

Original Research Article

# Racial Composition of Hospital and Inpatient Myocardial Infarction Discharges and Outcomes: A Comparative Pilot Study

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- Teaching
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Abstract

Depending on hospital characteristics, patients with myocardial infarction (MI) reportedly have different outcomes. In the present study, we evaluated the differences in the outcomes of patients with MI between a predominantly black private non-profit (PNP) medium urban teaching hospital (MUTH) and predominantly white PNP MUTHs. In addition, we investigated on the differences between the predominantly black MUTH and predominantly white MUTH categories such as private investor owner (PIO), and government non-federal (GNF) hospitals. Discharged patients diagnosed with myocardial infarction in 2012 were extracted from a U.S. nationwide patient dataset. International Classification Data, ICD 9 code (41000, 41000, 41001, and 410011 for MI) was used for the extraction, according to hospital setting, size, and teaching status. This dataset was then compared with another dataset extracted from a private non-profit (PNP) medium urban teaching, predominantly black hospital. Comparisons were made among the hospital categories.

The results showed that the MI patients discharged from the predominately black MUTH had a higher percentage of female patients, tended to be younger with higher incomes, and had a much higher percentage of patients who stayed in the hospital two or more weeks than was the case for the MI patients discharged from the predominantly white MUTHs. The total hospital charges for the predominantly black MUTH were similar to the charges from the predominantly white PNP teaching hospitals and the GNF teaching hospitals. Additional research may further explore these differences in more depth.

**Specific Aim:** This study sought the clarification of health disparities in myocardial infarction (MI) patients using two datasets, the Nationwide Inpatient Sample (NIS), (predominantly white patients), and data from an urban teaching hospital (predominantly black patients). This was a comparative pilot study to ascertain the differences in outcomes between the urban teaching hospital and other comparable national hospitals.

**Abbreviations:** MI: Myocardial Infarction; PNP: Private Non-profit; MUTH: Medium Urban Teaching Hospital; ICD-9: International Classification Data; PIO: Private Investor Owner; GNF: government non-federal

## INTRODUCTION

The increasing prevalence of cardiovascular diseases in hospitalized patients gives rise to a need to investigate the relationship between hospital characteristics and patient outcome data in this population. Increased cardiovascular disorders among minorities and the underserved, combined with factors such as poor diet, lack of physical activity, low socio-economic status, for example, make the U.S. rank first in the world in Coronary Artery Disease with 171,974 deaths per year in all ages, especially for age group 65 years and above [1]. According to the American Heart Association, every twenty-six seconds, a person in the United States has a major coronary event and every minute, someone dies of cardiovascular disorder [2]. Length of stay among cardiac surgery patients with diabetes is 0.76 days longer for every 50-mg/dL increase in glucose [3]. Study of this disease burden has been carried out primarily at annual or

biannual levels due to the lack of data integration linking clinical and administrative inpatient data.

Studies have shown that readmission following an inpatient hospitalization is fairly common and costly and frequent hospital readmissions and unexplained variances may indicate poor quality in healthcare, transitions of care, and outpatient management following discharge [5]. However, while some readmissions may be inevitable, reducing hospital readmissions has been a critical variable of several recent government efforts to improve quality and reduce costs in the federal insurance companies such as Medicare program [6]. MI has been identified as a common reason for Medicare hospitalizations and has been found to have a relatively high readmission rate [7]. Six hundred and thirty-three inpatient MI hospital stay was reported in the United States in 2009 [8]. The total cost for cardiovascular diseases in 2008 was \$448.5 billion with a direct medical cost of

\$296.4 billion [9]. The total estimated cost of diagnosed diabetes in 2012 is \$245 billion, including \$176 billion in direct medical costs and \$69 billion in reduced productivity [10]. A review of the current literature on diabetic MI revealed that few such studies [4,11,12] appears to have been conducted to date.

This project is relevant in various ways as little or no study has been done on comparative analysis between inpatients myocardial infarction (MI) discharged from predominantly black urban teaching hospital and those from predominantly white hospitals. Thus, this comparative study sought to elucidate if there are any hospital outcome differences in this population. The proposal also aimed to provide significant quantitative data about the outcome differences between MI patients who received care from different types of hospitals.

### Theoretical Framework

The organizing framework of this proposal was based on the Quality of Health Model of Care. This model proposed by the American Academy of Nursing Expert Panel on Quality Health Care (1998) is useful for measuring reciprocal directions of influences of multiple variables that impact quality of care and desired health outcomes [13]. This dynamic model applied to evaluating health care delivery systems allows researchers to utilize databases to delineate the relevant interrelationship between patient level characteristics, the context in which care is provided, and the quality of provider intervention and ultimately health outcomes. This framework is an expansion of Donebenian's 1966 linear framework which posit that structure affects process and process affects outcome and that patients' characteristics are considered as mediating outcomes [14].

### STUDY DESIGN

Data for this study consisted of hospital discharge data for 2012 collected via the National Inpatient Sample (NIS) Healthcare Cost and Utilization Project (HCUP), and data collected from a predominantly black MUTH serving the Washington, DC metropolitan area. The HCUP\_NIS is a family of health care databases and related software tools and products developed through a Federal-State- Industry partnership and sponsored by the Agency for Healthcare Research and Quality [15]. Selection of patients from the NIS database was based on the ICD-9 codes (41000, 41001, and 410011 for myocardial infarction). Inpatient diagnosed with MI admitted both hospital categories; age 20 years to 84 years were included. The following categories were excluded: obstetrics-gynecologic, ear-nose-throat, orthopedic and pediatric patients; short-term acute rehabilitation and long-term non-acute care patients; psychiatric and alcoholism/chemical dependency treatment patients.

The selected predominantly black MUTH serves a large proportion of patients in the District of Columbia who are disproportionately affected by heart diseases and diabetes, along with their respective comorbidities and complications. Studies have shown that the prevalence of chronic diseases is highest in areas [16] which this hospital serves. The selection criteria were similar as described above.

## RESULTS AND DISCUSSION

Table 1 displays a distribution of MI MUTH hospital discharged patients by ethnicity. It is noted that 91.7 percent of the MI discharged patients from the predominantly black private non-profit MUTH were black, compared to 10.7 percent of the discharged MI patients from the predominantly white private non-profit MUTHs. The percentage of the MI discharged patients from the other MUTH hospitals were roughly 22.5 percent for private-investor owned hospitals and 20 percent for non-federal government hospitals.

**Table 1:** Distribution of the Ethnicity of Myocardial Infarction Discharged Patients from Predominantly Black and Predominantly White Medium size, Teaching Private Non-Profit Hospitals and Other Hospitals

Ethnicity	Medium size, Predominantly Black, Private Non-Profit, Teaching Hospital	Medium size, Predominantly white Teaching Hospitals		
		Private-Non-Profit	Private-Investor Owned	Govt., Non-Federal
White	8.3	72.5	57.8	56.3
Black	91.7	10.7	22.5	20.0
Hispanic	0.0	4.3	14.5	15.2
Other	0.0	12.6	5.2	8.5
Total	100.0	100.0	100.0	100.0
Number	72	13560	2068	1207

Proportionally, there were more male MI discharged patients than female MI discharged patients across all the MUTH categories (Table 2). However, the black MUTH had the lowest percentage of male MI discharged patients (53.2 percent) and the highest percentage of female MI discharged patients (46.8 percent). The female percentage of the predominantly white MUTH categories ranged from 39.1 percent (government non-federal hospitals) to 40.8 percent (private non-profit hospitals). In terms of distribution of the gender of discharged MI patients, the predominantly black, private non-profit MUTH is more similar to the predominantly white, private non-profit MUTHs than it is similar to the other MUTHs.

**Table 2:** Distribution of the Gender of Myocardial Infarction Discharged Patients from Predominantly Black and Predominantly White Medium size, Teaching Private Non-Profit Hospitals and Other Hospitals

Gender	Medium size, Predominantly Black, Private Non-Profit, Teaching Hospital	Medium size, Predominantly white Teaching Hospitals		
		Private-Non-Profit	Private-Investor Owned	Govt., Non-Federal
Male	53.2	59.2	60.5	60.9
Female	46.8	40.8	39.5	39.1
Total	100.0	100.0	100.0	100.0
Number	77	13560	2068	1207

Age differences were noted as well (Table 3). The patients discharged from the black MUTH tended to be younger than the patients discharged from the other MUTHs. Moreover, as age increases, differences between the predominantly black MUTH hospital and other hospitals in the percent of MI discharged patients at the various age level increases. The smallest differences

are the differences in the percentages of MI inpatients under 40 years of age, and the largest differences are in the percentages of MI inpatients 80 years of age or older. A little less than 4 percent of the MI discharged patients from the predominantly black MUTH were under 40 years of age. The difference in the corresponding percentages for the other MUTH categories ranges from 0.2 percent to 0.8 percent. A little less than one-third (32.5 percent) of the discharged MI patients from the predominantly black MUTH were between the ages of 40 and 59. The corresponding percentages for the other MUTH categories were 2.3 to 2.9 percentage points lower. A little less than fifty percent of the discharged MI patients from the predominantly black MUTH were between the ages of 60 and 79. The corresponding percentages for the other MUTH categories were 7.9 to 9.7 percentage points lower. A little more than fourteen percent of the discharged MI patients from the predominantly black MUTH were 80 years of age or older. The corresponding percentages for the other MUTH categories were 12 to 13.7 percentage points higher. These differences could reflect the higher death rates among blacks due to heart disease.

**Table 3:** Distribution of the Age of Myocardial Infarction Discharged Patients from Predominantly Black and Predominantly White Medium size, Teaching Private Non-Profit Hospitals and Other Hospitals

Age	Medium size, Predominantly Black, Private Non-Profit, Teaching Hospital	Medium size, Predominantly white Teaching Hospitals		
		Private-Non-Profit	Private-Investor Owned	Govt., Non-Federal
Under 40	3.9	2.6	3.1	4.1
40 to 59	32.5	26.9	29.6	30.2
60 to 79	49.4	42.5	40.3	39.8
80 or older	14.3	28.0	26.9	26.0
Total	100.0	100.0	100.0	100.0
Number	77	13559	2068	1207

The median income of the zip codes where the patients discharged from the different types of hospitals lived were compared. The predominantly white discharged patients lived in zip codes that had more variability in income than the zip codes where the discharged patients from the predominantly black MUTH lived (Table 4). More than six out of ten of the MI patients discharged from the predominantly black MUTH lived in zip codes with a median income between \$48,000 and \$62,999. This percentage at this income level is much higher than the percentage for the other MUTH categories. For this income level, the percentage for the other MUTH categories ranged from 18.5 percent (predominantly white private-investor owned hospitals) to 24.2 percent (predominantly white private non-profit hospitals). Predominantly white private-investor owned hospitals and predominantly white government non-federal hospitals had the highest of percentages of discharged MI patients who lived in zip codes with median incomes less than \$39,000. Their percentages were 47.7 percent and 39.3 percent, respectively.

Relatively small differences exist in the length of stay in the

hospital for the discharged MI patients (Table 5). However, the MI patients discharged from the predominantly black MUTH had the highest percentage of patients whose stay in the hospital was fourteen days or longer. A little more than 18 percent of the patients discharged from the predominantly black MUTH were in the hospital for fourteen days or longer. On the other hand, the stay for the patients at the predominantly white MUTHs ranged from 8.7 percent (private non-profit hospitals) to 13.1 percent (government non-federal hospital). These differences may be due to differences in severity of the illness and treatment procedures.

**Table 4:** Distribution of the Median Income of Zip Codes of Myocardial Discharged Patients from Predominantly Black and Predominantly White Medium size, Teaching Private Non-Profit Hospitals and Other Hospitals

Median Income	Medium size, Predominantly Black, Private Non-Profit, Teaching Hospital	Medium size, Predominantly white Teaching Hospitals		
		Private-Non-Profit	Private-Investor Owned	Govt., Non-Federal
\$1-\$38,999	18.2	29.0	47.7	39.3
\$39,000-\$47,999	0.0	22.8	20.2	24.6
\$48,000-\$62,999	63.6	24.2	18.5	19.8
\$63,000 or more	18.2	23.9	13.6	16.4
Total	100.0	100.0	100.0	100.0
Number	77	13335	2022	1103

**Table 5:** Distribution of the Length of stay of Myocardial Discharged Patients from Predominantly Black and Predominantly White Medium size, Teaching Private Non-Profit Hospitals and Other Hospitals

Length of Stay in Hospital	Medium size, Predominantly Black, Private Non-Profit, Teaching Hospital	Medium size, Predominantly white Teaching Hospitals		
		Private-Non-Profit	Private-Investor Owned	Govt., Non-Federal
One day or less	13.0	13.4	11.7	11.2
Two days	19.5	20.9	20.0	15.2
Three days	19.5	15.8	15.3	17.0
Four to six days	18.2	22.4	22.7	22.1
Seven to thirteen days	11.7	18.7	19.2	21.4
Fourteen days or longer	18.2	8.7	11.1	13.1
Total	100.0	100.0	100.0	100.0
Number	77	13560	2068	1206

There are relatively small differences in total hospital charges among MI patients discharged from the predominantly black MUTH, predominantly white private non-profit MUTHs, and predominantly white government non-federal hospitals (Table 6). However, almost half, 47.5 percent, of the MI patients from the predominantly white private-investor owned hospitals, but only 26.5 to 29.9 of the other categories of MI discharged patients, had total hospital charges of \$80,000 or more.

## LIMITATON

The limitation in this study is the challenge in accessing the

data needed from the disparate datasets. The pertinent data might not be accessible to researchers and when eventually available, it might be limited to what is needed to complete a comprehensive study due to lack of systems interoperability. This is due to the fact that many of the hospitals may be reluctant to disclose certain pertinent information that might constitute a bridge in contract on the part of their customers. Hence the limitation is primarily related to the standardized database and hospitals' accuracy in reporting coded procedures and processes.

**Table 6:** Distribution of the Total Hospital Charges of Myocardial Discharged Patients from Predominantly Black and Predominantly White Medium size, Teaching Private Non-Profit Hospitals and Other Hospitals

Total Hospital Charges	Medium size, Predominantly Black, Private Non-Profit, Teaching Hospital	Medium size, Predominantly white Teaching Hospitals		
		Private-Non-Profit	Private-Investor Owned	Govt., Non-Federal
Less than \$20,000	18.2	16.6	7.4	20.2
\$20,000 to \$39,999	23.4	24.0	17.3	22.5
\$40,000 to \$79,999	28.6	32.9	27.9	27.8
\$80,000 or more	29.9	26.5	47.5	29.6
Total	100.0	100.0	100.0	100.0
Number	77	12914	1766	1206

This study has several other limitations. Only the demographic data and ICD-9-CM discharge diagnostic codes available in the datasets were used. Hence, the appropriateness of procedure used cannot be ascertained or measure the quality of care provided. The variables that affected individual health status at admissions such as duration and patterns of disease, knowledge of the disease state, adherence to therapeutic interventions and preceding lifestyle behaviors were not included in the datasets.

Furthermore, there were still unexplained variances found in this study that might have been due to certain potential independent variables that were not included due to the nature of the dataset used. There were no laboratory results in the datasets to assist in accounting for the confounders. Other variables that were lacking include patient's BMI, lifestyles like smoking and drinking habits of the patients. These independent variables unfortunately were not available in the used database. The variables if used would have helped to account for an authentic disparity result that was found in this study. There were no readmission status, practice patterns of providers, and the adequacy of the therapy to prevent disease progression in the datasets.

Finally, propensity score analysis would have been the most appropriate statistics to ascertain the effects of the independent variables on the outcomes between the medium urban teaching hospital and the national urban teaching hospitals. However, the descriptive analysis used was based on percentile for a validated comparative result.

## SIGNIFICANCE AND CONCLUSION

This project is significant as little or no study has been

done on comparative analysis between inpatients myocardial infarction (MI) discharged from predominantly black urban teaching hospital and those from predominantly white hospitals. Little or no work has been done in this area either due to lack of administrative and clinical data interoperability in certain hospitals or lack of informatics skills on part of the biomedical researchers. In addition, this study would provide significant descriptive data about the outcome differences between MI patients who received care from different types of hospitals using disparate systems. Finally, this project may lead to change in both healthcare disparity and professional behavior towards patients with MI health management and optimal care. Hence, this project has confirmed that there are significant differences between MI patients at predominantly black MUTHs and predominantly white MUTHs with regards to ethnicity, age, gender, income, LOS, and total hospital charges. The predominantly black MUTH tended to have proportionally more females, proportionally fewer patients 80 years of age or older, less variability in the median income of their neighborhoods, higher proportions of patients whose length of stay in the hospital was fourteen days or longer, and similar distribution of total hospital costs to private non-profit predominantly white MUTHs. The hospital characteristics such as hospital size, location, and status that were used in this study warrant serious considerations in the formulation on programs to improve the quality of health care.

## FUTURE STUDY

Additional research may further explore these differences in depth by comparing the predominantly black MUTH with only predominantly black hospitals in the NIS dataset using regression and propensity score match with age, gender and race, for a robust and validated disparity outcome.

## IMPLICATIONS

Reducing disparities in health care requires measurement and reporting, but these are not the ultimate goals. The basic aim of examining disparities is to ensure that health care improves the lives of all patients and their families, regardless of race, ethnicity, or socioeconomic status. It will make a difference in people's lives when MI is prevented early with timely screening of chronic diseases like obesity and diabetes; when a patient suffering from a heart attack is given the correct treatment procedure in a timely fashion; when medications are correctly administered; and when healthcare professionals listen to their patients and their families, show them respect, and answer their questions. The ability to assess and track changes in disparities is critical. It has been reported that the growing interest in public reporting for quality improvement activities continues to be an impetus to improve not only the quality of data but also the quality of care provided [9].

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## DISCLOSURE

There was no financial interest or conflict of interest in producing this report.

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Dr. Okunji is a registered nurse and assistant professor at Howard University, Division of Nursing. She has baccalaureate and master's degrees in nursing informatics from University of Maryland. She earned her doctoral degree in health sciences with specialization in international health and research. Dr. Okunji's scholarly paper in nursing informatics inspired her to use the Agency for Health Research (HCUP) and Quality (AHRQ) large database for her Ph.D. dissertation. In addition, she holds bachelor's and master's degrees in medical microbiology with post-graduate degrees in education. Clinically, Dr. Okunji is board-certified in medical surgical nursing, and has served in managerial positions.

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- Health disparities
- Large dataset
- Population research
- Health
- Nursing informatics
- Bio informatics
- Health informatics
- Online teaching and learning development and implementation
- Big data to knowledge (KL2)

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