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Gender Differences in Frequent Emergency Department Use among those with Multi-Morbid Chronic Diseases

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Abstract

Objectives—To examine the association between multi-morbid chronic disease and frequency of past six months emergency department (ED) visits, by gender, in a community sample of adults from North Florida (N=7,143).

Methods—Using logistic regression, we estimated associations between multi-morbid chronic disease and frequent ED use, using gender as an effect modifier.

Results—Multi-morbid chronic disease was associated with frequent ED use overall, with a stronger association among males. Of the 7,143 respondents, 14.4% were frequent ED users, 58.0% were female, and 61.5% were Black Non-Hispanic. Major findings included that females with 3+ chronic diseases were 2.49 (95% CI= 1.7, 3.6) times as likely as females without chronic diseases to report frequent ED use, compared to males with 3+ chronic diseases, who were 4.98 (95% CI= 2.9, 8.6) times as likely as males without chronic disease to report frequent ED use.

Conclusions—Multi-morbid chronic disease is very strongly associated with frequent ED use among all, but the association is especially strong among males. Future research is needed to further understand this association and its implication for health care.

Keywords

Epidemiology; Emergency Department Use; Chronic Disease

1. Introduction

Chronic diseases are those that can be managed but not cured, and affect approximately 117 million Americans, or about half of the United States (U.S.) population, making them one of the most common and costly health problems in the U.S.[1] Among U.S. adults with at least

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one chronic disease, half have additional co-morbid chronic diseases.[1] Some of the most common chronic conditions in the U.S. are coronary artery disease, cancer, COPD/asthma, diabetes, and hypertension. Chronic diseases make up a large portion of United States health spending, accounting for 86% (\$2.9 trillion) of U.S. healthcare costs in 2013.[2] Not only do these chronic diseases increase health care costs but they also result in lost productivity costs.[3]

In line with increasing healthcare costs, emergency department (ED) utilization is also increasing, with the number of ED visits increasing at about twice the rate of the population growth;[4] this has led to an overcrowding of emergency departments resulting in longer wait times, on average, 5.8 hours.[5] Long wait times threaten patient safety, especially among those with a severe illness that requires a time sensitive intervention.

Between 4.5% and 8% of individuals who use an ED are considered frequent visitors; they account for between 21% and 28% of all ED visits.[6] Patients who cycle in and out of the ED frequently receive no care until they experience a health emergency. Many of these patients end up in the ED because of lack of availability of same day primary care appointments or to other specialty services.[7] Managing patients' chronic illnesses, and increasing access to same day care can prevent unnecessary visits to the emergency department.[7,8]

Frequent ED use is generally highest among young adults and seniors compared to other age groups. Individuals who are members of racial or ethnic minorities, who are unemployed, or who have higher rates of poverty are also more likely to be frequent ED users;[6,7] and have less education compared to non-frequent ED users. They are typically covered by Medicare or Medicaid.[6,7]

Research shows that having any chronic disease increases an individual's utilization of the ED.[6,7,9] Associations between having a chronic disease and frequent ED use have been found among those who are older, male, food insecure, uninsured and unemployed.[10–14] Race is also associated with both chronic disease and frequent ED use with Whites having a higher risk of chronic illness and Blacks using the ED more frequently.[12–14] It is also well established that depression is associated both with having another chronic disease[15,16] and with frequent use of healthcare services.[17] Depression is also associated with gender; females have 1.5 to 3 times higher rates than males.[18] However, gender differences in the association between chronic illness and frequent emergency department use have not been established.

Two studies, one by Sun et al[19] and one by Vinton et al[7] were used to inform the current analysis. Sun and colleagues found that social distress and disadvantage, along with individual chronic diseases, were predictive of frequent ED use (4 prior ED visits in the past year). Vinton and colleagues also found associations between frequent ED use as well as super-frequent ED use (>10 ED visits in the last 12 months) and individual chronic diseases such as stroke, coronary artery disease and asthma.

Based on the literature, we hypothesized that having multiple chronic diseases would be significantly associated with frequent ED use and that that gender would modify this

association. Thus, the purpose of this analysis was to understand gender differences in the association between increasing numbers of chronic diseases and the frequency of emergency department visits within a six-month period in a community recruited sample of adults 18 and over in Northeast and North Central Florida, while controlling for important covariates including race, age, health insurance status, food insecurity, and employment status.

2. Methods

2.1 Population

Participants were members of HealthStreet, a community outreach engagement program at the University of Florida, approved by the University's Institutional Review Board, which utilizes the Community Health Worker (CHW) Model to assess community member health conditions and concerns, and willingness to participate in health research. HealthStreet then links community members with research participation opportunities as well as medical and social services.[20,21] For this cross-sectional analysis, participants 18 and over from Northeast and North Central Florida who completed the HealthStreet Intake Form from November 2011 to July 2016 were included. The HealthStreet Intake Form is an in-person interview that takes about 20 minutes to administer and elicits information on socioeconomic status, social connections, physical and mental health conditions, substance use, and basic demographic information. A total of 7,143 participants met the inclusion criteria for this analysis.

2.2 Measures

Exposure—The primary exposure in this analysis was number of lifetime chronic diseases reported. Five of the most common chronic diseases in the United States were used in this analysis: asthma, COPD, coronary artery disease, hypertension, and diabetes. The Health Intake Form asks participants “Have you ever been told you had, or have you ever had a problem with (disease)?” We used responses to those five questions to create a composite variable listing the number of chronic diseases each participant endorsed. Though previous literature categorized chronic diseases into zero and one or more than one,[6] we categorized chronic diseases as zero, “1-2”, and “3-5”, because in exploratory analyses those with 1-2 chronic diseases were statistically similar to each other in terms of socio-demographics, and different from those with 3-5 chronic diseases.

Outcome—Our outcome of interest was frequent ED use manifested by reporting two or more visits in the last six months. Observations with reported number of ED visits exceeding 40 in the last six months ($n=4$) skewed the distribution and were not included in this analysis. The literature varies on the definition of frequent ED use, but it generally defines frequent ED use as four or more visits annually.[6,7,14,19,22] We define frequent ED use as two or more visits in the last six months, roughly equivalent to four visits annually. This was one standard deviation away from the mean number of ED visits in the last six months of our sample (mean=0.6, SD=1.5).

Covariates—All of the covariates were selected based on evidence from the literature for possible effect on ED use.[1,12–14,23–27] Information such as respondent's self-reported

gender, race/ethnicity, age, marital status, history of depression, health insurance status, education level, food insecurity status, and employment status was recorded through the Intake Form. Race/ethnicity was categorized as Black Non-Hispanic, Black Hispanic, White Non-Hispanic, White Hispanic, other Non-Hispanic, or other Hispanic. The Intake Form asks respondents to give a numerical response for “last grade completed?” Responses were categorized as less than or equal to 12 years or more than 12 years to capture those who had completed high school or less and those who had greater than high school education. The Intake Form contains the questions “Have there been times in the last 12 months when you did not have enough money to buy food that you or your family needed?”, “Do you have any type of medical insurance?” and “Are you employed full or part time?” Answers to these questions were used for our food insecurity, insurance status, and employment status variables, respectively, coded as binary yes/no variables. Marital status was coded as never married, married, and separated/widowed/divorced. Depression was included as a covariate to control for the strong association between depression and other chronic diseases. All covariates were tested for effect modification prior to the final analysis.

2.3 Data Analysis

The data analysis for this paper was generated using SAS software, version 9.4 of the SAS System for Windows. Copyright © 2002-2012 SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA. Initial crude odds ratios (ORs) were determined. Each covariate was then assessed for effect modification using the Breslow-Day test for homogeneity; gender was found to be a strong effect modifier with a p-value of 0.028. Next, each covariate was assessed for confounding by determining if it was associated with chronic disease status and with frequent ED use among those with no chronic diseases. Finally, two logistic regression models were generated. The first model included the interaction term for gender, and age; the second included the interaction term, age and the social determinants of health covariates. Manual backward step-wise elimination was used to create the second logistic regression model. Parsimony was achieved by eliminating all covariates that impacted the OR by less than 10% when compared to the fully adjusted model. P-values less than 0.05 were considered to be statistically significant.

3. Results

Of the 7,143 respondents, 1028 (14.4%) were categorized as frequent ED users. About half (51.0%) did not endorse any of the five chronic diseases, 45.1% endorsed 1-2 chronic diseases, and 3.9% endorsed 3-5 chronic diseases. Most of the sample was Black Non-Hispanic (61.5%) and female (58.0%), and 27.2% of the sample endorsed a lifetime history of depression. Approximately two-thirds of the sample had 12 or less years of education (59.0%) and were unemployed (64.8%). Food insecurity was endorsed by almost half (47.0%) of respondents. The uninsured totaled 41.2% of the sample, 27.1% had private insurance, and 31.8% were insured with Medicaid/Medicare.

Table 1 displays demographic characteristics of the frequent ED and non-frequent ED users by self-reported male or female gender. There was no difference by race/ethnicity.

Additionally, for males, those who had endorsed no frequent ED use were significantly younger compared to males who had endorsed frequent ED use in the past six months (mean age 43.7 vs 45.7), but there were no differences in racial/ethnic background. Those who were frequent ED users were significantly less likely to be married (16.0% vs. 19.9%), have at least a high school education (28.5% vs. 37.4%), or be employed (18.5% vs. 38.4%). Frequent ED users were significantly more likely to be food insecure (64.9% vs. 43.5%), have public insurance (26.5% vs. 21.3%), and have a history of depression (39.2% vs. 19.1%). Among males, frequent ED users were significantly more likely to report having both 1-2 chronic diseases (50.0% vs 41.1%) and 3-5 chronic diseases (7.0% vs 1.9%) compared to those who were not frequent ED users.

Among females, those who had endorsed no frequent ED use were significantly older compared to females who had endorsed frequent ED use in the past six months, (mean age 44.2 vs 40.8), but there were no differences in racial/ethnic background. Those who were frequent ED users were significantly less likely to be married (16.3% vs. 22.9%), have at least a high school education (33.5% vs. 46.4%), or be employed (23.5% vs. 36.6%). Frequent ED users were significantly more likely to be food insecure (65.4% vs. 44.3%), have public insurance (44.4% vs. 37.6%), and have a history of depression (48.8% vs 28.0%). Among females, frequent ED users were significantly more likely to report having both 1-2 chronic diseases (55.5% vs 45.7%) and 3-5 chronic diseases (8.4% vs 4.2%) compared to those who were not frequent ED users.

Males and females in this sample, regardless of ED use status, endorsed similar levels of social disparities, including food insecurity ($p=0.1764$) and employment status ($p=0.1885$). However, education level and insurance status were significantly different between genders ($p<0.001$). Depression also varied significantly by gender, with females reporting significantly higher prevalence of lifetime depression compared to males (31.3% vs 21.5%; $p<0.001$).

Having multiple chronic diseases was generally associated with frequent ED use among males and females prior to assessment for effect modification or controlling for covariates. Table 2 shows the odds ratios for the model with the effect modifier and age included, and for the fully adjusted model. The fully adjusted model included the following as covariates in addition to age: marital status, employment status, food insecurity, insurance category, and depression. From the fully adjusted model, males with 1-2 chronic diseases had 1.58 (95% CI= 1.2, 2.0) times the odds of reporting frequent ED use compared to males with no chronic diseases, while males with 3-5 chronic diseases had 4.98 (95% CI= 2.9, 8.6) times the odds of reporting frequent ED use compared to males without chronic disease, after controlling for confounding. Females with 1-2 chronic diseases had 1.61 (95% CI= 1.3, 1.9) times the odds of reporting frequent ED use compared to females with no chronic diseases, while females with 3-5 chronic diseases had 2.49 (95% CI= 1.7, 3.6) times the odds of reporting frequent ED compared to females without chronic diseases, after controlling for confounding.

4. Discussion

Our analysis found that among both males and females, multi-morbid chronic disease was positively associated with increased odds of frequent emergency department use. Gender significantly modified this association with a stronger effect in males, especially males with 3-5 lifetime chronic diseases. Consistent with previous findings, these results found age, food insecurity, depression, marital status and employment status to be important covariates associated with both chronic disease as well as frequent emergency department use. [12,24,27–33] However, we did not find that race was a significant covariate, contrary to other literature.[12,14]

Our findings were in accordance with Van Oostrom[9] who found that individuals with more chronic diseases had a greater number of contacts with a general primary care practitioner. Our results were also in accordance with the findings of Sun and colleagues,[19] in that factors making up social disadvantage such as food insecurity, education level, and employment status were associated with both frequent ED use, and with increasing numbers of chronic diseases. However, we also found that additional chronic diseases in the form of multi-morbid disease resulted in an even greater increase in the odds of frequent ED use than would be expected by those social determinants alone, especially among men.

Gender was a strong effect modifier indicating that the combined effects of gender and number of chronic diseases are multiplicative. In males those with 1-2 chronic diseases had 1.58 times the odds of frequent ED use compared to males with no chronic diseases while males with 3-5 chronic diseases had 4.98 times the odds of frequent ED use compared to those with none. The difference found between those with 1-2 and 3-5 chronic diseases previously mentioned is not as drastic in females, while the difference is quite prominent in males, justifying our categorization of chronic diseases as zero, 1-2, and 3-5. To our knowledge, this is the first analysis to assess gender as an effect modifier as it relates to multiple chronic diseases and frequent ED use. Our results indicate a surprisingly high difference in frequent ED use, particularly in males, between those with 3-5 chronic diseases and those with no chronic diseases. This is an important finding because it indicates the potential for culturally defined gender roles and norms to have an effect on healthcare utilization. Some literature indicates that females seek out primary care more frequently, while males tend to use emergency and accident services.[24,34] Similarly, a recent study of the effects of a CHW intervention on ED visits by Burns and colleagues found that ED use was lower among females than males, regardless of the intervention given.[11]

Males who were frequent ED users were older than males who were not frequent ED users, while females who were frequent ED users were younger than females who were not. This may be an alternative explanation for the increased odds of frequent ED use among males with 3-5 chronic diseases compared to females with 3-5 chronic diseases.

Depression was an important covariate in this analysis. Overall, 31.3% of females and 21.5% of males reported a lifetime history of depression. Depression was more prevalent among frequent ED users compared to non-frequent ED users among both males and females, with 39.2% of male frequent ED users reporting depression and 48.8% of female

frequent ED users reporting depression. Depression has previously been linked to other chronic diseases and increased health resource use,[15–17] and it is well known that depression is more prevalent in females.[35] Depression among both males and females frequent ED users may be important to consider when designing interventions intended to curb frequent ED use among this population.

This analysis is among the first to evaluate multiple chronic diseases as a predictor for emergency department use, by gender, in a community sample from an urban and rural setting. Using a community sample allowed this analysis to not be biased by any particular hospital system. Multi-morbid chronic disease consistently predicted frequent ED use. Respondent's age, employment status, marital status, history of depression, and food insecurity were also significant in predicting frequent emergency department use but were controlled for, as covariates, in this analysis. These results help to fill a gap in research that predicts which individuals are at risk for becoming frequent ED users and provide a basis for the categorization of frequent ED users. By identifying frequent ED users, interventions can be specified to the most frequent users who might otherwise not receive adequate healthcare. [8]

A few limitations should be considered when interpreting the results of this analysis. First, the demographics of our community sample, though not representative, nonetheless provide a baseline understanding of the effect of multiple chronic diseases on emergency department use. In fact, the oversampling of African Americans and low income populations in our community sample provided a population that is similar to populations often found in EDs, large academic medical centers, and urban hospitals.[12] Second, the number of emergency department visits was self-reported and not confirmed through examination of medical records. Last, the R-squared value for the final model is relatively low, so the model is parsimonious but does not explain much of the variance. It is clear that the data available does not capture the entire picture of frequent ED use. However, that was not the intent of this analysis. Frequent ED use is a complicated problem that, based on previous literature, involves numerous variables across multiple domains including socio-economic status, demographics, healthcare access, mental health and acute and chronic illness.[12,14,19] We believe that the covariates included in our analysis represent important factors in frequent ED use due to consistent findings in similar studies.[1,12–14,23–25]

With emergency department utilization continuing to increase in recent years it will be important to further understand the causes of growth in order to plan effective interventions. This analysis has shown that multiple co-morbid chronic diseases are a significant indicator of emergency department use, especially in males, and these results highlight a need for additional studies that examine the degree to which multiple chronic diseases, compared a specific disease, affect frequency of ED use in a nationally representative sample. Similarly, the gender variations in our results highlight a need to further understand how cultural and societal norms may play a role in frequent ED use.

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Table 1

Socio-demographic characteristics by gender and ED use group in the past six months.

	Males		Females	
	No Frequent ED Use n=2636	Frequent ED Use n=358	No Frequent ED Use n=3473	Frequent ED Use n=669
Mean Age ($\pm$SD)^{ABC}	43.7 (15.6)	45.7 (13.7)	44.2 (16.2)	40.8 (14.3)
Race/Ethnicity				
Black Non-Hispanic	1666 (63.5%)	205 (57.6%)	2074 (60.1%)	417 (63.0%)
Black Hispanic	22 (0.8%)	3 (0.8%)	31 (0.9%)	6 (0.9%)
White Non-Hispanic	699 (26.6%)	115 (32.3%)	1043 (30.3%)	189 (28.6%)
White Hispanic	43 (1.6%)	4 (1.1%)	60 (1.7%)	11 (1.7%)
Other Non-Hispanic	(4.6%)	22 (6.2%)	138 (4.0%)	23 (3.5%)
Other Hispanic	74 (2.8%)	7 (2.0%)	102 (3.0%)	16 (2.4%)
Marital Status^{AB}				
Never Married	1406 (53.5%)	172 (48.2%)	1532 (44.2%)	323 (48.3%)
Married	522 (19.9%)	57 (16.0%)	792 (22.9%)	109 (16.3%)
Divorced/Widowed/Separated	700 (26.6%)	128 (35.9%)	1142 (33.0%)	237 (35.4%)
Education^{ABC}				
12 years	1644 (62.6%)	256 (71.5%)	1857 (53.6%)	444 (66.5%)
> 12 years	984 (37.4%)	102 (28.5%)	1609 (46.4%)	224 (33.5%)
Food Insecure^{AB}				
Yes	1141 (43.5%)	231 (64.9%)	1529 (44.3%)	436 (65.4%)
Insurance^{ABC}				
No Insurance	1297 (51.0%)	194 (55.3%)	1106 (32.3%)	277 (41.8%)
Private Insurance	704 (27.7%)	64 (18.2%)	1032 (30.1%)	91 (13.8%)
Medicare/Medicaid	541 (21.3%)	93 (26.5%)	1289 (37.6%)	294 (44.4%)
Employed^{AB}				
Yes	1003 (38.4%)	66 (18.5%)	1266 (36.6%)	156 (23.5%)
Hx of Depression^{ABC}				
Yes	503 (19.1%)	140 (39.2%)	968 (28.0%)	324 (48.8%)
Chronic Diseases^{ABC}				
0	1503 (57.0%)	154 (43.0%)	1740 (50.1%)	242 (36.2%)
1-2	1082 (41.1%)	179 (50.0%)	1586 (45.7%)	371 (55.5%)
3-5	51 (1.9%)	25 (7.0%)	147 (4.2%)	56 (8.4%)

^A P-value 0.05 for across group differences among males by ED use^B P-value 0.05 for across group differences among females by ED use^C P-value 0.05 for across group differences by gender only

Table 2

Odds ratios and 95% confidence intervals for the association between multiple chronic diseases and frequent emergency department use among adults 18 and over in a community sample of adults from North East and North Central Florida (Total N=7,143) presented by model

	Model 1[*]	Model 2^{**}
Males with 1-2 Chronic Diseases Compared to None	1.82 (1.4, 2.3)	1.58 (1.2, 2.0)
Males with 3-5 Chronic Diseases Compared to None	6.33 (3.7, 10.6)	4.98 (2.9, 8.6)
Females with 1-2 Chronic Diseases Compared to None	1.89 (1.6, 2.3)	1.61 (1.3, 1.9)
Females with 3-5 Chronic Diseases Compared to None	3.49 (2.5, 4.9)	2.49 (1.7, 3.6)

* Model 1 is stratified by gender and adjusted for age

** Model 2 is stratified by gender and adjusted for age, depression, marital status, employment status and food insecurity; Hosmer/Lemeshow Goodness-of-Fit p-value=0.2326, R^2 =0.0609