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Characteristics of Patients Admitted to Florida Hospitals for Cardiovascular Diseases

Characteristics of Patients Admitted to Florida Hospitals for Cardiovascular Diseases

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ABSTRACT
The present study evaluated the variations in demographic and clinical characteristics of patients hospitalized for cardiovascular diseases (CVD) in Florida hospitals in 2005. Using the 2005 data from the Florida Agency for Health Care Administration, patients admitted for any CVD were extracted by using the International Classification of Diseases, 9th edition (ICD-9) codes. Of all patients (N=2,534,641) hospitalized in 2005, about 17.7% (n=450,559) were admitted for CVD. There were nine distinct diagnosis groups for CVD and about 33.2% and 31.8% of patients were admitted for other forms of heart disease (OHD) and ischemic heart disease (IHD), respectively. Cerebrovascular disease or accident (CVA) was the third leading cause of CVD hospitalization in 2005. There were more women than men in all CVD categories except in IHD, OHD, and diseases of the arteries, arterioles, and capillaries (DAAC). Most patients in each group were whites, federal or Medicare beneficiaries, and likely to be admitted for emergency reasons. About 5% of patients with CVA and chronic rheumatic heart disease (CRHD) died in hospitals. Compared to other groups, more patients with CHRD and CVAs were discharged to other facilities for continued care. Patients with acute rheumatic fever (ARF) had the longest hospitals stays (mean=9.2 days) and those with IHD had the shortest (mean=4.2 days).
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Introduction

Chronic diseases have been the leading public health problems in the United States (U.S.) for decades (Justin et al., 2007). Among them, cardiovascular disease (CVD) is the leading cause of mortality in adult population (American Heart Association, 2004; Cooper et al., 2000) and refers to a wide variety of heart and blood vessel diseases including, but not limiting to, ischemic heart disease (IHD), hypertension (HT) or high blood pressure, and stroke or cerebrovascular accident (CVA) (Cardiovascular Surveillance Summary, 2007). Cardiovascular disease (CVD) accounted for 39% of all annual deaths in the U.S. in 2003 and 32.4% in 2005 (Daviglus et al., 2005; Rosamond et al., 2007; Kung, Hoyert, Xu, & Murphy, 2005). Deaths from CVD annually account for more lives than deaths due to cancer, chronic lower respiratory diseases, accidents, and diabetes mellitus combined (Rosamond et al., 2007). According to the American Heart Association (AHA) and the American Stroke Association (ASA), CVD is also a predictor of premature death, reduced quality of life, and increased medical expenses (Justin et al., 2007; Rosamond et al., 2007).

The Centers for Disease Control and Prevention (CDC) report indicated that CVD was also the leading cause of death in some racial/ethnic minority groups in the U.S. (CDC, 2007). The CVD death rates per 100,000 population for the racial/ethnic groups were as follows: 72 (Hispanics), 78 (Asians and Pacific Islanders), 80 (American Indians), 206 (blacks), and 259 (whites) (Cardiovascular Surveillance Summary, 2007). Age-specific death rates for CVD had declined among 18-24, 25-34, 35-44, and 45-54 year groups in the past two decades for both males and females (CDC, 2007; Cardiovascular Surveillance Summary, 2007). Despite the decline in age-specific death rates, CVD still remained the leading cause of death in the U.S. (Cooper et al., 2000; Daviglus et al., 2005; Rosamond et al., 2007). Similarly, a report from the Florida Department of Health in 2007 noted that CVD was the leading cause of death in Florida, accounting for 35% of all deaths. Florida is the fourth most populated state in the country with a diverse ethnic population (Guion, 2005). Research on CVD hospitalizations among multi-ethnic populations of Florida is needed for the development of health promotion and disease prevention and health services programs for its residents. Whereas the prevalence, mortality, risk factors, and health care associated with CVD have been documented in the general U.S. population, analyses of CVD-related hospitalization among Florida patients are scant. To our knowledge, there are currently no published reports on prevalence and socio-demographic and health care characteristics of Florida patients by CVD-diagnosis groups. To fill

this gap, characteristic differences of patients by CVD diagnosis groups as classified by the International Classification of Diseases, 9th edition (ICD-9) codes were examined. Specifically, variations in age, gender, race/ethnicity, insurance status, type of admission, discharge status, length of hospital stay and average hospital charges of patients by each CVD sub-diagnosis group were evaluated.

Methods

Administrative data of the 2005 Florida Agency for Health Care Administration (AHCA) were used for analyses. Among 2,534,641 hospitalizations in Florida in 2005, records with primary diagnosis of any CVD were included in the report. Primary diagnosis of any CVD was defined by using the ICD-9 codes (n = 450,559).

Specifically, ICD-9 codes of CVD that range from 390-459 were selected. They were further classified by specific diagnosis groups in nine mutually exclusive categories as follows: acute rheumatic fever (ARF), chronic rheumatic heart Disease (CRHD), Hypertensive Disease (HT), ischemic heart disease (IHC), diseases of pulmonary circulation (DPC), other forms of heart disease (OHD), Cerebrovascular Disease or Accident (CVA), diseases of arteries, arterioles, and capillaries (DAAC), diseases of veins and lymphatics, and other diseases of the circulatory system (DCS). The detailed ICD-9 codes of CVD subgroups appear in Table 1.

Descriptive characteristics of patients were reported for each diagnosis-specific group. Gender was dichotomized as male and female. Eight categories of race/ethnicity in the original data were recoded as: 1) whites, 2) blacks, 3) Hispanics and 4) others. Due to the small sample sizes, American Indian/Eskimo/Aleut, Asian or Pacific Islander, and others were combined. The original principal payer code or health insurance status was recoded into four mutually exclusive groups: 1) Commercial (Health Maintenance Organizations or HMO and Preferred Provider Organizations or PPO), 2) Federal/Medicare which included Medicare and other major federal carriers such as the Civilian Health and Medical Program of the Uniformed Services (CHAMPUS) and Veterans Administration (VA), 3) State/Medicaid which included Medicaid and other state payers such as Worker's Compensation , and 4) Others included underinsured, uninsured and charity. Admission status was dichotomized as emergency versus non-emergency (urgent or elective). The discharge status information contained 15 categories. These categories were recoded into three mutually exclusive types: 1) discharged home, 2) discharged to another facility (short-term general hospital, intermediate-care or skilled nursing facility, and home healthcare organization), and 3) died in hospital. Hospital length of stay (LOS) in days, age (years) and gross hospital charges (US $) were treated as continuous variables. Hospital charges included any services rendered in hospitals but excluded professional fees. Inpatient discharge data were collected from all acute care, short-term psychiatric hospitals of Florida in 2005 (AHCA, 2007). Descriptive statistics (mean, standard error or SE, and median) for LOS, age and hospital charges were computed.

Analyses were performed using Statistical Package for the Social Sciences 15.0. The variables included were CVD subgroups, gender, race/ethnicity, insurance status, type of admission, discharge status, age, LOS and total hospital charges. Nine sub-diagnosis-specific groups were compared using the Chi-square (χ^2) or Fisher's exact tests, as appropriate, and ANOVA test or general linear models (GLM).

Results

Among 2,534,641 hospitalizations in Florida, 450,559 (17.7%) patients had a primary diagnosis of CVD which was further divided into nine specific CVD types (Table 1). The most common forms of CVD were OHD (33.2%), IHD (31.8%), and CVA (15.8%). Acute and chronic forms of rheumatic heart diseases were the least common CVD hospitalization (< 2%) in 2005. HT diseases accounted for 5% of CVD hospitalizations.

The mean and median ages of patients by CVD subgroups varied (Table 2). Patients with CRHD had the highest mean (76.2) and median (79.0) age in years. Those with the ARF were the youngest of all groups with the mean of 51.2 years and median age of 58.0 years. Except for ARF, patients of all CVD subgroups were older than the median age of 65 years. Patients with ARF were the youngest but stayed the longest in the hospital with the median of 7 days, whereas those with HT diseases, IHD, and CVA had the shortest hospital stays with a median of 3 days. The median hospital charges for IHD were the highest ($40,162), whereas the lowest ($14,911) were for DCS. Despite the longest hospital stay, patients with ARF tended to incur fewer (median) hospital charges than those with IHD and DAAC.

The descriptive characteristics for patients by CVD-specific subgroups are shown in Table 3. Except for IHD, OHD, and DAAC, there were more women than men in all CVD subgroups. The most patients in all subgroups were whites and had federal or Medicare as primary health insurance. Regardless of CVD types, most patients were admitted for emergency reasons except for the DAAC group where over 70% of patients were admitted for non-

emergency reasons. Most patients in all groups except CRHD group were discharged home. About 53.8% and 42.1% of patients with CRHD and CVA, respectively, were discharged to another facility for continued care. Frequency of hospital deaths due to CVD ranged from 1.3% to 5.5%. In-hospital deaths due to CVA (5.5%) were the highest followed by CRDH (4.9%), DAAC (4.3%), DPC (3.8%), ARF (3.0%), IHD (2.8%), (OHD) (2.8%), HT diseases (1.8%) and DCS (1.3%).

To offer an additional element of distinction, findings specific to each subgroup were noted below. Patients with ARF were attributed to the lowest proportion (< 1%) of CVD hospitalizations in 2005, and were the youngest in age but stayed the longest in hospitals compared with other CVD subgroups. Of all CVD subtypes, patients with CRDH had the highest percentage of federal types of health insurance (82.1%) and the highest proportion of discharge to another care facility (53.8%). Only about 5% of CVD hospitalizations were due to HT diseases. Total median hospital charges due to HT diseases ranked eighth out of nine subgroups of CVD hospitalization. Although IHD was the second common CVD hospitalization, patients with this diagnosis incurred the highest median hospital charges although they tended to have briefer hospital stays compared to other CVD subgroups. The majority of patients with DPC were admitted for emergency reasons (81.1%). Other forms of heart disease (OHD) were the most common reason for CVD hospitalization. Patients with CVA tended to have the shortest hospital stays, but had the highest frequency of hospital mortality (5.5%). Compared to other CVDs, more patients with DAAC were admitted for non-emergency reason. The DCS group incurred the lowest total hospital charges and had the lowest hospital mortality among all CVD subgroups.

Proportionally, there were more whites than blacks, Hispanics or others in the hospitalized population of Florida in 2005; thus, the majority of patients in each CVD subgroup were whites. There were more blacks than Hispanics in seven of the nine CVD sub-diagnosis groups and they were ARF, HT diseases, DPC, OHD, CVA, DAAC, and DCS. However, more Hispanics than blacks were admitted for CRHD and IHC in Florida.

Discussion

Regardless of the decline of CVD death rates in the U.S., incidence of CVD had not declined since the late 1980s (CDC, 2007; Cooper et al., 2000). According to the National Heart, Lung, and Blood Institute (NHLBI), approximately 71.3 million adults or 22% of the U.S. population had one or more types of CVD (Mensah et al., 2007; Parker et al., 2003; Thorn et al., 2006). Analyses of inpatient data from the National Hospital Discharge Survey (NHDS), a nationally representative survey of hospital utilization in the U.S., reported that about 12% and 11.5% of all discharge records were associated with diseases of the heart in 2005 and 2006, respectively (National Center for Chronic Disease Prevention and Health Promotion, 2007; DeFrances & Hall, 2007). In our Florida study in 2005, CVD accounted for 17.7% of all hospitalizations which is, slightly higher than the 2005 and 2006 U.S. statistics. In our study, IHD and OHD together, accounted for 65% of total CVD hospitalizations, whereas 16% were due to CVA. The CDC reported that 13% of all hospital discharges in the U.S. in 2003 were a result of heart disease. Of all CVD discharges in the nation, 24% were due to congestive heart failure, 23% to coronary atherosclerosis, 18% to cardiac dysrhythmias, 17% to acute myocardial infarction, and 17% to other heart diseases (e.g., valve disorders and hypertensive heart disease) (CDC, 2003). Compared to our findings, the National Vital Statistics Report of 2004 had a higher percentage (29%) of hospitalizations due to CVA (CDC, 2007; Mensah et al., 2007). It is unknown if Florida adults received better preventive care of risk factors relating to CVA than their national counterparts or Florida adults received care for CVA outside of Florida state.

CVD has been recognized as the dominant cause of death in the U.S. for at least 50 years, with heart disease ranking the first and stroke ranking third as leading causes of death. Nationwide, CVD accounted for more than one million deaths (58%) in 2002 (Thorn et al., 2006) making it the number one cause of death for both men and women (Mensah et al., 2007; Murray et al., 2006; Cooper et al., 2000). According to the Cardiovascular Surveillance Summary of 2007, CVD remains the principal cause of death in Florida accounting for 50,629 deaths or 35% of total deaths in 2005 (CSS, 2007).

Correspondingly, in our 2005 inpatient study, there were 53,879 total deaths and 14,396 or 27% due to CVD. IHD and OHD contributed to more than half of CVD deaths among our hospitalized population, whereas CVA followed closely in third place, with 15.8 % of all CVD deaths.

Other findings deserve discussion. First, although CVD in general is considered a disease more common among men than women (Pilote et al., 2007), there were more women than men in all except three subgroups of CVDs in our study. Consistent with our findings, national statistics of hospitalization due to complications of heart disease noted a 34% increased since 1990, with a remarkable rise in women compared to men (Pilote et al., 2007;

Table 1: Hospitalizations by Cardiovascular Disease Subgroups in Florida Hospitals, 2005 (n = 450,559)

Group Number	ICD-9 codes	Acronym	Diagnosis Group	n	%
1	390-392	ARF	Acute Rheumatic Fever	99	0.00
2	393-398	CRHD	Chronic Rheumatic Heart Disease	5,152	1.10
3	401-405	HT	Hypertensive Disease	22,584	5.00
4	410-414	IHD	Ischemic Heart Disease	143,433	31.80
5	415-417	DPC	Diseases of Pulmonary Circulation	10,217	2.27
6	420-429	OHD	Other forms of Heart Disease	149,435	33.20
7	430-438	CVA	Cerebrovascular Disease	71,169	15.80
8	440-448	DAAC	Diseases of Arteries, Arterioles, and Capillaries	23,075	5.10
9	451-459	DCS	Diseases of veins & Lymphatics, and Other Diseases of Circulatory System	25,395	5.60
Total				450,559	100%

Mensah et al., 2007). In addition, readmission rates following stroke, have also been reported to be higher in females (Pilote et al., 2007). A review of the American National Hospital Discharge Survey noted a higher admission rate of CVD for women in the last 20 years, possibly due to higher proportion of women with clinically significant disease or with changes in cardiovascular risk factors (Pilote et al., 2007). A combination of biological and behavioral factors such as hormones, blood pressure, serum lipids, physical activity, obesity and smoking may be responsible for gender difference in CVD hospitalization profiles (Pilote et al., 2007; Rosamond et al., 2007; Rooks et al., 2002).

Second, racial disparities in CVD among the national population have been documented (Rooks et al., 2002; Cooper et al., 2000; Barnett et al., 2001) with about 30% of the U.S. population in 2006 consisted of racial/ethnic minority populations (NCHS, 2007). In our study, majority of patients were whites, thus, there were more whites in each CVD subgroup. However, a comparison among the race ethnic minority groups within each specific diagnosis group presented important findings. There were more blacks than Hispanics in some CVD types, namely, ARF, HT diseases, and DPC than Hispanics. Also, there were more Hispanics than blacks hospitalized for CRHD and IHD. These findings were consistent with previous evidence showing that black adults were more likely to have hypertension (Kuller et al., 2006; Rooks et al., 2002; Airhihenbuwa & Liburd, 2006; Rosamond et al., 2007). Because race-ethnic specific national prevalence of CRHD and IHD are not known, consistency with our report cannot be determined.

Third, federal health insurance was the most common (69%) of all types of insurance among Florida inpatients. These findings may be explained by the fact that disparities in health care may be defined as racial/ethnic and socioeconomic differences in the availability and quality of health care (NHIS, 2006; Hoffman & Wang, 2003). In addition, it has been reported that Medicare expenses rise considerably at the end of life for Americans 65 years and older (Daviglus et al. 2005). It is well established that the risk of CVD increases with age (Asia Pacific Cohort Studies Collaboration, 2006), clearly showing an association between cardiovascular risk and prevalence and Medicare charges in the later years of life (Daviglus et al. 2005).

The findings of our study are based on inpatient Florida data of 2005. Analyses of hospitalized patients provided important information about the frequencies and related clinical (e.g. length of stay) and economic (e.g. hospital charges) factors of special CVD subtypes prevalent among Florida inpatients. The study has some limitations. First, AHCA data used for this study was specifically collected for administrative purposes; consequently, a number of significant variables useful for clinical and epidemiologic studies were not accessible. Second, the accuracy of data reporting from Florida hospitals was uncertain. Third, since data were intended for public use, unique identifiers (e.g. social security number, patient ID) of records were not released. Thus, the unit of analysis was discharge records. Although some differences in CVD subgroups were found in race/ethnic groups, health behaviors and sociopolitical variables specific to race/ethnic groups

Table 2: Age and Hospital Characteristics of patients by Cardiovascular Disease Subgroups (n = 450,559)

		Age (Years)					Length of stay (days)					Hospital Charges (US $)				
Group	N	Mean	SE	Median	Rank by Median	p	Mean	SE	Median	Rank by Median	p	Mean	SE	Median	Rank by Median	p
ARF	99	51.18	2.47	58.00	*9*	**	9.23	0.80	7.00	*1*	**	52,440	6,712	28,675	*3*	**
CRHD	5,152	76.18	0.19	79.00	*1*		7.91	0.12	6.00	*2*		67,822	1,408	28,555	*4*	
HT	22,584	63.56	0.12	65.00	*8*		4.77	0.04	3.00	*4*		27,677	252	16,954	*8*	
IHD	143,433	67.62	0.03	69.00	*6*		4.21	0.02	3.00	*4*		53,259	150	40,162	*1*	
DPC	10,217	64.76	0.17	68.00	*7*		6.99	0.06	6.00	*2*		35,821	448	26,464	*5*	
OHD	149,435	71.16	0.04	74.00	*2*		4.96	0.02	4.00	*3*		36,178	128	20,770	*6*	
CVA	71,169	70.98	0.05	73.00	*3*		5.01	0.03	3.00	*4*		31,832	169	20,555	*7*	
DAAC	23,075	69.26	0.10	72.00	*4*		6.35	0.05	4.00	*3*		56,816	449	39,127	*2*	
DCS	25,395	67.05	0.11	70.00	*5*		4.87	0.03	4.00	*3*		21,835	171	14,911	*9*	

* p < .05; ** p < .01

were not available in the data. Despite these limitations, our study provided characteristic differences in clinical and economic impact of CVD among Florida patients.

Conclusion

Specific CVD subgroup analysis is important to assess utilization disparities among hospitalized patients. The frequency of major CVD groups IHD, OHD, and CVA in our study of hospitalized patients were similar to national and state populations. Health services programs in Florida should consider relevant epidemiologic and social environment data to evaluate health and economic impact of CVD hospitalizations. Further studies are needed to explore factors that determine the disparities in CVD subgroups among Florida patients.

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Table 3: Socio-demographic and Clinical Characteristics of Patients by Cardiovascular Disease-subgroups (n = 450,559)

Group #	1		2		3		4		5		6		7		8		9		P value
Acronym	ARF		CRHD		HT		IHD		DPC		OHD		CVA		DAAC		DCS		
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Sex																			
Male	42	42.4	2,363	45.9	10,369	45.9	89,493	62.4	4,510	44.1	78,917	52.8	34,519	48.5	13763	59.6	12149	47.8	**
Female	57	57.6	2,789	54.1	12,215	54.1	53,940	37.6	5,707	55.9	70,518	47.2	36,649	51.5	9312	40.4	13246	52.2	
Race/ethnicity																			
White	58	58.6	4,027	78.2	10,807	47.9	113,226	78.9	7,532	73.7	110,311	73.8	52362	73.6	18389	79.7	18586	73.2	
Black	22	22.2	452	8.8	7,657	33.9	10,408	7.3	1,523	14.9	19,257	12.9	9050	12.7	2343	10.2	3277	12.9	
Hispanic	14	14.1	537	10.4	3,550	15.7	14,764	10.3	958	9.4	16,739	11.2	7908	11.1	1861	8.1	3029	11.9	**
Other	5	5.1	136	2.6	570	2.5	5035	3.5	204	2.0	3,128	2.1	1849	2.6	482	2.1	503	2.0	
Insurance Status																			
Commercial	30	30.3	511	9.9	4,048	17.9	36,389	25.4	2,668	26.1	22,781	15.2	13051	18.3	4159	18.0	5202	20.5	
Federal	46	46.5	4,229	82.1	13,534	59.9	91,956	64.1	6,132	60.0	110,573	74.0	50090	70.4	16955	73.5	16781	66.1	
State	16	16.2	245	4.8	2,566	11.4	6,965	4.9	838	8.2	9,150	6.1	3981	5.6	1243	5.4	1977	7.8	**
Uninsured/ Uninsured	7	7.1	167	3.2	2,436	10.8	8,123	5.7	579	5.7	6,931	4.6	4047	5.7	718	3.1	1435	5.7	
Type of Admission																			
Emergency	55	55.6	3,272	63.5	17,601	77.9	76,497	53.3	8,290	81.1	108,616	72.7	53533	75.2	6340	27.5	18572	73.1	**
Non- emergency	44	44.4	1,880	36.5	4,983	22.1	66,936	46.7	1,927	18.9	40,819	27.3	17636	24.8	16735	72.5	6823	26.9	
Discharge Status																			
Discharge to Home	60	60.6	2,127	41.3	16,337	72.3	96,672	67.4	5,757	56.3	93,989	62.9	37333	52.5	13453	58.3	15599	61.4	
Discharge to another facility	36	36.4	2,774	53.8	5,837	25.8	42,799	29.8	4,068	39.8	51,287	34.3	29936	42.1	8638	37.4	9461	37.3	**
Expired	3	3.0	251	4.9	410	1.8	3,962	2.8	392	3.8	4,159	2.8	3900	5.5	984	4.3	335	1.3	
Total	99		5,152		22,584		143,433		10,217		149,435		71,169		23,075		25,395		

* p < .05; ** p < .01