ORIGINAL RESEARCH

GENDER DIFFERENCES IN IN-HOSPITAL MORTALITY RATES AMONG HISPANIC PATIENTS WITH ACUTE MYOCARDIAL INFARCTION

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ABSTRACT

Acute myocardial infarction (AMI) is a leading cause of death in the United States with over three million cases per year. Since the mid-1970s, the total number of deaths related to AMI in the United States has not declined. Studies suggest that women with AMI have worse outcomes compared to men. However, there is limited information regarding this topic among Hispanics.

This study was a secondary analysis of the Puerto Rican Heart Attack Study, which reviewed the records of Hispanic patients of Puerto Rico hospitalized for AMI at 21 academic and/or non-teaching hospitals in 2007, 2009 and 2011. This study set examined the differences in in-hospital mortality rates between genders. A p-value of 0.2 was used to select possible confounders and the chi-square test was used to examine associations between categorical variables. Factors associated with in-hospital mortality rates were identified using logistic regression. Collinearity was assessed using Pearson correlation coefficients. The 95% confidence interval and a p-value of 0.05 were used to determine statistical significance of odds ratios. Analysis was restricted to patients with ICD-9-CM code 410-414 who are above 18 (n = 2265).

In our sample, there were more men than women (1291 versus 974, respectively). Men were younger and smoked more compared to women. Compared to men, women were older and suffered more comorbidities, such as stroke and congestive heart failure (CHF). Women had higher rates of in-hospital mortality compared to men (OR = 1.4, p = 0.040). Factors associated with higher rates of in-hospital mortality included age and CHF (p<0.001). Patients with CHF showed higher rates of in-hospital deaths compared to patients who did not have CHF (OR = 1.6, p = 0.026). Patients over the age of 86 showed higher odds of in-hospital death compared to younger patients (OR = 10.5, p <0.001)

Significant disparities existed by gender in this sample of Hispanic AMI patients, with women showing higher in-hospital mortality compared to men. Women over 50 should perform regular checkups and discuss hormone replacement therapy or follow other preventive measures as suggested by their healthcare provider.

KEYWORDS: Gender Differences, In-Hospital Mortality, Hispanic Patients, AMI.

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INTRODUCTION

With over three million cases per year, myocardial infarction is a leading cause of death in the United States. Almost 620,000 Americans will have a new heart attack and 295,000 will have a recurrent heart attack [1]. It is also considered a leading cause of death in developed countries [2]. Despite the global decline in mortality rates due to acute myocardial infarction (AMI) since the mid-1970s, the total number of deaths related to AMI in the United States has not declined [3]. AMI occurs due to death of the myocardium as a result of an impairment of oxygenation and blood supply. It usually presents with chest pain radiating to the neck, jaw, arms, or back, commonly to the left side. In some cases, it can be asymptomatic or accompanied by other symptoms such as dyspnea, diaphoresis, nausea and vomiting [4].

On average, men suffer their first heart attack at 65 years and women at 72 years, with women having worse outcomes compared to men [1]. The physiological differences between genders may in part be responsible

for the higher mortality rates in women with AMI compared to men. Estrogen fluctuations in women during menstruation, pregnancy and menopause may have an adverse effect on their endothelial lining making them more prone to AMI [4]. However, there is very little information regarding gender differences in in-hospital mortality, especially among Hispanic patients with AMI. The purpose of our study is to investigate the disparities in in-hospital mortality between men and women with AMI.

METHODS

This study was a secondary data analysis of information collected from the Puerto Rico Heart Attack Study, which was a non-concurrent prospective study conducted during 2007, 2009 and 2011. It included data related to gender and in-hospital mortality for 2962 patients with AMI. All patients with ICD-9 410-114 codes who were 18 years or older were eligible for inclusion. The final sample size was 2265. Age was categorized as follows: less than 55,

55-64 years, 65-75 years, 75-85 years and 86 years or older. The chi-square test was used to examine the association between categorical variables to select confounders; a p-value of 0.2 was used as criteria to assess associations. Factors that did not meet this criteria were evaluated for their clinical importance. Missing data for all factors were estimated and were less than 10%. Binominal logistic regression was used to generate unadjusted and adjusted odds ratios (OR). Collinearity in the adjusted model was assessed using Pearson correlation. The 95% confidence interval and a p value of 0.05 were used to determine statistical significance of odds ratios. Statistical analysis was performed using SPSS 22

RESULTS

Table 1 describes demographic and clinical characteristics of men and women with AMI in Puerto Rico in 2007, 2009 and, 2011.

TABLE 1: Characteristics of the sample Puerto Rican patients with Acute Myocardial Infarction 2007,2009,2011 (n=2265)

Characteristics	Gender (%)		P-value
	Men N =1291	Women N =974	
Age			<0.001
<55	22.3	12.1	
55-64	25.5	18.4	
65-75	26.3	28.2	
75-85	18.3	27.5	
>86	7.7	15.5	
Current smoker			<0.001
Yes	21.7	8.5	
No	78.3	91.5	
Congestive heart failure			<0.001
Yes	10.2	15.5	
No	89.8	84.5	
Stroke			<0.001
Yes	4.2	8.3	
No	95.8	91.7	
Hyperlipidemia			0.546
Yes	27.6	28.8	
No	72.4	71.2	
Hypertension			<0.001
Yes	74.2	85.2	
No	25.8	14.8	
Diabetes			<0.001
Yes	54.1	44.5	
No	45.9	55.5	

There were statistically significant associations between gender and all characteristics except for hyperlipidemia. In our sample, the majority of cases were men. The higher proportion of cases was seen within the older age groups. The higher proportion of cases did not smoke or suffer from comorbidities. Between genders, females were older, smoked less and suffered more comorbidities

compared to men. On the other hand, men smoked and suffered from hypertension and diabetes more than women.

Table 2 describes the association between in-hospital mortality and gender, as well as other possible confounders. Women with AMI died in hospitals more than men.

TABLE 2: Unadjusted association between in hospital mortality and risk factors among Puerto Rican patients with Acute Myocardial Infarction 2007,2009,2011 (n=2265)

Characteristics	Mortality (%)		P-value	Unadjusted	
	Dead N=180	Alive N=2085		OR (95% CI) N=180	P-value N=2085
Gender			0.040		
Men	6.5	93.5		Ref	
Women	9.9	90.1		1.6 (1.2, 2.1)	0.004
Age			<0.001		
<55	1.5	89.5		Ref	
55-64	5.5	94.5		3.9 (1.6, 9.5)	0.003
65-75	7.4	92.6		5.3 (2.2, 12.6)	<0.001
75-85	11.9	88.1		9.0 (3.8, 21.1)	<0.001
>86	16.6	83.4		13.3 (5.5, 31,7)	<0.001
Current smoker			0.630		
Yes	5.3	94.7		0.6(0.4,1.1)	0.065
No	8.2	91.8		Ref	
Congestive heart failure			0.020		
Yes	12.5	87.5		1.9(1.3,2.8)	0.002
No	7.1	92.9		Ref	
Stroke			0.600		
Yes	9.0	91.0		1.2 (0.6, 2.2)	0.6
No	7.7	92.3		Ref	
Hyperlipidemia			0.698		
Yes	8.2	91.8		1.1(0.8,1.5)	0.698
No	7.7	92.3		Ref	
Hypertension			0.103		
Yes	7.4	92.6		0.7 (0.5, 1.1)	0.104
No	9.7	90.3		Ref	
Diabetes			0.695		
Yes	7.6	92.4		0.9 (0.7, 1.3)	0.695
No	8.1	91.9		Ref	

AMI patients between the ages of 75-85 had the highest mortality rates when compared to patients below the age of 55. Additionally, AMI patients who didn't smoke and didn't suffer from comorbidities such as hypertension and diabetes had higher in-hospital mortality rates than AMI patients who did smoke and suffered from hypertension and diabetes. Finally, AMI patients who suffered from congestive heart failure (CHF) died more compared to those who didn't suffer from CHF.

Table 3 presents the unadjusted and adjusted odds ratios for in-hospital mortality among Puerto Rican patients with AMI in 2007, 2009, 2011. No collinearity was found between the independent variables in the adjusted model. Factors that were not statistically associated with gender and in-hospital mortality but were included in the adjusted model for their clinical importance included hypertension, stroke and diabetes. After adjusting for all confounders and clinically important factors, the OR for women with AMI was 1.4 (95% CI 1.02-2.0) compared to men. AMI patients who suffered from CHF had an adjusted OR of 1.6 (95% CI 1.05 – 2.4) compared to those who didn't have CHF; this decreased from the unadjusted OR of 1.9. The older an AMI patient was, the higher the adjusted odds of dying in the hospital.

TABLE 3: The unadjusted and adjusted associations between in hospital mortality and risk factors among Puerto Rican patients with acute myocardial infarction in 2007, 2009, 2011.

Characteristics	Unadjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value
Gender				
Men	Ref		Ref	
Women	1.6 (1.2, 2.1)	0.004	1.4(1.02,2.0)	0.037
Age				
<55	Ref		Ref	
55-64	3.9 (1.6, 9.5)	0.003	4.4(1.8,10.8)	0.001
65-75	5.3 (2.2, 12.6)	<0.001	5.5(2.3,13.3)	<0.001
75-85	9.0 (3.8, 21.1)	<0.002	8.9(3.7,21.2)	<0.001
>86	13.3 (5.5, 31,7)	<0.003	10.5(4.2,26.2)	<0.001
Current smoker				
Yes	0.6(0.4,1.1)	0.065	1.1(0.65,1.9)	0.68
No	Ref		Ref	
Congestive heart failure				
Yes	1.9(1.3,2.8)	0.002	1.6(1.05,2.4)	0.026
No	Ref		Ref	
Stroke				
Yes	1.2 (0.6, 2.2)	0.6	0.8(0.4,1.6)	0.509
No	Ref		Ref	
Hyperlipidemia				
Yes	1.1(0.8,1.5)	0.698	-	-
No	Ref		Ref	
Hypertension				
Yes	0.7 (0.5, 1.1)	0.104	0.5(0.3,0.7)	<0.001
No	Ref		Ref	
Diabetes				
Yes	0.9 (0.7, 1.3)	0.695	0.97(0.7,1.4)	0.97
No	Ref		Ref	

DISCUSSION

The result of this population-based study of Puerto Rican men and women showed marked disparities by gender in mortality rates among patients with AMI. Data collected from the Puerto Rico Heart Study showed that women were 40% more likely to die in-hospital compered to men. Additionally, patients with CHF were 60% more likely to die compared to those who didn't have CHF. Furthermore, our study shows that the older the patient was, the higher the odds of dying in the hospital.

These results are in concordance with several other studies, which conclude that females with myocardial infarction have higher in-hospital mortality compared to men [5-10]. Also similar to other studies, women in this sample were older and smoked less than men [10]. They also experienced more comorbidities such as hypertension, stroke and diabetes.

Moreover, women have been shown to receive less aggressive in-hospital treatment for AMI compared to men [11].

In contrast to our results, studies conducted in China suggest that hospital mortality was greater at a younger age [5,6]. This difference may be attributed to geographical and ethnic differences.

One strength of this study is that its results may be generalizable to other Hispanic communities. Not many studies of this nature have been conducted among Hispanic populations. Additionally, the majority of studies reviewed had similar findings.

One limitation of this secondary data analysis is that it was based on a non-concurrent cohort study. A concurrent cohort study may further strengthen conclusions regarding the relationship between gender and in hospital mortality. Another limitation is that it may not be appropriate to generalize these findings to the general population, since the study was limited to Hispanic patients. Additionally, there is limited information related to biological mechanisms that might explain why women with AMI have worse outcomes compered to men. It may be due to the fact that women generally experience their first AMI at a later age. It may also be linked to the fact that loss of estrogen in elderly, post-menopausal women makes them more prone to cardiovascular risks. Studies suggest that the incidence of coronary artery disease in women actually increases after menopause, equaling that of men by the age of 70, making it the leading cause of mortality in older women, accounting for one-third of all deaths [12].

IN CONCLUSION

This secondary analysis of a sample of Hispanic patients obtained from the Puerto Rico Heart Attack Study revealed marked differences between genders in in-hospital mortality rates. Results suggest that women had higher mortality rates than men. They were also older and experienced more comorbidities than men. Further studies are needed to investigate the higher mortality for women with AMI.

LIST OF ABBREVIATIONS

AOR   Adjusted Odds Ratio
OR   Odds Ratio
IRB   Institutional Review Board
AMI   Acute Myocardial Infarction
CHF   Congestive Heart Failure

COMPETING INTERESTS

The authors declare no competing interests.

AUTHORS' CONTRIBUTIONS

The participation of each author corresponds to the criteria of authorship and contributorship emphasized in the Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly work in Medical Journals of the International Committee of Medical Journal Editors. Indeed, all the authors have actively participated in the redaction, the revision of the manuscript and provided approval for this final revised version.

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