions.

Keywords: Peripheral artery disease; Diabetes; Atherosclerosis; Health insurance; Rural; Access to care; Emergency department, Disparities; Survey data; Primary care; Low income

Introduction

Ambulatory care-sensitive conditions (ACSCs) are those in which hospital admission could be prevented by primary care interventions [1]. Acute and preventative management of ACSCs act as a buffer to reduce hospital emergency department (ED) utilization rates for these conditions. In the United States, ACSCs can represent a measure of health care system performance by assessing access to primary care resources. These conditions typically respond well to primary care level interventions and management to prevent hospital ED admission.

Despite the potential preventative management from primary care providers, an increasing number of ACSCs are being treated in ED settings [2]. The disproportionate use of the ED for ACSCs are typically highest for underserved groups, indicating differential primary care access or quality care for these populations [3]. Previous studies have identified discrepancies in the nonemergent use of EDs among black, Hispanic, uninsured and low-income patients [4,5]. Johnson et al. (2012) specifically found disparities in ED visits for ACSCs among black, Hispanic, Medicaid insured, those older than 50 and low socioeconomic status [3].

Peripheral artery disease (PAD) is a condition often caused by atherosclerosis and leads to many symptoms and complications including claudication, ischemic rest pain, ischemic ulcerations and limb loss [6]. The diagnosis of PAD is critical as potential complications include myocardial infarction, stroke, cardiovascular disease and all-cause mortality are elevated among those with PAD [7,8]. PAD has a strong relationship with cardiovascular disease as well and shares key risk factors [8]. Diabetes is a major risk factor for vascular disease as well and the PAD course can even be accelerated in those with diabetes. The prevalence of PAD in those with diabetes has been estimated to be as high as 30% [9]. PAD effects approximately 10% of the U.S. adult population [10]. Socioeconomic status, an important contributor to overall health, has been demonstrated to have a strong relationship with PAD [11]. Specifically, those with lower income and education are more likely to develop PAD [12]. Low socioeconomic status is also associated with increased risk of hospitalization from PAD [12].

The purpose of this study was to analyze the patient characteristics associated with PAD-related ED utilization. This study fills a gap in the current knowledge since limited research has been conducted on the patient demographic and socioeconomic characteristics and comorbidities associated with PAD. To our knowledge there is limited information on the association between low income patients with PAD and diabetes.

Methods

The 2015 Nationwide Emergency Department Sample (NEDS) was used to model the incidence of PAD in U.S. EDs based on various patient demographic and socioeconomic data and the presence of diabetes. The NEDS is one database in a collection offered through the Healthcare Cost and Utilization Project (HCUP) sponsored by the Agency for Healthcare Research and Quality. The NEDS contains a stratified sample of all-payer, patient-level ED utilization in the U.S. Weighted results can be used to estimate national trends in U.S. ED visits. ED visits were based on patient demographics (age, gender, location), socioeconomic indicators (primary payer, household income), and health status (discharge status, length of stay, and presence of diabetes). For location, urban was classified as center or fringe metropolitan area, suburban is classified as having a population between 50,000-999,999, and rural has a population less than 50,000. PAD was analyzed using ICD-9 and ICD-10 codes since the transition from the ninth to tenth edition occurred during the third quarter of 2015. The ICD-9 and ICD-10 codes used for PAD and diabetes are as follows: PAD 443.9 and I739, Diabetes 250.00 and E119, respectively. Data was analyzed using bivariate frequencies to determine incidence of PAD. Multivariate logistic regression was used to analyze a binary outcome variable for PAD to calculate odds ratios of the likelihood of occurrence based on patient demographics, socioeconomic status, and health status.

Results

Of the 95,524,715 weighted ED visits in the 2015 NEDS, there were 972,117 (1.02%) incidences of PAD. Results of bivariate analysis (Table 1) indicate that patients who present at the ED for PAD tend to be 65 or older (70.56%), male (54.50%), Medicare beneficiaries (77.33%), have a lower median household income, and reside in a large metropolitan area. Sixty-six percent of patients in the ED for PAD were admitted to the hospital as an inpatient and 26.23% experienced a routine discharge from the ED. Forty-one percent of patients had a length of hospitalization less than two days. Approximately 26% of those with PAD also had diabetes.

Results of multivariate logistic regression (Table 2) indicate that patients with PAD were significantly more likely to be 65 and older, male, a Medicare beneficiary, and have a lower household income. Patients living in urban and suburban locations were significantly more likely to experience PAD compared to rural patients. Patients with PAD were significantly more likely to be admitted as an inpatient (OR: 4.946; CI: 4.607, 5.309), discharged to home health care (OR: 4.406; CI: 4.016, 4.834), die in the ED (OR: 1.471; CI: 1.296, 1.668), or transferred to another acute care hospital or other short-term hospital (OR: 1.745; CI: 1.644, 1.852) compared to a routine discharge. Patients with PAD were significantly more likely to be hospitalized for longer lengths of time and were more likely to have diabetes.

When stratified by diabetes, results of multivariate logistic regression (Table 3) indicate that the demographic characteristics of patients with both PAD and diabetes are comparable to those of patients with just PAD. However, there was no significant difference between suburban and rural patients. Furthermore, the only significant difference in discharge status was that patients with PAD and diabetes were significantly less likely to be admitted as an inpatient compared to having a routine discharge (OR: 0.902; CI: 0.844, 0.963). Finally, patients with PAD and diabetes experienced significantly shorter lengths of hospitalization.

Patient Demographics	n	%
Age		
65+	685,910	70.56%
45-64	263,587	27.11%
27-44	22,621	2.33%
Gender		
Male	539,766	54.50%
Female	442,244	45.50%
Payer		
Medicare	751,274	77.33%
Medicaid	79,756	8.21%
Private	104,610	10.77%
Uninsured	18,066	1.86%
Other government	17,771	1.83%
Median Household Income		
0-25%	334,175	34.92%
26-50%	230,831	24.12%
51-75%	223,177	23.32%
76-100%	168,756	17.64%
Patient Location		
Urban	488,541	50.40%
Suburban	315,242	32.52%
Rural	165,512	17.08%
Discharge Status		
Routine	255,020	26.23%
Transferred to another facility	31,635	3.25%
Home health care	7,599	0.78%
Against medical advice	4,007	0.41%
Admitted as inpatient	642,134	66.06%
Died in ED	1,851	0.19%
Unknown	29,869	3.07%
Length of stay		
0-1 day	404,680	41.63%
2-3 days	222,659	22.90%

4-6 days	200,508	20.63%
7+ days	144,269	14.84%
Diabetes		
No	712,443	73.29%
Yes	259,673	26.71%

Table 1: Bivariate analysis of the patient demographics associated with PAD.

Effect	Point Estimate	95% Confidence Limits		p-values
Age				
65+	11.697	10.876	12.578	<.0001
45-64	7.616	7.187	8.071	<.0001
Gender				
Male	1.507	1.485	1.528	<.0001
Payer				
Other	0.505	0.458	0.558	<.0001
Uninsured	0.317	0.285	0.353	<.0001
Private	0.477	0.452	0.503	<.0001
Medicaid	0.576	0.543	0.611	<.0001
Median Household Income				
0-25%	1.312	1.229	1.401	<.0001
26-50%	1.183	1.114	1.257	<.0001
51-75%	1.130	1.073	1.189	<.0001
Patient Location				
Urban	1.095	1.009	1.188	0.0303
Suburban	1.091	1.008	1.180	0.0311
Discharge Status				
Unknown	1.262	0.985	1.617	0.0662
Died in ED	1.471	1.296	1.668	<.0001
Admitted as inpatient	4.946	4.607	5.309	<.0001
Against medical advice	0.912	0.826	1.007	0.0686
Home health care	4.406	4.016	4.834	<.0001
Transfer to another facility	1.745	1.644	1.852	<.0001
Length of stay				
7+ days	1.076	1.037	1.117	0.0001

4-6 days	1.165	1.133	1.199	<.0001
2-3 days	1.087	1.062	1.114	<.0001
Diabetes				
No	0.671	0.657	0.687	<.0001

Table 2: Logistic Regression of Patients with PAD.

Effect	Point Estimate	95% Confidence Limits		p-value
Age				
65+	1.524	1.367	1.699	<.0001
45-64	1.564	1.405	1.742	<.0001
Gender				
Male	1.049	1.024	1.075	0.0001
Payer				
Other	0.969	0.889	1.057	0.4803
Uninsured	0.740	0.627	0.873	0.0004
Private	0.893	0.855	0.934	<.0001
Medicaid	0.921	0.866	0.979	0.0077
Median Household Income				
0-25%	1.365	1.266	1.471	<.0001
26-50%	1.210	1.123	1.304	<.0001
51-75%	1.134	1.061	1.213	0.0002
Patient Location				
Urban	1.071	1.005	1.140	0.0340
Suburban	1.012	0.951	1.078	0.7011
Discharge Status				
Unknown	1.222	1.026	1.456	0.246
Died in ED	1.203	0.947	1.528	0.1294
Admitted as inpatient	0.902	0.844	0.963	0.0021
Against medical advice	0.907	0.767	1.072	0.2507
Home health care	0.864	0.741	1.007	0.0613
Transfer to another facility	1.067	0.999	1.140	0.0527
Length of stay				
7+ days	0.690	0.655	0.728	<.0001
4-6 days	0.830	0.793	0.869	<.0001

2-3 days	0.932	0.890	0.976	0.0030

Table 3: Logistic Regression of Patients with PAD and Diabetes.

Discussion

In the present study, we found a strong positive association between PAD and lower household income. There was also a strong positive association between those with PAD and diabetes and lower household income. Several potential mechanisms behind PAD and lower household income are plausible. Primarily, cardiovascular disease, which shares key risk factors with PAD, is highly prevalent in low socioeconomic groups [13]. Additionally, access to healthcare is a potential barrier for routine care. Individuals with low income are more likely to lack adequate health insurance and thus refrain from routine medical care [12]. Other plausible factors linking income to PAD includes chronic psychological stress and limited health literacy. Chronic psychological stress is often higher in low socioeconomic and is shown to be associated with atherosclerosis, the key pathology in PAD [14]. Limited health literacy in the low-income groups might also influence health□seeking behaviors like when and where to seek care and adherence to medication. This could also explain an increased risk for PAD among those with low income.

Our study shows the presence of diabetes impacts utilization of health care services for PAD. Patients with PAD and diabetes were more likely to experience a routine discharge. This is likely because hospital discharge instructions for patients with PAD include lifestyle modifications, risk factor reduction therapies and medications, weight control, knowledge of symptoms of disease and maintaining good blood sugar control to reduce diabetes complications [15]. Once the patient's beliefs and knowledge about the disease are better acquainted, effective discharge education can be accomplished with individualized health care interventions. Compliance with lifestyle modifications can then be maintained throughout the treatment process, including follow-up visits with general practitioners, laboratory tests like fasting glucose levels and hemoglobin A1c and continued patient-caregiver education in the primary care setting.

Findings indicate that 17% of patients with PAD live in rural communities. This can be due to a lack of physical resources in rural areas leading to reduced management and exacerbation of complications. One study found a negative association between primary care physicians per capita and the likelihood of hospital admissions for ambulatory conditions [16]. This implies that when fewer primary care physicians are available to the community, a greater number of patients must seek treatment as an inpatient. These unnecessary admissions are avoidable if appropriate medical services are available in the community. Because PAD affects a larger number of people, performing health screenings in rural health clinics may help prevent morbidity and mortality through early diagnosis and management. One study in a rural context observed how specialized training of primary care providers increased their skill and competence in PAD screening [17].

The current study has several limitations. The cross-sectional design precludes the temporal nature of the association between peripheral artery disease and the respective covariates. The study also utilized secondary data which limited the number of variables, preventing further data manipulation. Furthermore, during the 3rd quarter of 2015 the U.S. healthcare industry transitioned from using ICD-9 codes to ICD-10 codes. This transition could have led to coding errors in data analysis and may explain the variation in results over time. However, the current study has several strengths including a large and diverse national sample and availability of several potential confounders for adjustment in multivariable models. These strengths allow for generalizability of the results.

Conclusions

Our findings raise important questions about the preventative care of PAD among vulnerable demographics. The lack of access to quality health care resources may place those with low income and those living in rural areas at a significant disadvantage regarding disease prevention. Evidence for community-based health care interventions targeting specific ACSCs has showed to result in reduced hospital admissions for these conditions [18]. This suggests that similar interventions should be targeted towards patients with PAD to reduce preventable complications.

Our findings point to areas in which PAD management is susceptible to the influence of other health conditions and insurance status. Our study adds to the literature by identifying vulnerable populations within patients who have PAD. To address the quality of care gap, we need to start by providing underserved communities with appropriate education, awareness and quality improvement programs.

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