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Family burden or caregiver's burden in young cardiac patients

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Epidemiology

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Bachelor of Medicine
Huazhong University of Science and Technology
2013

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A thesis submitted to the Faculty of the

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2015

ABSTRACT

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By Jinyi Sun

Introduction: Caring for ill relatives is burdensome and stressful to many family members and may adversely affect caregivers' health status and increase the risk of adverse events. Existing research found that family burden is associated with the risk for coronary heart disease (CHD), but little is known about the relationship between caregiving burden and mental stress-induced myocardial ischemia, a prognostic factor in patients with CHD. We aimed to examine sex and race differences in family burden and the association between family burden and mental stress-induced myocardial ischemia in young post-MI patients.

Methods: We studied 228 patients younger than 60 years who were admitted in the previous 8 months with a confirmed diagnosis of myocardial infarction (MI) in a cross-sectional study with an experimental task. Participants received three single-photon emission computed tomography (SPECT) imaging scans, one with rest, one with mental stress and one with physical stress. A summed difference score was used to assess the severity of myocardial ischemia. Family burden was assessed through questionnaires.

Results: Bivariate analysis showed that women, patients who had a lifetime history of major depression or those who were obese were more likely to perceive family burden were more likely to perceive family burden compared to men (60.9% vs 39.1%, P = 0.0081; 38.3% vs 22.1%, P = 0.0092; 43.3% vs 23.0%, P = 0.0028). However, race was not associated with family burden. In addition, family burden was not associated with either physical stress or mental stress in the unadjusted and adjusted models.

Conclusion: Our study confirmed a strong association of family burden with caregivers' sex, with women having more caregiving burden, but there was no relationship with race. Although our results show no association between family burden and mental stress-induced myocardial ischemia in younger post-MI patients, we did find substantial associations of family burden with depression and obesity, suggesting that family burden may increase cardiovascular risk in the long term in this population through these factors.

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BACKGROUND

Cardiovascular disease is the leading cause of death in North America, killing nearly 380,000 people annually (1) and acute myocardial infarction (MI) accounts for a large proportion of these deaths. More than 7 million people each year are estimated to have an MI. Post-MI patients may develop a recurrent MI, cardiac arrhythmia and left ventricular dysfunction, which can contribute to cardiac death (2). A history of systemic hypertension, diabetes mellitus, high lipid level, weight, lack of physical activity and not taking the medication are all the risk factors of adverse outcomes among post-MI patients (3). Also recent studies have paid great attention to the association between the prognostic of MI and some psychosocial risk factors, such as mental disorders, depression and anxiety (4), (5), (6). Among all these factors, the role of family burden and caregiver's burden is not clear.

Family burden refers to "all the difficulties and challenges experienced by families as a consequence of someone's illness" (7). Caregiving simply refers to activities and experiences involved in providing help and assistance to relatives or friends who are unable to provide for themselves (8). Caregivers are essential to ill or disabled individuals, however time pressure, distress, lack of physical exercise and other factors may all adversely affect their health status and increase the risk of adverse events.

Several studies examined racial and sex differences in the level of family burden. Barnes et al. noted that caregivers of elderly heart failure (HF) patients tend to be women, and for HF patients, they may be elderly women with health problems of their own (9).

Papastavrou and colleagues also found that women had a higher burden score than men, possibly due to social or relational deprivation (10, 11). As for race, according to a study by Fredman et al., White caregivers report significantly more burden than Black caregivers in multivariate regression analyses (12). Similarly, Shin et al. found that African American caregivers reported lower levels of caregiver strain than did non-Hispanic white caregivers (11, 13). Vaingankar et al. conducted a cross-sectional household survey among 2458 adult residents of age 18 years and above in Singapore. Logistic analysis showed that women were more likely (OR 1.58, P=0.0026) and Malays were less likely (OR 0.68, P=0.0044) to perceive burden [20]

A number of studies have provided evidence that caregivers' burden is associated with the risk for coronary heart disease (CHD). Lee and his team conducted a prospective 4 years' follow-up study of 54,412 women from the Nurses' Health Study and found that high levels of caregiving burden for ill spouses was associated with increased risk of coronary heart disease among women (14). Buyck used data from the Whitehall II study, a prospective cohort study, and examined caregiving and caregiver's health using self-rated health, mental health assessments using the General Health Questionnaire, and physical component score of the SF-36. In this study caregiving in midlife was not in itself associated with greater risk of CHD, but was associated with increased risk for CHD among caregivers who reported being in poor health. Also, there was some evidence of a stronger effect of caregiving on CHD in older, female, married/cohabiting, non-white participants from the lower socioeconomic group (15). Haley et al. administered an interview to participants who were providing in-home caregiving to a disabled spouse in the REasons for Geographic and Racial Differences in Stroke (REGARDS) study. They concluded that caregiving strain was significantly associated with higher estimated stroke risk, with largest effects for men, particularly African American men (11). On the other hand, Capistrant and his team conducted a 8-year follow-up study of 8472 married respondents aged 50+ years and reported that long-term caregiving was associated with a doubling of the risk of CVD among white participants (HR=2.37, 95% CI 1.43 to 3.92) but not among non-white participants (HR=0.28, 95% CI 0.06 to 1.28) (16). However, there are no data on the relationship between family burden and the prognosis among patients who have CHD.

Family burden was found to be associated with incidence of emotional distress and mental health problems, which can be risk factors for ischemia and adverse outcomes in post-MI patients. Sales and his team used data from the National Comorbidity Study Replication (NCS-R) to conducted a binary logistic regression and found that perceiving family burden might represent a predictor of increased likelihood of reporting a mental health difficulty (7). Many more studies reported that family burden can increase caregivers' depressive symptoms (17, 18, 19). Vaingankar et al. conducted a cross-sectional household survey among 2458 adult residents of age 18 years and above in Singapore. They reported a positive association of perceived burden of care with anxiety and depression (20).

The precise mechanisms through which family burden and caregiving stress may increase the risk for adverse cardiovascular outcomes are not known. A possible mechanism is an increased risk for mental stress-induced myocardial ischemia (MSIMI). MISMI, which is different from physical stress-induced myocardial ischemia, is less likely to result in chest pain and electrocardiographic changes. In a recent meta-analysis of MISMI and subsequent cardiac events in patients with coronary artery disease (CAD), all studies showed an association between MSIMI and adverse outcomes. Although they had some limitations, these studies yielded similar results of a doubling of the risk of subsequent events or deaths for CAD patients who developed MSIMI compared with those without MSIMI (21). As described above, family burden was found to be associated with incidence of psychological stress and depression, and many studies also have consistently shown that mental stress may result in myocardial ischemia in post-MI patients (22), which may lead to poor diagnosis. However, no previous study has examined the relationship between family burden and MISMI.

The existing literature points to an association between family burden and the incidence of cardiovascular disease. Also, studies have shown race and sex differences in this relationship, although results were not consistent. There are no published reports of studies on associations of family burden or caregiver's burden with prognosis of cardiovascular disease. Since patients after acute MI are a vulnerable group, it is important to examine whether family burden and caregiver's burden can affect risk status in post-MI patients. Finally, no data are available on the mechanisms potentially linking family burden to adverse cardiovascular events in cardiac patients. Thus, in a study of young (60 years old or younger) post-MI patients, we aimed to address the following questions:

--Is family burden associated with mental stress-induced myocardial ischemia in young post-MI patients?

--Are there sex and race differences in family burden in young post-MI patients?

METHODS

Study Population:

The participants for this study were recruited from the pool of patients younger than 60 years of age admitted in the previous 8 months with a confirmed diagnosis of myocardial ischemia (MI) at Emory-affiliated hospitals. Patients who had unstable angina or decompensated congestive failure within the past week, metastatic cancer, renal failure on a dialysis, current alcohol or substance abuse, who were pregnant, or had severe psychiatric disorders were excluded.

Study Design:

Participants of this cross-sectional study with experimental tasks received three single-photon emission computed tomography (SPECT) imaging scans, one with rest, one with mental stress and one with physical stress. Mental and physical stress scans were performed on separate days (4 days apart on average) and the rest scan was performed on the first visit. All tests were done after an overnight fast and patients held any anti-ischemic medication the morning of the scan. Trained research personnel interviewed participants on the first visit prior to cardiac tests using paper-based questionnaires to obtain information on socio-demographic variables, medical history, depressive symptoms and family burden. At the end of the study protocol, medical records were abstracted for clinical information. All participants signed a written informed consent.

Mental Stress Procedure:

After patients rested for 30 minutes in a quiet, dimly lit room, mental stress was induced by a standardized public speaking task (23). Patients were asked to imagine a stressful situation, a close relative been mistreated in a nursing home, and asked to give a speech around this scenario. They were given two minutes to prepare the speech and three minutes to present it in front of a camera and a small audience wearing white coats.

Myocardial Perfusion Imaging:

Three SPECT myocardial perfusion imaging scans were performed using conventional methodology after injection of sestamibi radiolabelled with Technetium-99m Sestamibi, at rest, after mental stress, and after physical stress. Then data was acquired with a gamma camera (Discovery NM 530c, General Electric, Milwaukee, WI) (24). Only one resting scan was performed and the mental stress and physical stress scan followed at least 2 hours later.

We used Emory Cardiac Toolbox software, which provides objective quantitative assessment of perfusion with established validity and reproducibility, to quantify myocardial perfusion abnormalities (25,26). The three-dimensional tracer uptake distribution in the left ventricle was oriented along the short axis and sampled onto a two-dimensional polar map. Then we constructed a quantitative summed stress (SSS) and rest score to describe the extent and the severity of the perfusion defects across the 17 myocardial segments (27). Separate scores were obtained for the rest images (summed rest score, SRS) and the stress images (summed stress score, SSS). A summed difference score (SDS), quantifying the number and severity of reversible myocardial perfusion defects, was obtained by subtracting the rest score from the stress score; in the presence of a reversible defect (or ischemia), the score is positive.

Family Burden:

We used the CIDI 3.0 Family Burden Module to assess family caregiving burden (28). Respondents were asked how many close and living family members they had (including spouse/partner, parents, siblings and children). They were then presented a list of 12 chronic conditions and for each, were asked to list if any of the above relatives had that health problem. Those respondents who reported to have at least 1 relative with any chronic conditions were asked if they were affected by the health problems of their relatives, taking into consideration their time, energy, emotions, finances, and daily activities. A 4-point scale was used to assess the burden, where ‘1’ denoted ‘A lot’ and 4 ‘Not at all’. Respondents who reported ‘a lot’ and ‘some’ burden were classified as having family burden, as opposed to those who responded as ‘a little’ or ‘not at all’. Those who reported family burden were then asked further about both objective burden (e.g. the spending time with practical tasks such as washing, dressing, housework, taking medications or spending more time keeping company or giving emotional support or giving financial support) and subjective burden (e.g. psychological distress such as embarrassment, or being worried, anxious or depressed).

Other Measurements:

In addition to the CIDI 3.0, respondents were also asked information on their socio-demographic factors and history of a detailed medical history using standard questionnaires from population studies. Weight and height were used to calculate body mass index. Venous blood samples were drawn for the measurements of glucose and lipid profile after an overnight fast.

Statistical Analysis:

All data analysis steps were conducted using the software Statistic Analysis System (SAS, version 9.4; SAS Institute Inc.). Descriptive statistics were computed by comparing levels of study variables according to presence or absence of family burden using chi-square test. Next, multivariate linear regression models were used to examine the association between family burden and stress perfusion scores adjusting for possible confounding factors. The SDS, which indicates ischemia, was our main outcome. Since the SDS for both mental and physical stress was highly skewed and the SSS was approximately normally distributed, we used the SSS score as dependent variables while adjusting for the rest score (SRS). We adjusted for a set of variables that were considered as possible confounding factors or mediators of the relationships under study. Adjustment factors included socio-demographic and lifestyle characteristics (sex, employment, race, marital status and cigarette smoking), current medication (use of statins, beta-blockers and anti-depressants), traditional CAD risk factors (history of diabetes and hypertension, and BMI), previous revascularization procedures (coronary artery bypass grafting and percutaneous coronary intervention) and study period.

RESULTS

Socio-demographic Characteristics of the Sample

Between 2009 and 2014, 121 male and 107 female MI patients younger than 60 years were included in the study. The socio-demographic characteristics are presented in Table 1. Of the participants, 53.1% were women, 57.9% were African American, 59.7% had at least high school education and 30.3% had an income below the poverty level. Overall, 38.9% of the patients had an ST-elevation MI, 73.1% had previous percutaneous coronary interventions, and 21.8% had previous coronary artery bypass graft surgery.

Family burden

There were 28.1% patients who perceived family burden due to health problems of their close family members. Women, patients who had a lifetime history of major depression, those who were obese or used anti-depressants were more likely to perceive family burden. However, race was not associated with family burden (Table 1). Furthermore, there was no interaction between race (African American versus white) and sex (Figure 1). Respondents who perceived family burden most commonly took care of their parents or siblings: 62.5% of the respondents who perceived family burden had parental illness and 48.4% had sibling illness (Table 2). Respondents who perceived family burden reported objective burden in terms of time spent in physical tasks (62.5%), providing emotional support (64.1%) and financial cost (46.9%). As for subjective burden, 76.6% respondents experienced feelings of being worried, anxious or depressed (Table 3).

Association of family burden with myocardial ischemia severity

Family burden was not associated with the SDS with either physical stress or mental stress in the unadjusted model and the adjusted model which adjusted for demographic factors, lifestyle factors, traditional risk factors and medications (Table 4).

DISCUSSION

In this cross-sectional study with an experimental component (mental stress testing) of young and middle-aged post-MI patients, we found no association between family burden and inducible myocardial ischemia with both mental stress and physical stress. Although no studies have examined this association before, we had hypothesized that there would be a positive relationship between family burden and inducible ischemia with mental stress. Our hypothesis was based on the fact that family burden was previously found to be associated with anxiety, depression and many other mental problems (7,17-20). Furthermore, previous studies found that depressive symptoms are associated with mental stress-induced myocardial ischemia in younger post-MI patients (21) and also stable CAD patients (29). Our unexpected finding of no association may be due to the characteristics of our study population. We examined young and middle-aged patients with a large proportion of African Americans, who may be less vulnerable to caregiver strain (30, 31). Fredman et al. found that White caregivers report significantly more burden than Black caregivers in multivariate regression analyses (11). Also, Shin et al. found that African American caregivers reported lower levels of caregiver strain than did non-Hispanic white caregivers (12, 13).

Consistent with other studies, we found that sex and lifetime history of major depression were strongly related to family burden, with women and those with history of depression being more likely to perceive family burden. High burden among female caregivers has been described by a number of previous studies (20, 32, 33). Caregivers' anxiety often results in feelings of worry about their relatives' health status which may adversely affect caregivers' own health (20). The association of depression and anxiety with family burden is also widely documented in earlier studies (17-20). For example, a study conducted among 106 caregivers of patients with dementia reported that stress from taking care of patients enhanced the experience of "burnout" among caregivers, i.e., a sensation of emotional exhaustion, and higher levels of perceived "burnout" were associated with higher levels of depressive symptoms (34). Thus, protracted emotional strain and feelings of burnout could be a mechanism for the high lifetime prevalence of depression among caregivers perceiving high burden.

We also did not find an association between perceived burden and race. This finding is in contrast with a previous study which reported that African Americans have lower perceived family burden than non-African Americans (12). However, our results are in line with a study of 767 in-home caregivers for a disabled spouse, among whom there was no difference in perceived family burden by race (11).

Limitations and Strengths of the Study

A limitation of this study is that our cross-sectional study design did not allow us to establish a temporal sequence of events. However, since ischemia was induced in the laboratory, reverse causation is unlikely. Also since the information on perceived family burden and on relatives' health status was collected by self-report surveys, it may be affected by recall and information bias. We could not confirm the relatives' health status through other sources like medical records or interviewing relatives' physicians. Also, the definition of 'family caregiver' was broad and not exclusive for 'primary' caregivers, who take primary responsibility for the sick relatives. It is possible that 'primary caregivers' have a higher objective family burden than other caregivers (35); we were not able to examine this distinction. In addition, since we studied young post-MI patients, results may not be generalizable to other patient populations or older patients.

Conclusion

Since family members are a major source of caregiving to sick patients, it is important to get a better understanding of the health consequences of family burden. The illnesses those patients have are likely to exacerbate over time, a process likely to worsen caregivers' emotional strain. Caregivers' physical and mental burden may also result in burden to the society due to the worse health outcome of caregivers which would increase the cost imposed on the health care system (36). Thus, it is imperative to clarify the relationship between family burden and caregivers' health. Our study confirmed a strong association of family burden with caregivers' sex, but there was no relationship with race. Although our results show no association between family burden and mental stress-induced myocardial ischemia in younger post-MI patients, we did find substantial associations of family burden with depression and BMI, suggesting that family burden may increase cardiovascular risk in the long term in this population, although through mechanisms other than stress-induced ischemia. At present, there are limited interventions targeting caregivers. Consistent with previous literature, our data suggest that it is essential to provide supportive services and social support to not only the patients but also their caregivers.

REFERENCES

(1) Murphy, S. L., Xu, J. Q., & Kochanek, K. D. (2013). Deaths: final data for 2010. *National vital statistics reports*, *61*(4), 1-118.

(2) Bigger Jr, J. T., Heller, C. A., Wenger, T. L., & Weld, F. M. (1978). Risk stratification after acute myocardial infarction. *The American journal of cardiology*, *42*(2), 202-210.

(3) Kornowski, R., Goldbourt, U., Zion, M., Mandelzweig, L., Kaplinsky, E., Levo, Y., & Behar, S. (1993). Predictors and long-term prognostic significance of recurrent infarction in the year after a first myocardial infarction. *The American journal of cardiology*, *72*(12), 883-888.

(4) Frasure-Smith, N., Lespérance, F., & Talajic, M. (1993). Depression following myocardial infarction: impact on 6-month survival. *Jama*, *270*(15), 1819-1825.

(5) Van Melle, J. P., De Jonge, P., Spijkerman, T. A., Tijssen, J. G., Ormel, J., Van Veldhuisen, D. J., ... & Van Den Berg, M. P. (2004). Prognostic association of depression following myocardial infarction with mortality and cardiovascular events: a meta-analysis. *Psychosomatic medicine*, *66*(6), 814-822.

(6) Moser, D. K., & Dracup, K. (1996). Is anxiety early after myocardial infarction associated with subsequent ischemic and arrhythmic events?. *Psychosomatic medicine*, *58*(5), 395-401.

(7) Sales, E. (2003). Family burden and quality of life. *Quality of life research*, *12*(1), 33-41.

(8) Pearlin, L. I., Mullan, J. T., Semple, S. J., & Skaff, M. M. (1990). Caregiving and the stress process: An overview of concepts and their measures. *The gerontologist*, *30*(5), 583-594.

(9) Barnes, S., Gott, M., Payne, S., Parker, C., Seamark, D., Gariballa, S., & Small, N. (2006). Characteristics and views of family carers of older people with heart failure. *International journal of palliative nursing*, *12*(8), 380-389.

(10) Papastavrou, E., Kalokerinou, A., Papacostas, S. S., Tsangari, H., & Sourtzi, P. (2007). Caring for a relative with dementia: family caregiver burden. *Journal of advanced nursing*, *58*(5), 446-457.

(11) Haley, W. E., Roth, D. L., Howard, G., & Safford, M. M. (2010). Caregiving strain and estimated risk for stroke and coronary heart disease among spouse caregivers differential effects by race and sex. *Stroke*, *41*(2), 331-336.

(12) Fredman, L., Daly, M. P., & Lazur, A. M. (1995). Burden among White and Black caregivers to elderly adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *50*(2), S110-S118.

(13) Shin, S. H., & Brown, T. (2009). Racial and ethnic disparities in caregiver strain and the use of child mental health services: a structural equation model. *Psychiatric Services*, *60*(8), 1039-1045.

(14) Lee, S., Colditz, G. A., Berkman, L. F., & Kawachi, I. (2003). Caregiving and risk of coronary heart disease in US women: a prospective study. *American journal of preventive medicine*, *24*(2), 113-119.

(15) Buyck, J. F., Ankri, J., Dugravot, A., Bonnaud, S., Nabi, H., Kivimäki, M., & Singh-Manoux, A. (2013). Informal caregiving and the risk for coronary heart disease: The

Whitehall II study. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, glt025.

(16) Capistrant, B. D., Moon, J. R., Berkman, L. F., & Glymour, M. M. (2011). Current and long-term spousal caregiving and onset of cardiovascular disease. *Journal of epidemiology and community health*, jech-2011.

(17) Smith, G. R., Williamson, G. M., Miller, L. S., & Schulz, R. (2011). Depression and quality of informal care: a longitudinal investigation of caregiving stressors. *Psychology and aging*, *26*(3), 584.

(18) Temzstedt, S. L., & Schulz, R. (2000). The extent and impact of dementia care: Unique challenges experienced by family caregivers. *Handbook on dementia caregiving: Evidence-based interventions for family caregivers*, 1.

(19) Fortinsky, R. H., Tennen, H., Frank, N., & Affleck, G. (2007). Health and psychological consequences of caregiving. In C. Aldwin, C. Park, & R. Spiro (Eds.), Handbook of health psychology and aging (pp. 227–249). New York, NY: Guilford.

(20) Vaingankar, J. A., Subramaniam, M., Abdin, E., He, V. Y., & Chong, S. A. (2012). How much can I take?": predictors of perceived burden for relatives of people with chronic 20. *Ann Acad Med Singapore*, *41*(5), 212-20.

(21) Wei, J., Rooks, C., Ramadan, R., Shah, A. J., Bremner, J. D., Quyyumi, A. A., ... & Vaccarino, V. (2014). Meta-Analysis of Mental Stress–Induced Myocardial Ischemia and Subsequent Cardiac Events in Patients With Coronary Artery Disease. *The American journal of cardiology*.

(22) Boyle, S. H., Samad, Z., Becker, R. C., Williams, R., Kuhn, C., Ortel, T. L., ... & Jiang, W. (2013). Depressive symptoms and mental stress–induced myocardial ischemia in patients with coronary heart disease. *Psychosomatic medicine*, *75*(9), 822-831.

(23) Goldberg AD, Becker LC, Bonsall R, Cohen JD, Ketterer MW, et al. (1996) Ischemic, hemodynamic, and neurohormonal responses to mental and exercise stress. Experience from the Psychophysiological Investigations of Myocardial Ischemia Study (PIMI). Circulation 94: 2402–2409.

(24) Esteves FP, Raggi P, Folks RD, Keidar Z, Askew JW, et al. (2009) Novel solidstate-detector dedicated cardiac camera for fast myocardial perfusion imaging: multicenter comparison with standard dual detector cameras. J Nucl Cardiol 16: 927–934.

(25) Garcia EV, Faber TL, Cooke CD, Folks RD, Chen J, et al. (2007) The increasing role of quantification in clinical nuclear cardiology: the Emory approach. J Nucl Cardiol 14: 420–432.

(26) Garcia EV, DePuey EG, DePasquale EE (1987) Quantitative planar and tomographic thallium-201 myocardial perfusion imaging. Cardiovasc Intervent Radiol 10: 374–383.

(27) Cerqueira, M. D., Weissman, N. J., Dilsizian, V., Jacobs, A. K., Kaul, S., Laskey, W. K., ... & Verani, M. S. (2002). Standardized myocardial segmentation and nomenclature for tomographic imaging of the heart a statement for healthcare professionals from the cardiac imaging committee of the Council on Clinical Cardiology of the American Heart Association. *Circulation*, *105*(4), 539-542.

(28) Kessler RC, Ãœstuuml, n TB. The world mental health (wmh) survey initiative version of the world health organization (who) composite. International diagnostic interview (cidi). *International Journal of Methods in Psychiatric Research*. 2004;13:93-121

(29) Jiang, W., Babyak, M. A., Rozanski, A., Sherwood, A., O'Connor, C. M., Waugh, R. A., ... & Blumenthal, J. A. (2003). Depression and increased myocardial ischemic activity in patients with ischemic heart disease. *American heart journal*, *146*(1), 55-61.

(30) Ennis, E., & Bunting, B. P. (2013). Family burden, family health and personal mental health. *BMC public health*, *13*(1), 255.

(31) Neri, A. L., Yassuda, M. S., Fortes-Burgos, A. C. G., Mantovani, E. P., Arbex, F. S., de Souza Torres, S. V., ... & Guariento, M. E. (2012). Relationships between gender, age, family conditions, physical and mental health, and social isolation of elderly caregivers. *International Psychogeriatrics*, *24*(03), 472-483.

(32) Zahid, M. A., & Ohaeri, J. U. (2010). Relationship of family caregiver burden with quality of care and psychopathology in a sample of Arab subjects with schizophrenia. *BMC psychiatry*, *10*(1), 71.

(33) Chien, L. Y., Chu, H., Guo, J. L., Liao, Y. M., Chang, L. I., Chen, C. H., & Chou, K. R. (2011). Caregiver support groups in patients with dementia: a meta-analysis. *International journal of geriatric psychiatry*, *26*(10), 1089-1098.

(34) Takai, M., Takahashi, M., Iwamitsu, Y., Ando, N., Okazaki, S., Nakajima, K., ... & Miyaoka, H. (2009). The experience of burnout among home caregivers of patients with dementia: Relations to depression and quality of life. *Archives of Gerontology and Geriatrics*, *49*(1), e1-e5.

(35) Tornatore, J. B., & Grant, L. A. (2002). Burden among family caregivers of persons with Alzheimer's disease in nursing homes. *The Gerontologist*, *42*(4), 497-506.

(36) Bolden, L., & Wicks, M. N. (2010). Predictors of mental health, subjective burden, and rewards in family caregivers of patients with chronic liver disease. *Archives of psychiatric nursing*, *24*(2), 89-103.

TABLES AND FIGURES

Table 1. Family burden according to characteristics of the study sample (n=228).

	N	(%)	No family burden N=164 (71.9%)		Family burden N=64 (28.1%)		P-value^1
Sex							
Male	121	(53.1)	96	(79.9)	25	(20.1)	0.0081
Female	107	(46.9)	68	(63.6)	39	(36.4)	
Race							
African American	128	(57.9)	92	(71.9)	36	(28.1)	0.7020
White	93	(42.1)	69	(74.2)	24	(25.8)	
Currently Married							
Yes	104	(45.6)	76	(73.1)	28	(26.9)	0.7241
No	124	(54.4)	88	(71.0)	36	(29.0)	
Number of Parents Alive							
0	72	(32.6)	51	(70.8)	21	(29.2)	0.5935
1	96	(43.4)	71	(74.0)	25	(26.0)	
2	53	(24.0)	35	(66.0)	18	(34.0)	
Number of Siblings Alive							
0	15	(6.8)	8	(53.3)	7	(46.7)	0.1403
1-2	76	(34.6)	51	(67.1)	25	(32.9)	
>2	129	(58.6)	97	(75.2)	32	(24.8)	
Number of Children Alive							
0	44	(19.8)	30	(68.2)	14	(31.8)	0.6194
1-2	87	(39.2)	60	(69.0)	27	(31.0)	
>2	91	(41.0)	68	(74.7)	23	(25.3)	
Education							
High school or more	136	(59.7)	97	(71.3)	39	(28.7)	0.8044
Less than high school	92	(40.3)	67	(72.8)	25	(27.2)	
Employment Status							
Employed	117	(51.8)	90	(76.9)	27	(23.1)	0.0955
Unemployed	109	(48.2)	73	(67.0)	36	(33.0)	
Income above poverty level							
Yes	152	(69.7)	115	(75.7)	37	(24.3)	0.0243
No	66	(30.3)	40	(60.6)	26	(39.4)	
Current Smoking							
Yes	51	(22.6)	36	(22.1)	15	(23.8)	0.7811
No	175	(77.4)	127	(77.9)	48	(76.2)	
Hypertension							
Yes	163	(72.4)	114	(69.9)	49	(30.1)	0.3834
No	62	(27.6)	47	(75.8)	15	(24.2)	
Depression							
Yes	81	(35.8)	50	(61.7)	31	(38.3)	0.0092
No	145	(64.2)	113	(77.9)	32	(22.1)	

Table 1. Continued

Diabetes							
Yes	56	(24.9)	39	(56.4)	17	(43.6)	0.7143
No	169	(75.1)	122	(72.2)	47	(27.8)	
Obesity							
Yes	60	(26.7)	34	(56.7)	26	(43.3)	0.0028
No	165	(73.3)	127	(77.0)	38	(23.0)	
MI Type							
ST-Elevation MI	75	(38.9)	58	(77.3)	17	(22.7)	0.1899
Non ST-Elevation MI	118	(61.1)	81	(68.6)	37	(31.4)	
Previous Revascularization Procedures							
CABG							
Yes	49	(21.8)	37	(75.5)	12	(24.5)	0.4878
No	176	(78.2)	124	(70.5)	52	(29.5)	
PTCA							
Yes	163	(73.1)	119	(73.0)	44	(27.0)	0.4919
No	60	(26.9)	41	(68.3)	19	(31.7)	
Current Medication							
Statins							
Yes	193	(85.4)	139	(72.0)	54	(28.0)	0.7842
No	33	(14.6)	23	(69.7)	10	(30.3)	
Beta blockers							
Yes	201	(88.9)	143	(71.1)	58	(28.9)	0.6113
No	25	(11.1)	19	(76.0)	6	(24.0)	
ACE-Inhibitors							
Yes	113	(50.0)	77	(75.2)	28	(24.8)	0.2376
No	113	(50.0)	85	(77.0)	26	(23.0)	
Aspirin							
Yes	184	(81.4)	132	(71.7)	52	(28.3)	0.9678
No	42	(18.8)	30	(71.4)	12	(28.6)	
Anti-depressants							
Yes	34	(15.0)	18	(52.9)	16	(47.1)	0.0085
No	192	(85.0)	144	(75.0)	48	(25.0)	

Abbreviations: MI: Myocardial Infarction; ACE-Inhibitors: angiotensin-converting enzyme inhibitors; CABG: coronary artery bypass graft; PCI: percutaneous coronary intervention.

[1] P-value was generated via the Chi-square test comparing family burden according categories of each characteristic.

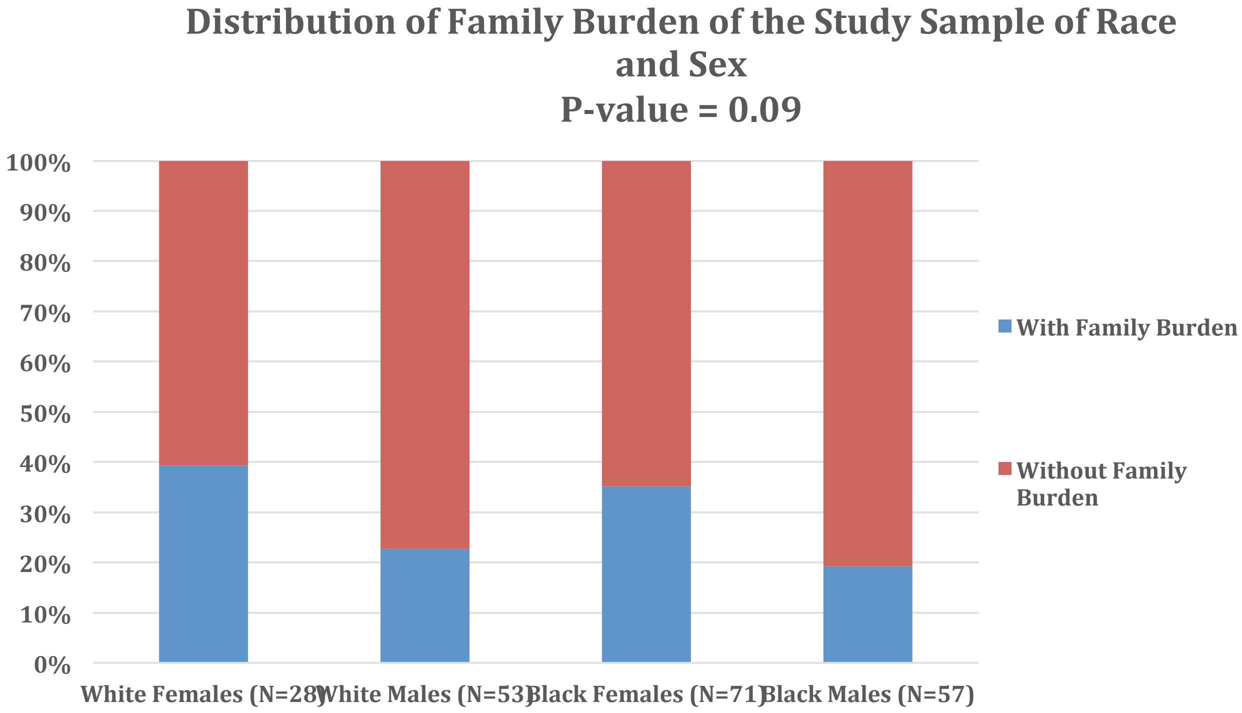

Figure 1. Distribution of family burden of the study sample of race and sex (N=209). The p-value was generated via the ANOVA test comparing family burden by race and sex.

Table 2. Distribution of illnesses among family members in patients with and without family burden.

	Family Burden		No Family Burden		p-value
Parental illness	40	(62.5)	36	(22.0)	<0.0001
Spousal illness	10	(15.6)	8	(4.9)	0.0068
Children illness	15	(23.4)	15	(9.2)	0.0041
Sibling illness	31	(48.4)	39	(23.8)	0.0003

Table 3. Objective and subjective burden among respondents who perceived burden of care (N=64)

		Family burden (N=64)	
		n	**%**
Objective Burden			
Provide on…	Physical tasks (washing, dressing, taking medicines, etc.)	40	62.5
	Emotional support	41	64.1
	Financial cost (Paying for relative/earnings lost)	30	46.9
Subjective Burden			
Feelings of…	Embarrassment	8	12.5
	Being worried/anxious/depressed	49	76.6

Table 4. Association between perceived family burden and myocardial ischemia severity, as quantified by the SDS with mental stress and physical stress (exercise or pharmacological) stress of the sample (N=228).

	β (95% CI) [1]	**P value**
Mental Stress		
Model 1: Unadjusted	0.09 (-0.60, 1.08)	0.8585
Model 2: Adjusted for demographic factors, lifestyle factors[2], traditional risk factors and medications[3]	-0.09 (-1.16, 0.98)	0.8684
Physical Stress		
Model 1: Unadjusted	-0.76 (-1.95, 0.42)	0.2089
Model 2: Adjusted for demographic factors, lifestyle factors[2], traditional risk factors and medications[3]	-1.24 (-2.49, 0.01)	0.0535

Abbreviations: CI: confidence interval; SDS: summed difference score

[1] The β coefficient expresses the differences in SDS score points between whether the patient have family burden or not. Each model was constructed with SSS as dependent variable adjusting for the rest score (SRS) using multivariate linear regression models.

[2] Sex, employment, race, marital status and cigarette smoking.

[3] Hypertension, diabetes, BMI, previous revascularization procedures, use of statins, beta-blockers, and anti-depressants.