

Informal Caregiver Assistance among Adults with Cardiovascular Disease in Ohio

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About the Ohio Family Health Survey

With more than 51,000 households interviewed, the Ohio Family Health Survey is one of the largest and most comprehensive state-level health and insurance surveys conducted in the country. The project was managed by The Ohio State University's Ohio Colleges of Medicine Government Resource Center, and the Health Policy Institute of Ohio and the survey was conducted by Macro International. The Ohio Departments of Insurance, Job and Family Services, Health, and Mental Health, the Cleveland State University, and the Ohio Board of Regents funded the project. This current project is the third in a series of statewide health surveys, following family health surveys in 1998 and 2004.

Ohio Family Health Survey Web site (all sponsored research reports are available for download here):

<http://grc.osu.edu/ofhs>

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Abstract

Background and Objectives: Cardiovascular disease (CVD) is the leading cause of death in the US and Ohio. The number of Americans living with CVD in the US, including stroke and coronary heart disease, is increasing. Adults with CVD require more caregiver assistance, even long-term, than adults without CVD. We assessed the amount and cost of informal caregiver assistance reported by community-dwelling adult Ohioans with CVD in 2008.

Methods: We examined self-reported CVD prevalence, defined as history of heart attack, coronary heart disease, stroke, or congestive heart failure (CHF), among adults aged 18 years or older responding to the population-based Ohio Family Health Survey year 2008. The amount of self-reported informal caregiver assistance, measured in total hours per month and average hours per person per month, was assessed in the overall respondent group of adults with CVD and the overall respondent group of adults without CVD. We estimated the additional hours of informal caregiver assistance attributable to CVD by assessing the difference in mean hours of informal caregiver assistance per person per month in the groups with and without CVD after adjusting for factors associated with informal caregiver assistance. Using the median 2007 home health aide wage (\$9.15/hour) from the US Bureau of Labor Statistics as the cost to replace assistance with community and domestic activities (the value for informal caregiver time), we estimated the costs of informal caregiver assistance attributable to CVD.

Findings: In 2008, 890,000 (10%) adults aged ≥ 18 years reported a history of CVD, of whom 352,000 (47%) reported informal caregiver assistance. Increased informal caregiver assistance was reported among adults with CVD who were female, non-Hispanic black, Hispanic, living in Appalachia, or living in poverty. Two specific CVD types, stroke and CHF, were associated with increased caregiver assistance particularly if both were present. Adults with CVD reported 5.8 hours of additional informal caregiver assistance per person per month (95% confidence interval (CI) 4.8-6.7 hours per person per month) compared to adults without CVD after adjusting for age, gender, race/ethnicity, region, poverty level, education, marital status, number of adults in the household, health insurance, hypertension, diabetes, cigarette smoking, health status, and number of hospitalizations in the past year. The average cost of informal caregiver assistance attributable to CVD was \$53 per person per month (95% CI \$44-\$61) or \$632 per person per year (95% CI \$529-\$736) in 2008. For the state of Ohio, the annual estimated cost of informal caregiver assistance attributable to CVD was \$563 million (95% CI \$471-\$655 million) in 2008. Among adults with CVD, similar percentages of adults (65%) with Medicaid or both Medicaid and Medicare reported informal caregiver assistance. The average yearly cost of informal caregiver assistance attributable to CVD was \$694 per person for Medicaid recipients and \$1471 per person for Medicaid and Medicare recipients.

Conclusion: Almost 50% of community-dwelling adult Ohioans with CVD report informal caregiver assistance. In 2008, the estimated annual cost of informal caregiver assistance attributable to CVD was \$563 million for the state of Ohio.

Policy Implications: Information regarding the utilization and cost of informal caregiver assistance for adults with CVD in Ohio is crucial in planning for the long-term care

needs of this large, costly population. The demonstration of significant disparities in caregiver assistance for adults with CVD by age, gender, race, region, and income can help focus efforts on the most vulnerable CVD patients and their caregivers who may require ancillary health care and social services. These data can inform Ohio policy-makers and health insurers who seek to expand or more efficiently allocate resources to care for adults with CVD.

I. Introduction

Cardiovascular disease (CVD) is the leading cause of death in the US and Ohio accounting for 35-40% of deaths.^{1,2} The US prevalence of CVD, particularly stroke, coronary heart disease (CHD), and congestive heart failure (CHF), is increasing owing to improved survival with these conditions and increasing size of the 65 and older population.^{1,3} In 2005, 5.4 million US adults reported a history of stroke, 16 million adults reported a history of CHD, and 4.9 million adults reported a history of CHF.¹ CVD prevalence in Ohio is substantial. In 2007, 3.1% of Ohioans aged ≥ 20 years reported a history of stroke (~270,000 persons), 5.1% reported a history of angina/CHD (~444,000 persons), and 5.4% reported a history of myocardial infarction (MI) (~471,000 persons) (CHF data unavailable).⁴ Whether CVD prevalence is increasing in Ohio and the effect of CVD prevalence on the use and costs of healthcare and non-health care services are unknown.

Adults with CVD have greater disability and greater need for home and community-based services and often require considerable caregiver assistance even long-term.⁵⁻⁷ The majority of adults with CVD, even those with stroke, live at home.⁸ Informal caregiver assistance (e.g., personal care, domestic work, health care coordination, and transportation) commonly is provided to CVD patients to preclude paid caregiving and to avoid institutionalization, thereby enabling the CVD survivor to remain at home. The amount of caregiver assistance required by a CVD patient may depend on the type of CVD with increased caregiver assistance possibly required for patients with stroke or CHF compared to those with CHD.^{6,7} A recent analysis of CVD cost in the United Kingdom estimated that informal care is a commonly used resource for adults with CHD and stroke respectively.⁹ The amount of caregiver assistance for adults with CVD in Ohio is unknown.

Caregiver assistance is an important outcome of CVD and may have adverse effects on the caregiver, the health care system, and employers. Caregivers of adults with CVD may incur considerable personal cost¹⁰⁻¹² and may have negative health effects, including emotional distress and disability, unmet demands for psychosocial care, and unmet demands for assistance in activities of daily living.^{12,13} A landmark study by Schulz and Beach found that being a caregiver who is experiencing mental or emotional strain is an independent risk factor for mortality, with 63% higher adjusted mortality than non-caregiving controls, among elderly spousal caregivers.¹⁴ Caregiver assistance is a major burden for employers because 60-70% of adult caregivers under 65 and 10-15% of adult caregivers 65 or older work either full-time or part-time.¹² The majority of working caregivers (60%) reported needing to make work adjustments as a result of their caregiving responsibilities, including such things as work absenteeism, work leaves, and departing the workforce entirely.¹² In response to employees' emerging adult dependent care needs, employers have developed various dependent care

benefits; but, current information about the amount and cost of informal care for OH adults with CVD would help employers plan allocations for adult dependent care.

The chronic care of CVD survivors is costly particularly for Medicaid. The estimated direct and indirect cost of stroke, CHD, and CHF in the US is 65.5 billion, 156.4 billion, and 34.8 billion respectively. Although many cost analyses for chronic disease conditions including CVD do not include the cost of caregiver assistance particularly unpaid or informal care, recent studies have shown that informal care represents a major proportion of CVD costs. In a recent United Kingdom analysis, informal care represented 20% and 40% of the costs related to CHD and stroke respectively.⁹ In the US, informal care is the third (\$4,038) most expensive yearly stroke cost per person after nursing home care(\$33,636) and lost earnings (\$22,880)¹⁵ and was estimated to cost the US \$6.1 billion in 1999.⁷ Adults with CVD, particularly those with stroke or vascular dementia, represent a costly population for Medicaid. Although the prevalence of stroke among Ohio adult Medicaid recipients was 5% in 2003, the total Ohio Medicaid expenditures for Ohio adult Medicaid recipients with stroke was \$1.3 billion, representing 17% of the total expenditures for all Medicaid recipients.¹⁶ Among Ohio adult Medicaid recipients with stroke, 58% received Aged, Blind or Disabled (ABD) Medicaid and 34% received Medicare premium assistance.¹⁶ The amount and cost of caregiver assistance for adults with CVD in Ohio overall and among those receiving Medicaid are unknown.

This study assessed current prevalence and costs of informal caregiver assistance for adults reporting a history of CVD for the state of Ohio. In the Ohio Plan to Prevent Heart Disease and Stroke 2002-2007, four populations were found to have higher CVD burden in Ohio: men, African-Americans, Appalachians, and those living in poverty.² These populations also were deemed "disparate populations" because they may have less access to health care services. It is uncertain whether these priority populations with higher CVD burden and reduced health care access also have disparities in caregiver assistance. The OFHS is uniquely able to assess caregiver assistance and provide state population estimates for adults with a history of CVD across all ages, sex, race, state region, income, insurance type, and CVD type. Because the OFHS has separate questions for different forms of caregiver assistance, we explored the types of caregiver assistance reported for adults with CVD. These data can be used by state insurers and policymakers planning long-term care needs related to CVD.

II. Methods and Data Sources

A. Study Population

Data from the 2008 Ohio Family Health Survey (OFHS) was used to generate the findings in this report. OFHS is a statewide, random digit dial telephone survey of over 50,000 Ohio residents. OFHS used a stratified, list-assisted sampling frame that sampled respondents using random digit dialing computer assisted telephone interviewing (CATI) methods. The sample was stratified by county with several additional samples. The six largest metropolitan counties were sub-sampled to ensure greater representation of African Americans. Additional targeted supplemental samples were drawn to ensure good representation of Asian and Hispanic residents. Finally, a separate cell phone sample ensured good representation of younger people more often

reached via cell phones in 2008. A detailed description of the survey methodology can be found in the 2008 OFHS Methodological Report.¹⁷ The final adjusted response rate for 2008, defined by Council of American Survey Research Organizations (CASRO) and equivalent to the adjusted response rate defined by the American Association for Public Opinion Research (AAPOR) for the random digit dialing and African-American over-sample portion of the OFHS 2008 survey was 31.1% for cell phone users and 34.6% for landline phone users.¹⁷

We identified all Ohioans aged ≥ 18 years with reported CVD status (present or absent). For 2008, adults with CVD were identified as respondents who report being told by a doctor or other health professional that they had (a) a heart attack, (b) “coronary heart disease also known as coronary artery disease, congestive heart disease, angina”; (c) a stroke; or (d) congestive heart failure.

B. Primary Outcome Measure

The OFHS identifies respondents reporting caregiver assistance as those who “currently need any of the following types of assistance [because of health problems]”: (a) Assistance with personal care, such as bathing, dressing, toileting, or feeding; (b) domestic assistance, such as shopping, laundry, housekeeping, cooking, or transportation; (c) help with household maintenance, such as painting or yard work; (d) social or emotional support, such as companionship, recreation, and socialization; (e) coordinating health care, such as making appointments for doctor’s visits or therapies; (f) assistance managing financial affairs, such as managing your checkbook or legal affairs; (g) other kinds of assistance. Respondents who report needing any of the types of assistance are then asked to report the overall amount of assistance needed for all types of assistance combined (“How many hours of assistance do you currently require on average for the types of assistance that were just mentioned?”). The amount of caregiver assistance measured in hours per person per month was the primary outcome measure.

Because respondents are not asked to report the provider of the assistance, we cannot state whether the assistance is provided by informal caregivers (family or friends) or formal caregivers (paid workers such as a home health aides). We will refer to the assistance as informal care in this report; however, some of the assistance may be currently performed by formal caregivers.

C. Independent Variables

Based on literature review and clinical observation, we identified covariates as those factors which may affect the relationship between CVD status and informal caregiver assistance. Covariates included age (18-44 years, 44-64 years, ≥ 65 years), sex, race/ethnicity, region (Appalachia, Metropolitan, Rural, or Suburban), poverty level, education ($<$ high school, \geq high school), marital status (married or unmarried couple vs. divorced, widowed, separated), number of adults in the household, co-morbidity (hypertension, diabetes, and cigarette smoking), health status, and number of hospitalizations. We combined self-reported race and ethnicity to create 4 racial/ethnic groups: non-Hispanic whites, non-Hispanic blacks, Hispanics, and other. Annual household income was categorized according to federal poverty criteria based on household size ($\leq 100\%$ federal poverty level, 101-150% federal poverty level, 151-

200% federal poverty level, 201-300% federal poverty level, >300% federal poverty level). Health insurance status was defined as Medicaid and Medicare, Medicaid only, Medicare only, Private, other, and uninsured. Low self-reported health status was defined as poor or fair on a 5-point Likert scale. CVD type was classified as stroke, CHF, and CHD (heart attack and/or coronary heart disease). Because stroke or CHF may be associated with increased caregiver assistance requirements and participants often have more than one type of CVD, we examined informal caregiver assistance by CVD type with 5 mutually exclusive categories: 1) Stroke + CHF (\pm CHD), 2) stroke without CHF \pm CHD, 3) CHF \pm CHD, 4) CHD only, 5) no CVD.

D. Statistical Analysis

Analysis of the Amount of Caregiver Assistance

Baseline characteristics of the two CVD groups (CVD and no CVD) were compared using χ^2 or t-test as appropriate. The unadjusted proportion of adults reporting informal caregiver assistance by CVD group and by age (≥ 18 years overall, 18-44 years, 44-64 years, ≥ 65 years) were compared using χ^2 . We estimated the total unadjusted hours of informal caregiver assistance needed monthly for the two respondent groups with CVD and without CVD respectively, with each respondent group including adults who reported zero hours per month of informal caregiver assistance and those who reported 1 or more hours per month of informal caregiver assistance. We also estimated the average monthly hours per person for adults with CVD and without CVD respectively, with each respondent group including adults reported zero hours per month of informal caregiver assistance and those who reported 1 or more hours per month of informal caregiver assistance. All analyses used the survey weights to accommodate the complex sampling design and to provide weighted results that reflect population estimates. Analyses were repeated in the subgroups of participants in the four priority CVD populations in Ohio, those receiving any Medicaid, and those receiving Medicaid and Medicare.

The distribution of informal caregiver hours is highly skewed owing to the majority of respondents not receiving informal caregiver assistance. To determine the degree that informal caregiver assistance was attributable to CVD, we used a two-part regression model to further analyze the data.^{6, 7, 18} In the first part of the two-part model, logistic regression was used to estimate the probability of reporting informal caregiver assistance among the respondent groups with and without CVD respectively, adjusting for factors associated with informal caregiver assistance including health status, comorbidity, potential caregivers in home, and socio-demographic factors. In the second part of the two-part model, ordinary least squares regression examined the association of CVD category with the natural logarithm of informal caregiver assistance hours per month for respondents who reported any informal caregiver assistance. The results from each part of the model were combined to obtain an estimate of the average effect of CVD on monthly hours of informal caregiver assistance required per person. This estimate represents the unconditional (not conditioned on report of informal caregiver assistance) effect of CVD on monthly hours of informal caregiver assistance.⁷ Regression model results were retransformed to hours for easier interpretation.

Cost Analysis of Caregiver Assistance

Although opportunity cost is the preferred measure of cost for health care economic analyses, the opportunity costs of the time of an informal caregiver are uncertain as there are no appropriate wage data (e.g., the wage rate for a retired elderly person to provide informal care to a person with CVD).^{7,19} An alternative and accepted approach is to use the market price of an equivalent service or worker as an estimate of the opportunity cost for the time of an informal caregiver.¹⁹ The value of informal caregiver time is estimated using the replacement costs of assistance with community and domestic activities, i.e., the cost to replace the informal caregiver with an equivalent worker, in this case, a home health aide.^{7, 11, 19} Using this method, we estimated the annual cost of informal caregiver assistance attributable to CVD by multiplying the adjusted monthly hours of informal caregiver assistance per person attributable to CVD by the 2007 US median wages for a home health aide (\$9.15/hour) using data from the US Bureau of Labor Statistics and multiplied by 12 (months per year).²⁰ To obtain an estimate of the annual cost of informal caregiver assistance attributable to CVD for the state of Ohio in 2008, we multiplied the annual cost of informal caregiver assistance per person attributable to CVD by the population estimate of the number of adult Ohioans with CVD in 2008. The two-parts model yields an estimate of the average effect of CVD on monthly hours of informal caregiver assistance required per person not conditional on report or receipt of informal caregiver assistance and similar studies^{6,7} have used the total CVD population estimate (i.e., adults reporting no informal caregiver assistance and those reporting informal caregiver assistance) to estimate costs of informal caregiver assistance attributable to CVD. The entire analysis was repeated in the subgroup of respondents with CVD with any Medicaid insurance and the subgroup of respondents with CVD and both Medicaid and Medicare insurance.

III. Findings

A. CVD Prevalence in Ohio

In Ohio, the prevalence of CVD (heart attack, coronary heart disease, stroke or congestive heart failure) in adults aged 18 years or older was 10.4% (890,000) in 2008. The prevalence of adults with CVD in Ohio increased by age with approximately 50% of adults with CVD aged 65 years or older (**Table 1**). Among adult Ohioans, 5.4% reported a history of heart attack, 6.3% reported a history of coronary heart disease, 3.5% reported a history of stroke, and 3.0% reported a history of congestive heart failure.

Table 1: Ohio Cardiovascular Disease Prevalence, Overall and by Age Group, 2008

Age Group	n (%)	Population Estimate
Age ≥18 years (overall)	7,040 (10%)	889,890
Age 18-44 years	425 (11%)	100,765
Age 45-64 years	2,674 (40%)	358,598
Age ≥65 years	3,941 (48%)	430,527

Source: State of Ohio: Department of Insurance, Department of Job and Family Services, Department of Health, and Department of Mental Health. Ohio Family Health Survey, 2008-09 [Computer File]. Ohio State University, Ohio Colleges of Medicine Government Resource Center [distributor], 2009. Columbus, Ohio.

B. Characteristics of Adults with CVD in Ohio

Compared to adults without CVD, adults with CVD were more likely to be older, male, and have less than high school education (**Appendix A**). A higher proportion of adults with CVD were living in poverty compared to adults without CVD. Adults with CVD more frequently reported themselves as the only adult in the household and as having fair or poor health status. The number of hospitalizations and the number of emergency department visits in the last year were higher among adults with CVD than those without CVD. Adults with CVD had higher rates of hypertension and diabetes but similar current cigarette smoking as those without CVD. Adults with CVD more commonly reporting needing assistance to do day-to-day activities compared to those without CVD.

C. Percentage of Adults with CVD Reporting Informal Caregiver Assistance

Adults with CVD more frequently reported informal caregiver assistance than did adults without CVD (**Appendix B**). In 2008, 352,000 (47%) adults with CVD reported informal caregiver assistance. Only 25% of adults without CVD reported informal caregiver assistance. Among adults aged ≥ 65 years with CVD, approximately 178,000 persons reported informal caregiver assistance representing half of the number of adults with CVD reporting informal caregiver assistance (**Table 2**). Informal caregiver assistance was reported similarly by adults with CVD in each of the three age groups.

Table 2: Percentage of Adults with Cardiovascular Disease (CVD) Reporting Informal Caregiver Assistance in Ohio, Overall and by Age, 2008

Age Group	% (95% Confidence Interval)	Population Estimate
Age ≥ 18 years (overall)	47% (45%-49%)	352,240
Age 18-44 years	49% (41%-57%)	33,783
Age 45-64 years	45% (42%-48%)	139,961
Age ≥ 65 years	48% (46%-51%)	178,496

Source: State of Ohio: Department of Insurance, Department of Job and Family Services, Department of Health, and Department of Mental Health. Ohio Family Health Survey, 2008-09 [Computer File]. Ohio State University, Ohio Colleges of Medicine Government Resource Center [distributor], 2009. Columbus, Ohio.

C.1. Percentage of Adults with CVD Reporting Informal Caregiver Assistance by Type of CVD

Informal caregiver assistance varied significantly by CVD type, with the highest rates (67%) among adults with stroke and CHF; moderate but similar rates (55%) among adults with stroke without CHF \pm CHD or CHF \pm CHD; lower rates (37%) among adults with CHD only; and lowest rates (25%) among adults without CVD (**Figure 1 and Appendix C**).

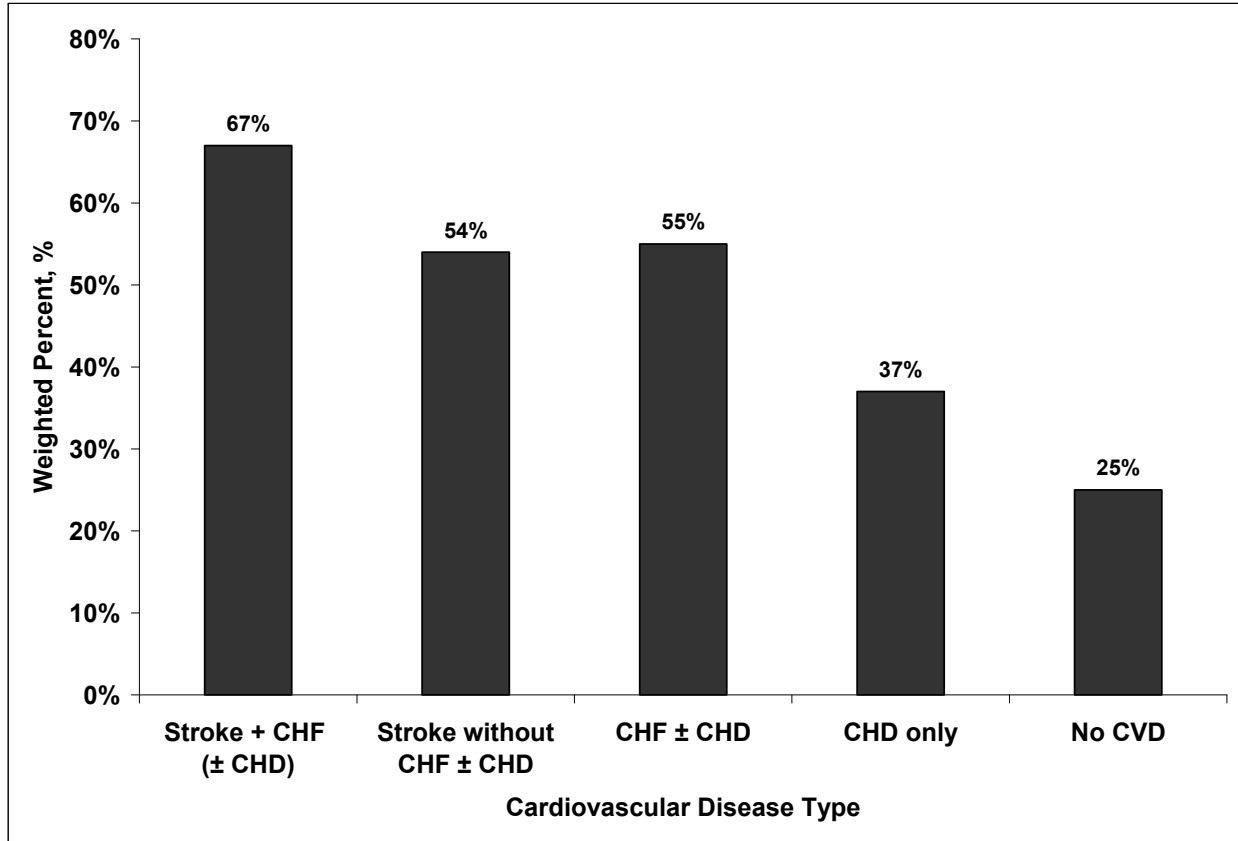


Figure 1: Percentage of Adults with Cardiovascular Disease Reporting Informal Caregiver Assistance in Ohio by Type of Cardiovascular Disease, 2008

Source: State of Ohio: Department of Insurance, Department of Job and Family Services, Department of Health, and Department of Mental Health. Ohio Family Health Survey, 2008-09 [Computer File]. Ohio State University, Ohio Colleges of Medicine Government Resource Center [distributor], 2009. Columbus, Ohio.

C.2. Variations in Informal Caregiver Assistance for Adults with CVD in Ohio by Gender, Race/Ethnicity, Region, and Income

We examined whether adults in the four priority CVD groups (men, blacks, Appalachians, and those living in poverty) had higher rates of informal caregiver assistance than adults not in the four priority CVD groups (**Appendix D**).

C.3. Gender

Compared to men with CVD, women with CVD more frequently reported informal caregiver assistance (55% versus 40%; $P < 0.05$). The gender difference in informal caregiver assistance was largely due to greater proportions of women with CVD aged ≥ 45 years reporting informal caregiver assistance than similarly aged men with CVD (**Table 3**).

Table 3: Percentage of Adults with Cardiovascular Disease Reporting Informal Caregiver Assistance in Ohio, by Gender and Age, 2008

Age Group	Men (n=2957) % (95%CI)	Women (n=4083) % (95% CI)
Age ≥18 years (overall)	40% (37%-43%)	55% (52%-57%)
Age 18-44 years	46% (35%-57%)	53% (43%-63%)
Age 45-64 years	39% (35%-43%)	53% (49%-57%)
Age ≥65 years	40% (36%-44%)	56% (53%-59%)

Source: State of Ohio: Department of Insurance, Department of Job and Family Services, Department of Health, and Department of Mental Health. Ohio Family Health Survey, 2008-09 [Computer File]. Ohio State University, Ohio Colleges of Medicine Government Resource Center [distributor], 2009. Columbus, Ohio.

C.4. Race/Ethnicity

Among adults with CVD, non-Hispanic blacks (58%) and Hispanics (58%) more frequently reported informal caregiver assistance compared to non-Hispanic whites (45%) (Table 4).

Table 4: Percentage of Adults with Cardiovascular Disease Reporting Informal Caregiver Assistance in Ohio by Race/Ethnicity, 2008

	Race/Ethnicity			
	Non-Hispanic Whites n=5745	Non-Hispanic Blacks n=861	Hispanics n=87	Other Racial/Ethnic Groups n=165
Self-reported informal caregiver assistance, percentage, (95% CI)	45% (43%-47%)	58% (53%-64%)	58% (47%-70%)	63% (52%-75%)

C.5 Region

Adults with CVD living in Appalachia reported higher rates of informal caregiver assistance than adults with CVD residing in suburban or rural regions but similar rates as adults with CVD residing in metropolitan regions in 2008 (Table 5).

Table 5: Percentage of Adults with Cardiovascular Disease Reporting Informal Caregiver Assistance in Ohio by Region, 2008

	Region			
	Appalachia n=1825	Metropolitan n=2980	Rural n=1488	Suburban n=747
Self-reported informal caregiver assistance, percentage, (95% CI)	52% (48%-56%)	48% (46%-51%)	41% (38%-45%)	42% (38%-48%)

C.6. Poverty Level

The rates of informal caregiver assistance among adults with CVD increased with poverty level in 2008 (Figure 2).

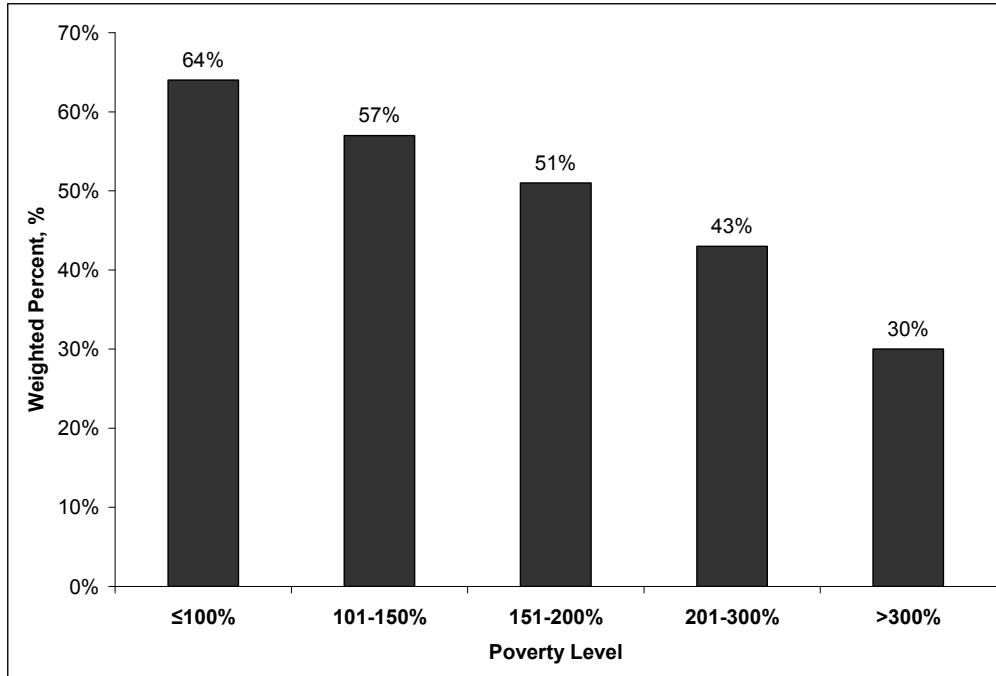


Figure 2: Percentage of Adults with Cardiovascular Disease Reporting Informal Caregiver Assistance in Ohio by Poverty Level, 2008

Source: State of Ohio: Department of Insurance, Department of Job and Family Services, Department of Health, and Department of Mental Health. Ohio Family Health Survey, 2008-09 [Computer File]. Ohio State University, Ohio Colleges of Medicine Government Resource Center [distributor], 2009. Columbus, Ohio.

D. Hours of Informal Caregiver Assistance by CVD Group

D.1. Unadjusted Hours of Informal Caregiver Assistance by CVD Group

We calculated the unadjusted hours of informal caregiver assistance for the respondent group with CVD and the respondent group without CVD respectively (**Appendix B**). Each CVD respondent group included adults who reported no informal caregiver assistance (zero hours per month) and adults who reported informal caregiver assistance (1 or more hours per month). The total unadjusted hours of informal caregiver assistance per month were higher in the group without CVD than the group with CVD due to the greater number of adults in the group without CVD (n=5022) compared to the number of adults in the group with CVD (n=2592). However, the average monthly hours of informal caregiver assistance per person was higher among adults with CVD than among adults without CVD in 2008. In 2008, adults with CVD reported 101 mean hours of informal caregiver assistance per person per month (95% CI 89-112 hours) compared to adults without CVD who reported an average of 79 hours of informal caregiver assistance per person per month (95% CI 72-86 hours)(P<0.001). In 2008, adults aged ≥65 years with CVD reported significantly higher number of hours of informal caregiver assistance per person per month (104 mean hours, 95% CI 86-121 hours) compared to adults aged ≥65 years without CVD (59 mean hours, 95% CI 47-72 hours); no other age group comparisons reached statistical significance.

D.2. Adjusted Hours of Informal Caregiver Assistance Attributable to CVD

We calculated the adjusted hours of informal caregiver assistance for the two respondent groups with CVD and without CVD with each group including adults who reported no informal caregiver assistance (zero hours per month) and adults who

reported informal caregiver assistance (1 or more hours per month) respectively. **Appendix E** shows full model results. In 2008, adults with CVD required 5.8 adjusted hours of additional informal caregiver assistance per person per month (95% CI 4.8-6.7 hours per person per month) compared to adults without CVD after adjusting for age, gender, race/ethnicity, region, poverty level, education, marital status, number of adults in the household, health insurance, hypertension, diabetes, cigarette smoking, health status, and number of hospitalizations in the past year (**Appendix F**).

E. Cost of Informal Caregiver Assistance Attributable to CVD

The estimated cost of informal caregiver assistance attributable to CVD was \$53 per person per month (95% CI \$44-\$61) or \$632 per person per year (95% CI \$529-\$736) in 2008 (**Table 6 and Appendix F**). Using the 2008 population estimate of adults with CVD who reported informal caregiver assistance (889,890), the estimated cost of informal caregiver assistance attributable to CVD for adults in Ohio was \$563 million in 2008 (95% CI \$471-\$655 million).

Table 6: Cost of Informal Caregiver Assistance Attributable to Cardiovascular Disease (CVD) among Adults in Ohio, 2008

Row	Variable	Number (95% Confidence Interval)
1	Adjusted hours of informal caregiver assistance per person per month for adults aged ≥18 years with CVD, in Hours per person per month (95% CI)	15.74 (13.96-17.52)
2	Adjusted hours of informal caregiver assistance per person per month for adults aged ≥18 years without CVD, in hours per person per month (95% CI)	9.98 (9.14-10.82)
3	Adjusted monthly hours of informal caregiver assistance attributable to CVD Difference in adjusted hours of informal caregiver assistance per person per month for adults with CVD minus adjusted hours of informal caregiver assistance per person per month for adults without CVD, in hours per person per month (row 1 minus row 2)	5.76 (4.82-6.70)
4	Hourly rate for home health aide (2007)	\$9.15/hr
5	Monthly cost of informal caregiver assistance attributable to CVD, in dollars per person per month (2008) (row 3 multiplied by row 4)	\$52.70 (\$44.10-\$61.31)
6	Yearly cost of informal caregiver assistance attributable to CVD, in dollars per person per year (2008) (row 5 x 12 (months per year))	\$632.45 (\$529.15-\$735.75)
7	Population estimate of adults with CVD (2008)	889890
8	Yearly cost of informal caregiver assistance for adults with CVD (2008) (row 6 multiplied by row 7)	\$563 million (\$471 million-\$655 million)

Source: State of Ohio: Department of Insurance, Department of Job and Family Services, Department of Health, and Department of Mental Health. Ohio Family Health Survey, 2008-09 [Computer File]. Ohio State University, Ohio Colleges of Medicine Government Resource Center [distributor], 2009. Columbus, Ohio.

F. Amount of Informal Caregiver Assistance among Adults with Medicaid Insurance by CVD Status

We examined the amount of informal caregiver assistance among adults with Medicaid insurance by CVD status (**Appendix G**). We defined two groups of adults with Medicaid insurance that are not mutually exclusive: a) recipients of any Medicaid insurance and b) recipients of both Medicaid and Medicare insurance. Among all adults receiving any Medicaid, adults with CVD more frequently reported informal caregiver assistance compared to those without CVD (65% versus 53%; $P < 0.001$). In 2008, approximately 68,000 adult Medicaid recipients with CVD reported informal caregiver assistance of whom 20% were aged 18-44 years, 50% were aged 45-64 years, and 30% were aged ≥ 65 years.

Among all adult recipients of Medicaid and Medicare insurance, informal caregiver assistance was not more frequently reported by those with CVD compared to those without CVD (64% versus 61%; $P = 0.22$). However, age modified the association between informal caregiver assistance and CVD status among adults with Medicaid and Medicare insurance. There was no evidence of an association between informal caregiver assistance and CVD status for adults aged 18-64 years in this group. Among the elderly (age 65 years or older), CVD was associated with informal caregiver assistance. In adults with Medicaid and Medicare insurance, adults aged ≥ 65 years with CVD more frequently reported informal caregiver assistance than those without CVD (61% versus 41%; $P < 0.05$).

G. Cost of Informal Caregiver Assistance among Adults with Medicaid Insurance by CVD Status

We calculated the adjusted hours of informal caregiver assistance for the two respondent groups with CVD and without CVD for adults with any Medicaid insurance and for adults with Medicaid and Medicare insurance with each group including adults who reported no informal caregiver assistance (zero hours per month) and adults who reported informal caregiver assistance (1 or more hours per month) respectively.

G.1. Medicaid Recipients

In 2008, adult Medicaid recipients with CVD reported 6.3 adjusted hours of additional informal caregiver assistance per person per month (95% confidence interval 4.9-7.7 hours per person per month) compared to adults without CVD after adjusting for age, gender, race/ethnicity, region, poverty level, education, marital status, number of adults in the household, health insurance, hypertension, diabetes, cigarette smoking, health status, and number of hospitalizations in the past year (**Appendix H**). The estimated cost of informal caregiver assistance attributable to CVD for adult Medicaid recipients was \$58 per person per month (95% CI \$45-\$71) or \$694 per person per year (95% CI \$541-\$847) in 2008 (**Appendix H**). Using the 2008 population estimate of adult Medicaid recipients with CVD (119,789), the estimated cost of informal caregiver assistance attributable to CVD in Ohio was \$83 million in 2008 (95% CI \$65-\$101 million).

G.2 Medicaid and Medicare Recipients

In 2008, adult recipients of Medicaid and Medicare insurance with CVD reported 13.4 adjusted hours of additional informal caregiver assistance per person per month (95% CI 2.3-24.5 hours per person per month) compared to adults without CVD after adjusting for age, gender, race/ethnicity, region, poverty level, education, marital status, number of adults in the household, health insurance, hypertension, diabetes, cigarette smoking, health status, and number of hospitalizations in the past year (**Appendix I**). The estimated cost of informal caregiver assistance attributable to CVD for adult Medicaid and Medicare recipients was \$123 per person per month (95% CI \$21-\$224) or \$1471 per person per year (95% CI \$258-\$2685) in 2008 (**Appendix I**). Using the 2008 population estimate of adult Medicaid and Medicare recipients with CVD (70,793), the estimated cost of informal caregiver assistance attributable to CVD in Ohio was \$104 million in 2008 (95% CI \$18 million-\$190 million). This figure is higher than the corresponding figure for Medicaid recipients because separate models were run for the two groups generating separate estimates of informal care hours for recipients of any Medicaid insurance and recipients of both Medicaid and Medicare respectively. Because adults with any Medicaid insurance reported less informal care particularly for those without CVD, the estimated hours and subsequent costs of informal caregiver assistance are averaged over a larger group of adults with many reporting no informal caregiver assistance. Conversely, adults with Medicaid and Medicare insurance reported more informal care and have fewer persons with no informal care in the group resulting in higher estimates but, owing to smaller sample size, larger confidence intervals.

H. Types of Informal Caregiver Assistance by CVD Group

Because the OFHS respondents do not report the hours of informal caregiver assistance for each specific type of caregiver activity, we examined the frequency of reporting each type of caregiver assistance activity among respondents who reported 1 or 2 types of caregiver assistance to estimate the activities with which adults with and without CVD need help (**Appendix J**). The majority of adults with CVD reporting informal caregiver assistance with only one activity reported help with household maintenance (62%) with fewer adults reporting receiving domestic assistance (19%), social or emotional support (9%), assistance managing financial affairs (6%) and coordination of health care (4%). Adults without CVD reporting informal caregiver assistance with only one activity reported a different pattern of activities with less household maintenance (52%), and more social or emotional support (20%), less domestic assistance (12%), and similar rates of coordination of health care (8%) and assistance managing financial affairs (6%).

IV. Discussion

This analysis provides current estimates for the self-reported prevalence rates of CVD and informal caregiver assistance among adults living in Ohio. In 2008, 47% of adults with CVD reported informal caregiver assistance. Our findings provide estimates for the amount and cost of informal caregiver assistance attributable to CVD and suggest that informal caregiver assistance represents a substantial health care cost in Ohio. The number and cost of hours of informal caregiver assistance attributable to CVD was 5.8 additional hours (\$53) per person per month in 2008. The average yearly cost of informal caregiver assistance attributable to CVD was \$632 per person per year. For the

890,000 adult Ohioans with CVD, the estimated cost of informal caregiver assistance attributable to CVD was \$563 million in 2008.

Our results demonstrate vulnerable CVD populations identified by increased informal caregiver assistance. Women with CVD more frequently reported informal caregiver assistance than men with CVD. Among adults with CVD, a greater proportion of non-Hispanic blacks or Hispanics reported informal caregiver assistance than non-Hispanic whites. Adults with CVD living in Appalachia had higher rates of informal caregiver assistance compared to those living in suburban or rural regions of Ohio. The percentage of adults with CVD reporting informal caregiver assistance increased as poverty worsened. Thus, three of the four CVD groups deemed priority and disparate groups because of increased CVD risk and reduced access to care respectively—non-Hispanic blacks, Appalachians, and those living in poverty-- report greater needs for informal caregiver assistance.

Medicaid recipients account for a significant proportion of adults with CVD reporting informal caregiver assistance. Among adults with CVD, 65% of Medicaid recipients reported informal caregiver assistance representing 20% of the total number of adult Ohioans with CVD reporting informal care. Medicaid recipients account for 15% (\$82 million) of the total cost of informal caregiver assistance attributable to CVD. Among adults with CVD, 65% of Medicaid and Medicare recipients reported informal caregiver assistance representing 11% of the total number of adult Ohioans with CVD reporting informal care. However, Medicaid and Medicare recipients with CVD have higher adjusted monthly hours of informal caregiver assistance and higher costs attributable to CVD after adjusting for co-morbidity, health status, and socio-demographic factors. In the two Medicaid respondent groups, the elderly account for a considerable proportion of informal caregiver assistance for adults with CVD. Among adult Medicaid recipients, those aged 65 years or older account for 30% of the adults with CVD reporting informal caregiver assistance. Among adult Medicaid and Medicare recipients, those aged 65 years or older account for half of the adults with CVD reporting informal caregiver assistance.

Our data confirm that the type of CVD or combination of CVD types impacts the amount of informal caregiver assistance. Stroke or CHF are associated with increased informal caregiver assistance compared to CHD. However, the combination of stroke and CHF is associated with the greatest informal caregiver assistance with 67% of adults with stroke and CHF reporting informal caregiver assistance. The OFHS allows for some estimates of the types of caregiver assistance that are required by adults with CVD. Among adults with CVD reporting the need for 1 type of informal caregiver assistance, more than 60% need assistance with household maintenance, 20% need domestic assistance, and 5-10% require social or emotional support, assistance managing financial affairs, or coordination of health care.

V. Policy Ramifications

Our data provide current estimates of the prevalence (>45%) and cost of caregiver assistance (\$563 million) for adults with CVD in Ohio. These data are crucial in planning for the long-term care needs of this large, costly population. The finding of significant disparities in informal caregiver assistance for certain CVD groups including women,

non-Hispanic blacks, Hispanics, adults living in Appalachia, and adults living in poverty may help focus efforts on the most vulnerable CVD patients and their families who may require ancillary health care and social services. Ohio policy-makers and health insurers may use these data to expand or more efficiently allocate resources to care for adults with CVD.

Given that nearly half of adults with CVD reported caregiver assistance, health care organizations, policy makers, and insurers may develop and implement programs to identify adults with CVD who have care needs. Many adults with CVD may not have available informal caregivers because 45% of adults with CVD are divorced, widowed or separated and 35% of adults with CVD are the only adults living in the household. Health care organizations including providers, policy makers and insurers may target these vulnerable single adults with CVD who may require community resources to perform some or all of the needed care if informal caregivers are not available. Prior to the promotion of widespread programs to screen for care needs in adults with CVD, however, the availability and quality of current resources and programs to provide home and community-based care to adults with CVD must be determined. The coordination of these home and community-based health care and non-health care services across agencies and the streamlining of applications for services by patients and their caregivers would be expected to improve efficiency and patient/caregiver satisfaction.

Elderly adults with CVD represent a particularly vulnerable population at risk for unmet care needs owing to several factors including increased co-morbidity, frailty, poverty, living alone or social isolation. The availability, adequacy and quality of specific programs targeting the elderly such as Meals on Wheels, visiting nurse and home health aide services, and patient health navigators needs to be assessed for the high-risk population of elderly adults with CVD reporting informal caregiver assistance. The Ohio Department of Aging PASSPORT program provides home and community-based services including assistance with activities of daily living to frail Medicaid-eligible older Ohioans aged 60 years or older.²¹ Given our findings and the rising prevalence of CVD over time, the Ohio Department of Aging may target the CVD population for enrollment into the PASSPORT program and increase the number of program slots to allow greater enrollment of adults with CVD. High-risk elderly adults with CVD and increased care needs, including those with stroke and/or CHF and those receiving both Medicaid and Medicare, represent a priority group for targeted PASSPORT enrollment efforts. Taken together, these efforts may result in the identification and provision of additional care needs for elderly adults with CVD. The provision of appropriate home-based care for community-dwelling elderly adults with CVD may reduce hospital and nursing home stays.

The burden on caregivers providing informal care to these adults with CVD warrants special attention. Caregiver burden may be addressed by providing community resources to perform some or all of the care needed for adults with CVD, by ensuring adequate availability and duration of family medical leave if the caregiver is employed, and by increasing the availability and health insurance coverage of respite care for informal caregivers of adults with CVD. Caregivers have increased prevalence rates of emotional distress including depression and unmet psychosocial care needs. Thus,

efforts to ensure the availability and health insurance coverage of counseling and support services for caregivers of adults with CVD are warranted.

VI. Limitations and Further Research Needs

Given the observational study design, we cannot infer causation from observed associations. These self-reported data are subject to recall bias and reporting error. Self-report of informal caregiver assistance may underestimate assistance that is infrequent.⁷ Recent data suggests that self-report of CVD is accurate,²² even among the disabled elderly.²³ Several factors, such as severity of CVD, onset of CVD, quality of CVD care, dementia, cannot be assessed in the OFHS data. The association of informal caregiver assistance and acute or chronic rehabilitation needs cannot be determined as the rehabilitation status or requirements of adults with CVD were not ascertained in the OFHS. Because the OFHS does not sample persons who are institutionalized, this analysis includes community-dwelling adults and does not include adults living in long-term care or skilled nursing facilities. Based on the design of the OFHS questions, participants are not asked to report the number of hours required for each of the seven possible types of assistance needed. We assessed the prevalence of types of assistance needed among participants reporting 1 or 2 types of informal caregiver assistance to obtain a description of the types of informal caregiver assistance required by participants with and without CVD. Since participants are not asked to report the diseases that cause their disability or their needs for informal caregiver assistance, we cannot determine the number of hours specifically attributable to CVD. Instead, we used an accepted two-parts modeling approach to estimate the hours of informal caregiver assistance after adjusting for known factors associated with caregiver assistance among those with or without CVD as a means of estimating the amount of informal caregiver assistance attributable to CVD.^{6,7} Future surveys or studies could ask a participant to report the disease or condition responsible for disability or needs for caregiver assistance to more directly measure caregiver assistance attributable to CVD. Our findings should be confirmed in other epidemiological studies. We used the median hourly wage for a home health aide to calculate the cost to replace the care performed by an informal caregiver with the care provided by a formal caregiver. But, some informal caregiver assistance, e.g., social/emotional support, may or may not be performed by a home health aide.

VII. Conclusion

Informal caregiver assistance is substantial among community-dwelling adult Ohioans with CVD. Increased caregiver assistance was reported among adults with CVD who were female, non-Hispanic black, Hispanic, living in Appalachia or living in poverty. Two specific CVD types, stroke and CHF, were associated with increased caregiver assistance particularly if both were present. In 2008, the yearly cost of informal caregiver assistance for adults with CVD was \$632 per person. In Ohio, costs of informal caregiver assistance for adults with CVD were approximately \$563 million in 2008. Efforts to ensure that sufficient community resources are available to meet the care needs of adults with CVD and their caregivers are warranted.

Bibliography

1. Rosamond W, Flegal K, Furie K et al. Heart disease and stroke statistics--2008 update: a report from the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. *Circulation*. 2008;117:e25-146
2. Ryan NJ, Chan, W. F., and Sherwood, R. The Ohio Plan to Prevent Heart Disease and Stroke 2002 – 2007, 1st Ed. Columbus, OH: Alliance for Cardiovascular Health, March 2003
3. He WS, M. Velkoff, VS. DeBarros KA. *65+ in the United States: 2005*.: US Census Bureau; 2005.
4. Centers for Disease Control and Prevention (CDC). *Behavioral Risk Factor Surveillance System Survey Data*. Atlanta, GA [2007].
5. Mathew ST, Gottdiener JS, Kitzman D, Aurigemma G. Congestive heart failure in the elderly: the Cardiovascular Health Study. *Am J Geriatr Cardiol*. 2004;13:61-68
6. Gure TR, Kabeto MU, Blaum CS, Langa KM. Degree of disability and patterns of caregiving among older Americans with congestive heart failure. *J Gen Intern Med*. 2008;23:70-76
7. Hickenbottom SL, Fendrick AM, Kutcher JS et al. A national study of the quantity and cost of informal caregiving for the elderly with stroke. *Neurology*. 2002;58:1754-1759
8. Anderson CS, Linto J, Stewart-Wynne EG. A population-based assessment of the impact and burden of caregiving for long-term stroke survivors. *Stroke*. 1995;26:843-849
9. Luengo-Fernandez R, Leal J, Gray A et al. Cost of cardiovascular diseases in the United Kingdom. *Heart*. 2006;92:1384-1389
10. Dura JR, Kiecolt-Glaser JK. Sample bias in caregiving research. *J Gerontol*. 1990;45:P200-204
11. Dewey HM, Thrift AG, Mihalopoulos C et al. Informal care for stroke survivors: results from the North East Melbourne Stroke Incidence Study (NEMESIS). *Stroke*. 2002;33:1028-1033
12. *Caregiving in the US*, National Alliance for Caregiving and AARP, 2005.
13. Scholte op Reimer WJ, de Haan RJ, Rijnders PT et al. The burden of caregiving in partners of long-term stroke survivors. *Stroke*. 1998;29:1605-1611
14. Schulz R, Beach SR. Caregiving as a risk factor for mortality: the Caregiver Health Effects Study. *JAMA*. 1999;282:2215-2219
15. Brown DL, Boden-Albala B, Langa KM et al. Projected costs of ischemic stroke in the United States. *Neurology*. 2006;67:1390-1395
16. DeFiore-Hyrmer J. and Pryor B. The Burden of Stroke in Ohio. Columbus, OH: Chronic Disease and Behavioral Epidemiology, Ohio Department of Health; 2006.
17. Ohio Family Health Survey. Accessed on May 4, 2009 at: <http://ofhs.webexone.com/>.
18. Duan N, Manning WG, Morris CN, Newhouse JP. A comparison of alternative models for the demand of medical care. *Journal of Business and Economic Statistics*.1983;1:115-26.
19. Gold MR, Siegel, J.E., Russell, L.B., Weinstein, M.C. (eds.). *Cost-effectiveness in Health and Medicine*. 1st edition ed. New York: Oxford University Press, 1996

20. United States Department of Labor Bureau of Labor Statistics Occupational Employment Statistics. Accessed on March 11, 2009 at:
http://www.bls.gov/oes/2007/may/oes_oh.htm
21. Ohio Department of Aging PASSPORT Program. Accessed on May 4, 2009 at:
<http://aging.ohio.gov/services/passport/>
22. Horner RD, Cohen HJ, Blazer DG. Accuracy of self-reported stroke among elderly veterans. *Aging and Mental Health*. 2001;5:275-281
23. Simpson CF, Boyd CM, Carlson MC et al. Agreement between self-report of disease diagnoses and medical record validation in disabled older women: factors that modify agreement. *J Am Geriatr Soc*. 2004;52:123-127

APPENDIX

Appendix A: Characteristics of Adults with and without Cardiovascular Disease (CVD), Ohio Family Health Survey Year, 2008

Respondent Characteristic	CVD n=7040 (10%)	Population estimate n=889890	No CVD n=42681 (88%)	Population Estimate n=7655766
Age				
18-44 years	435 (11%)	100,765	14715 (52%)	3,983,398
45-64 years	2674 (40%)	358,598	18275 (34%)	2,624,485
≥65 years	3941 (48%)	430,527	9691 (14%)	1,047,883
Men	2957 (53%)	473,166	14837 (36%)	3,619,198
Race/ethnicity				
Non-hispanic white	5,745 (85%)	746,451	34,947 (84%)	6,381,368
Non-hispanic black	861 (11%)	97,468	4599 (11%)	814,430
Hispanic	87 (1.3%)	12,297	1598 (2%)	162,956
Other	165 (2.8%)	24,918	1048 (2.8%)	218,235
Region				
Appalachia	1825 (15%)	132,383	9243 (13%)	964,025
Metropolitan	2980 (52%)	462,819	19349 (55%)	4,218,425
Rural	1488 (15%)	129,511	9077 (14%)	1,074,191
Suburban	747 (19%)	165,176	5012 (18%)	1,399,126
Income as Percentage of Poverty Level				
≤100%	1659 (22%)	192,054	6454 (15%)	1,148,651
101-150%	1230 (17%)	152,924	4413 (10%)	784,535
151-200%	834 (12%)	106,292	3790 (8%)	646,864
201-300%	1398 (20%)	179,521	8317 (19%)	1,443,087
>300%	1919 (29%)	259,100	19707 (47%)	3,632,631
Education				
<high school	1239 (27%)	241,734	3350 (11%)	841,424
≥high school	5801 (73%)	648,156	39331 (89%)	6,814,342
Marital status				
Married or unmarried couple	3078 (54%)	483,988	23962 (61%)	4,643,906
Divorced, widowed, separated	3940 (45%)	401,781	18577 (39%)	2,990,229
Adults living in household				
1	3654 (36%)	317,407	16598 (26%)	1,958,923
2	2826 (49%)	438,426	20612 (52%)	3,995,376
>2	560 (15%)	134,056	5417 (22%)	1,701,468
Insurance type				
Medicaid and Medicare	963 (8%)	70,793	1784 (2%)	165,677
Medicaid, no Medicare	471 (6%)	48,996	2619 (6%)	453,908
Medicare, no Medicaid	3649 (50%)	449,756	9467 (15%)	1,137,076
Private	1344 (24%)	214,832	23068(59%)	4,532,166
Other	151 (3%)	23,741	1045 (3%)	239,787
Uninsured	462 (9%)	81,772	4698 (15%)	1,127,153
Hypertension	5343 (74%)	657,647	15221 (29%)	2,197,004

Appendix A: Characteristics of Adults with and without Cardiovascular Disease (CVD), Ohio Family Health Survey Year, 2008 (continued)

Diabetes	2603 (35%)	310,794	5202 (10%)	728,983
Current cigarette smoking	1644 (26%)	226,283	9541 (25%)	1,872,509
Fair or poor health status	3649 (51%)	453,122	6743 (13%)	1,056,926
No. of hospitalizations (mean)	0.63 (0.022)	-	0.17 (0.004)	-
Number of hospitalizations				
0	4570 (65%)	577,749	37471 (88%)	6,769,880
1	1458 (21%)	183,300	3860 (9%)	657,054
>1	970 (14%)	123,552	1249 (3%)	208,062
No. of ER visits (mean)	.84 (.037)	-	0.37 (.008)	-
Number of ER visits				
0	4222 (61%)	538,521	34277 (80%)	6,092,913
1	1523 (21%)	189,339	5516 (13%)	1,017,200
>1	1244 (18%)	156,351	2770 (7%)	529,230
Person needs assistance to do day-to-day activities	2051 (28%)	252,093	3539 (7%)	525,485

Appendix B: Informal Caregiver Assistance among Adults with and without Cardiovascular Disease (CVD) by Age, Ohio Family Health Survey Year 2008

	CVD n=7040				No CVD n=42681			
Proportion Reporting Informal Caregiver Assistance by Age and CVD Group								
	%	95%CI		Population Estimate	%	95%CI		Population Estimate
≥18 years (overall)	47%	45%	49%	352240	25%	24%	26%	837851
18-44 years	49%	41%	57%	33783	26%	24%	27%	312470
45-64 years	45%	42%	48%	139961	21%	20%	22%	311523
≥65 years	48%	46%	51%	178496	30%	29%	32%	213857
Total Unadjusted Hours of Caregiver Assistance Required per Month by CVD Group (in millions)								
≥18 years, mean	29.53	25.6	33.5	NA	54.83	49.3	60.3	NA
18-44 years	4.45	2.4	6.5	NA	26.34	21.9	30.8	NA
45-64 years	9.7	7.9	11.5	NA	18.36	15.8	20.9	NA
≥65 years	15.37	12.4	18.3	NA	10.12	7.8	12.4	NA
Average Unadjusted Hours of Caregiver Assistance Required per Person per Month by CVD Group , mean, SE								
≥18 years	101(6)	89	112	NA	79(4)	72	86	NA
18-44 years	156(29)	99	212	NA	99(7.5)	85	114	NA
45-64 years	83(7)	70	96	NA	71(5)	62	80	NA
≥65 years	104(9)	86	121	NA	59(6.4)	47	72	NA

NA = not applicable

Appendix C: Informal Caregiver Assistance by Cardiovascular Disease (CVD) Type and Age, Ohio Family Health Survey Year 2008

Age Group	Stroke + CHF (± CHD) n=428			Stroke without CHF ± CHD n=1768			CHF ± CHD n=1606			CHD only n=3238			No CVD n=42681		
	%	95% CI		%	95% CI		%	95% CI		%	95% CI		%	95%CI	
≥18 years (overall)	67%	59%	74%	54%	50%	58%	55%	51%	59%	37%	34%	40%	25%	24%	26%
18-44 years	66%	41%	91%	60%	46%	74%	59%	41%	76%	35%	24%	47%	26%	24%	27%
45-64 years	67%	54%	79%	52%	46%	58%	52%	45%	58%	36%	32%	40%	21%	20%	22%
≥65 years	68%	58%	77%	54%	49%	60%	56%	51%	61%	39%	35%	42%	30%	29%	32%

CHF = congestive heart failure

CHD = coronary heart disease

Appendix D: Informal Caregiver Assistance by Cardiovascular Disease (CVD) Priority Group and Age, Ohio Family Health Survey Year 2008

Priority CVD Group	≥18 years (overall)	18-44 years	45-64 years	≥65 years
Gender				
Men (n=2957), %	40%	46%	39%	40%
95% CI	37-43%	35-57%	35-43%	36-44%
Women (n=4083), %	55%	53%	53%	56%
95% CI	52-57%	43-63%	49-57%	53-59%
Race/ethnicity				
Non-hispanic whites (n=5745), %	45%	43%	42%	47%
95% CI	43-47%	34-52%	39-45%	44-50%
Non-hispanic blacks (n=861), %	58%	62%	59%	57%
95% CI	53-64%	44-80%	51-66%	49-65%
Hispanics (n=87), %	58%	64%	58%	56%
95% CI	47-70%	32-96%	41-76%	40-73%
Other racial/ethnic groups (n=165), %	63%	84%	66%	55%
95% CI	52-75%	59-111%	50-83%	39-72%
Region				
Appalachia (n=1825), %	52%	66%	49%	50%
95% CI	48-56%	51-82%	44-56%	46-56%
Metropolitan (n=2980), %	48%	49%	45%	50%
95% CI	46-51%	39-60%	41-50%	47-54%
Rural (n=1488), %	41%	23%	41%	44%
95% CI	38-45%	10-38%	35-48%	39-49%
Suburban (n=787), %	42%	44%	41%	43%
95% CI	38-48%	22-67%	34-49%	37-51%
Poverty				
Poverty ≤100% (n=1659), %	64%	66%	67%	59%
95% CI	60-68%	54-78%	61-72%	53-65%
Poverty 101-150% (n=1230), %	57%	63%	60%	56%
95% CI	53-62%	45-81%	51-68%	50-61%
Poverty 151-200% (n=834), %	51%	32%	55%	51%
95% CI	46-57%	6-57%	45-65%	44-58%
Poverty 201-300% (n=1398), %	43%	41%	40%	46%
95% CI	39-48%	21-61%	32-47%	41-51%
Poverty >300% (n=1919), %	30%	25%	25%	36%
95% CI	27-33%	10-40%	21-30%	32-41%

CI=confidence interval

Appendix E: Results of Two-Parts Multivariable Regression Model Estimating Informal Caregiver Assistance Attributable to Cardiovascular Disease (CVD) among Adults in Ohio, 2008

Regression Model Coefficients*				
Covariates	Coefficient	Standard Error	z-score	p-value
CVD	5.758	1.076	5.352	<0.001
Age (per year)	-0.290	0.544	-0.533	0.593
Gender	0.177	0.818	0.217	0.839
Race/ethnicity	0.989	0.571	1.732	0.083
Region	-0.446	0.410	-1.089	0.276
Income as percentage of poverty level	-2.150	0.286	-7.515	<0.001
Education	-1.771	0.964	-1.837	0.066
Marital status	2.419	0.849	2.850	0.004
Adults living in the household	3.084	0.654	4.715	<0.001
Insurance type	-2.146	0.316	-6.786	<0.001
Hypertension	-2.226	0.814	-2.734	0.006
Diabetes	-3.021	0.865	-3.495	<0.001
Cigarette smoking	-2.454	0.864	-2.841	0.004
Number of hospitalizations	4.799	0.535	8.976	<0.001
Health status	13.592	0.907	14.985	<0.001
<p>*The first part of the model was a logistic regression model estimating the probability of receiving informal caregiver assistance for each CVD category, controlling for all covariates in the model. The second part of the model used ordinary least squares regression to examine the association of CVD category with the natural logarithm of informal care hours per month for respondents who received any care. The results from each part of the model were combined to yield an estimate of the unconditional effect of CVD category on monthly hours of informal caregiver assistance. Bootstrapping technique with 300 observations was used to derive the standard error.</p>				

Appendix F: Cost Estimates of Informal Caregiver Assistance Attributable to Cardiovascular Disease (CVD) among Adults in Ohio, 2008

Variable	All Adults			
	Mean	Standard Deviation	Lower CI	Upper CI
Adjusted monthly hours of informal caregiver assistance per person for adults aged ≥18 years with CVD, in hours per person per month	15.74	0.91	13.9564	17.5236
Adjusted monthly hours of informal caregiver assistance per person for adults aged ≥18 years without CVD, in hours per person per month	9.98	0.43	9.1372	10.8228
Adjusted monthly hours of informal caregiver assistance attributable to CVD Difference in adjusted monthly hours of informal caregiver assistance per person for adults with CVD minus adults without CVD	5.76		4.8192	6.7008
Hourly rate for home health aide (median, 2007)	\$9.15			
Monthly cost of informal caregiver assistance attributable to CVD per person	\$52.70		\$44.10	\$61.31
Yearly cost of informal caregiver assistance attributable to CVD, per person	\$632.45		\$529.15	\$735.75
Population estimate of adults with CVD (2008)	889890			
Yearly cost of informal caregiver assistance for adults attributable to CVD (2008)	\$562,809,151		\$470,883,656	\$654,734,645
CI = Confidence Interval				
*Adjusted for age, gender, race/ethnicity, region, income as percentage of poverty level, education, marital status, adults living in the household, insurance type, hypertension, diabetes, cigarette smoking, number of hospitalizations in past year, and health status.				

Appendix G: Informal Caregiver Assistance among Adults with and without Cardiovascular Disease (CVD) by Medicaid Eligibility, Ohio Family Health Survey Year 2008

All Adults with Medicaid Insurance								
	CVD n=1434				No CVD n=4403			
Proportion Reporting Informal Caregiver Assistance by Age and CVD Group								
	%	95%CI		Population Estimate	%	95%CI		Population Estimate
≥18 years (overall)	65%	61%	70%	68015	53%	50%	56%	169984
18-44 years	60%	46%	72%	12732	52%	47%	56%	103902
45-64 years	70%	64%	76%	34473	61%	56%	66%	53587
≥65 years	62%	55%	68%	20810	40%	34%	47%	12495
Total Unadjusted Hours of Caregiver Assistance Required per Month by CVD Group (in millions)								
≥18 years, mean	8.5	6.2	10.8	NA	17.48	14.1	20.9	NA
18-44 years	2.69	0.9	4.4	NA	11.96	8.8	15.1	NA
45-64 years	3.23	2.4	4.1	NA	4.72	3.5	6.0	NA
≥65 years	2.57	1.4	3.8	NA	0.797	0.5	1.1	NA
Average Unadjusted Hours of Caregiver Assistance Required per Person per Month by CVD Group								
≥18 years, mean (SE)	143 (16)	113	174	NA	117 (10)	97	136	NA
18-44 years	242 (56)	131	352	NA	129 (15)	100	158	NA
45-64 years	105 (11)	83	127	NA	101 (12)	78	123	NA
≥65 years	149 (27)	95	202	NA	78 (12)	55	102	NA
All Adults with Medicaid and Medicare Insurance								
	CVD n=963				No CVD n=1784			
Proportion Reporting Informal Caregiver Assistance by Age and CVD Group								
	%	95%CI		Population Estimate	%	95%CI		Population Estimate
≥18 years (overall)	64%	58%	69%	39628	61%	56%	65%	67815
18-44 years	62%	38%	80%	4862	70%	61%	78%	31987
45-64 years	68%	58%	76%	15445	64%	57%	70%	23786
≥65 years	61%	54%	68%	19321	41%	35%	48%	12041
Total Unadjusted Hours of Caregiver Assistance Required per Month by CVD Group (in millions)								
≥18 years, mean	5.4	3.6	7.2	NA	5.8	4.4	7.2	NA
18-44 years	1.5	0.2	2.8	NA	2.88	1.8	4.0	NA
45-64 years	1.4	0.9	2.0	NA	2.155	1.2	3.1	NA
≥65 years	2.4	1.3	3.6	NA	0.775	0.5	1.1	NA
Average Unadjusted Hours of Caregiver Assistance Required per Person per Month by CVD Group,								
≥18 years, mean (SE)	156 (21)	115	197	NA	96 (10)	76	117	NA
18-44 years	366 (93)	183	549	NA	99 (16)	67	131	NA
45-64 years	101 (14)	73	130	NA	101 (18)	66	138	NA
≥65 years	150 (29)	93	207	NA	78 (12)	54	102	NA

Appendix H: Cost Estimates of Informal Caregiver Assistance Attributable to Cardiovascular Disease (CVD) among Adults with Medicaid Insurance in Ohio, 2008

Variable	<u>Adults with Medicaid Insurance</u>			
	Mean	SD	Lower CI	Upper CI
Adjusted* monthly hours of informal caregiver assistance per person for adults aged ≥18 years with CVD, in hours per person per month	14.21	3.4	7.546	20.874
Adjusted* monthly hours of informal caregiver assistance per person for adults aged ≥18 years without CVD, in hours per person per month	7.89	2.69	2.6176	13.1624
Adjusted monthly hours of informal caregiver assistance attributable to CVD Difference in adjusted monthly hours of informal caregiver assistance per person for adults with CVD minus adults without CVD	6.32		4.9284	7.7116
Hourly rate for home health aide (median, 2007)	\$9.15			
Monthly cost of informal caregiver assistance attributable to CVD per person	\$57.83		\$45.09	\$70.56
Yearly cost of informal caregiver assistance attributable to CVD, per person	\$693.94		\$541.14	\$846.73
Population estimate of adults with CVD and Medicaid insurance (2008)	119789			
Yearly cost of informal caregiver assistance for adults with Medicaid insurance attributable to CVD (2008)	\$83,125,900		\$64,822,418	\$101,429,381
CI = Confidence Interval				
*Adjusted for age, gender, race/ethnicity, region, income as percentage of poverty level, education, marital status, adults living in the household, insurance type, hypertension, diabetes, cigarette smoking, number of hospitalizations in past year, and health status				

Appendix I: Cost Estimates of Informal Caregiver Assistance Attributable to Cardiovascular Disease (CVD) among Adults with Medicaid and Medicare Insurance in Ohio, 2008

Variable	Adults with Medicaid and Medicare Insurance			
	Mean	SD	Lower CI	Upper CI
Adjusted* monthly hours of informal caregiver assistance per person for adults aged ≥18 years with CVD, in hours per person per month	31.45	7.58	16.5932	46.3068
Adjusted* monthly hours of informal caregiver assistance per person for adults aged ≥18 years without CVD, in hours per person per month	18.05	1.94	14.2476	21.8524
Adjusted monthly hours of informal caregiver assistance attributable to CVD Difference in adjusted monthly hours of informal caregiver assistance per person for adults with CVD minus adults without CVD	13.4		2.3456	24.4544
Hourly rate for home health aide (median, 2007)	\$9.15			
Monthly cost of informal caregiver assistance attributable to CVD per person	\$122.61		\$21.46	\$223.76
Yearly cost of informal caregiver assistance attributable to CVD, per person	\$1,471.32		\$257.55	\$2,685.09
Population estimate of adults with Medicaid and Medicare insurance (2008)	70,793			
Yearly cost of informal caregiver assistance for adults with Medicaid and Medicare insurance attributable to CVD (2008)	\$104,158,785		\$18,232,451	\$190,085,118
CI = Confidence Interval				
*Adjusted for age, gender, race/ethnicity, region, income as percentage of poverty level, education, marital status, adults living in the household, insurance type, hypertension, diabetes, cigarette smoking, number of hospitalizations in past year, and health status				

Appendix J: Type of Informal Caregiver Assistance Among Adults Reporting One and Two Types of Assistance by CVD Group, Ohio Family Health Survey Year 2008

Adults Reporting One Type of Assistance														
	Persons requiring assistance by CVD Group								Average Hours of Caregiver Assistance Required per Person per Month by CVD Group					
Type of Assistance	CVD (n=1258)				No CVD (n=3049)				CVD			No CVD		
	n	%	95% CI		n	%	95% CI		Mean hours/month	95% CI		Mean hours/month	95% CI	
Assistance with personal care	13	0.9%	0.4%	2.4%	27	1.2%	0.7%	2.1%	50.8	-4.9	106.5	59.0	24.3	93.0
Domestic assistance	265	18.9%	15.9%	22.3%	388	11.6%	10.0%	13.4%	54.0	35.2	72.4	38.0	27.8	47.4
Help with household maintenance	801	61.9%	57.7%	65.9%	1911	51.7%	48.9%	54.5%	31.0	23.7	37.8	29.3	23.3	35.2
Social or emotional support	84	8.5%	6.3%	11.5%	392	19.9%	17.5%	22.5%	57.5	34.5	80.6	65.3	38.5	92.2
Coordinating health care	39	3.6%	2.3%	5.5%	148	7.7%	6.2%	9.6%	10.3	2.5	18.2	55.9	14.9	96.8
Assistance managing financial affairs	45	5.8%	3.9%	8.5%	144	6.7%	5.3%	8.5%	11.7	5.8	17.7	49.4	16.5	82.3
Other kinds of assistance	11	0.4%	0.2%	0.9%	39	1.2%	0.7%	1.9%	72.2	26.27	118.2	286.9	26.4	547.4
Adults Reporting Two Types of Assistance														
	Persons requiring assistance by CVD Group								Average Hours of Caregiver Assistance Required per Person per Month by CVD Group					
Type of Assistance	CVD (n=796)				No CVD (n=1486)				CVD			No CVD		
	n	%	95% CI		n	%	95% CI		Mean hours/month	95% CI		Mean hours/month	95% CI	
Assistance with personal care	75	8.9%	6.3%	12.4%	69	4.5%	3.2%	6.4%	105.0	64.4	145.7	82.4	43.2	121.6
Domestic assistance	579	66.8%	61.2%	71.9%	1009	62.9%	58.9%	66.7%	66.2	52.5	79.9	63.0	51.1	74.9
Help with household maintenance	602	72.9%	67.7%	77.5%	1073	63.4%	59.3%	67.4%	60.2	46.9	73.6	52.6	43.8	61.3
Social or emotional support	143	20.3%	16.1%	25.2%	395	31.6%	27.9%	35.6%	57.5	39.2	75.9	53.5	40.9	66.1
Coordinating health care	75	14.1%	10.3%	19.0%	178	16.9%	13.8%	20.4%	66.4	28.4	104.4	73.4	42.5	104.2
Assistance managing financial affairs	98	14.9%	11.3%	19.5%	206	17.9%	14.9%	21.4%	45.4	25.4	65.4	37.6	21.3	53.8
Other kinds of assistance	20	2.1%	1.2%	3.7%	42	2.8%	1.7%	4.6%	48.5	6.81	90.2	82.9	31.7	134.1