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**BARRIERS TO CARE FOR CARDIOVASCULAR
RISK FACTOR MANAGEMENT**

by

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Submitted in partial fulfillment of the requirements for the degree of

Master of Public Health

Yale School of Public Health

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Abstract

Introduction: Hypertension, high cholesterol, diabetes, obesity, and smoking are established risk factors for cardiovascular disease (CVD), and the presence of several risk factors is associated with worse health outcomes. Access to healthcare has a major influence on the management and treatment of these modifiable conditions. The objective of this study is to examine barriers to care among non-elderly adults with multiple risk factors for CVD, and to furthermore identify socio-demographic disparities within this group. **Methods:** Analyses utilized data from a subset of 39 U.S. states and territories that implemented the optional healthcare access module in the 2013 Behavioral Risk Factor Surveillance System (BRFSS) survey. A sample of non-elderly adults (18–64 years) with three or more risk factors for CVD was used to estimate barriers to care, which included not having insurance, not having a regular provider, not receiving a checkup within two years, not seeing a doctor due to cost, and not taking medications as prescribed due to cost. Descriptive analysis and logistic regression were conducted.

Results: From a sample of 216,961 eligible respondents, 12.5% had three or more risk factors. Among this subset, 22.9% lacked insurance, 20.1% did not have a regular provider, 14.6% did not have a checkup within two years, 28.9% were unable to visit a provider due to cost, and 25.8% reported not taking medications as prescribed due to cost. Cost-related barriers were even greater among a sub-group with history of cardiovascular conditions. Assessment of socio-demographic characteristics revealed that respondents in the younger age group were more likely to experience all barriers to care. Cost-related barriers in particular were more common among females and low-income individuals, while the access-related barriers occurred more frequently among males, certain race/ethnicity groups, and those with low education. **Conclusion:** Barriers to care are widespread among non-elderly adults with multiple risk factors for CVD, and financial barriers are most likely to affect those who are young, female, and low-income.

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Introduction

Hypertension, high cholesterol, diabetes, obesity, and smoking are known risk factors for cardiovascular disease (CVD), which continues to be the leading cause of death in the United States.¹ Lifetime risk of death from CVD has been shown to increase as risk-factor burden intensifies.² Fortunately, cardiovascular-related deaths are expected to be preventable through practice of clinical preventive services such as hypertension control, high cholesterol treatment, and smoking cessation.³ Through modification of these common risk factors, the detrimental impact of cardiovascular disease can be considerably reduced. Healthy People 2020 goals aim to reduce the overall proportions of persons with hypertension and high cholesterol, and also to increase the proportions of those receiving proper management and treatment for these conditions.⁴ The American Heart Association promotes its “Simple 7” steps to modify CVD risk, which include the following recommendations: manage blood pressure, control cholesterol, reduce blood sugar, maintain an active lifestyle, eat a healthy diet, lose weight, and quit smoking.⁵

Access to healthcare, and thereby clinical preventive services, plays a major role in the management of modifiable risk factors for CVD. Uninsured adults are less likely to experience monitored control and treatment of hypertension, high cholesterol, and diabetes when compared to those who are insured.^{6–9} Furthermore, the absence of a regular source of care is associated with lower likelihood of treatment for these conditions, even after controlling for insurance status.¹⁰ Barriers to receiving optimal healthcare are not equally distributed across socio-demographic groups, and evident disparities have emerged. For example, the uninsured population is more likely to be younger, non-white, male, low income, and less educated compared to those who have health insurance.¹¹ Non-elderly adults (aged 18–64 years)

experience higher uninsured rates than adults 65 years or older, who are eligible for Medicare coverage. Given that CVD generally develops later in life, this younger age group represents a population that could significantly benefit from preventive services offered in the healthcare setting.

Recent health reform in the United States intends to address issues around access to care. Among its many goals, the Affordable Care Act (ACA) aims to expand the number of Americans with health insurance coverage and to establish a model of care that is focused on disease prevention. The ACA proclaims that all new plans must cover designated preventive services without cost-sharing, including adult screenings for blood pressure, cholesterol, and Type 2 Diabetes, as well as counseling for smoking cessation and weight loss.¹² Since its inception, the ACA has been associated with improvements in insurance coverage, access to a regular provider, and affordability of care.¹³

In the midst of U.S. healthcare reform this study aims to identify current barriers to care among a population of non-elderly adults at increased risk for cardiovascular disease, as well as any sociodemographic disparities.

Methods

The Behavioral Risk Factor Surveillance System (BRFSS) is an annual state-based, random-digit-dialed telephone survey of non-institutionalized adults (aged ≥ 18 years) residing in the United States. Currently all 50 states, the District of Columbia, Puerto Rico, and Guam collect data each year. BRFSS uses a complex weighting methodology to produce estimates that are most representative of the selected population. The questionnaire is composed of three major parts; the core component, optional modules, and state-added questions. The core component is a

standard set of questions that all states are required to incorporate without modification, while individual states can decide whether to include optional modules or add state-specific questions.

In 2013, a subset of 37 states (Alaska, Arizona, California, Colorado, Connecticut, Delaware, Florida, Georgia, Idaho, Indiana, Iowa, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nebraska, Nevada, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, Tennessee, Utah, Vermont, Virginia, Washington, West Virginia, and Wisconsin), the District of Columbia, and Puerto Rico implemented the optional Healthcare Access module. The sample was subset to individuals between ages 18–64 years (excluding those ≥ 65 years) in the interest of assessing a population that holds greater potential for prevention of cardiovascular disease development and progression.

Five risk factors for cardiovascular disease were assessed in the current study: hypertension, high cholesterol, diabetes, obesity, and current smoking. Self-reported hypertension, high cholesterol, and diabetes were considered present if the participant had ever been told by a doctor, nurse, or other health professional that he or she had the condition. Participants with a body mass index (BMI) of $\geq 30 \text{ kg/m}^2$ were classified as obese, based on self-reported height and weight. Finally, current smoking status was defined as having smoked at least 100 cigarettes in one's lifetime in combination with currently smoking every day or some days. Multiple risk factor status was defined as having three or more of the five risk factors.

Access to healthcare was evaluated based on the following four questions from the BRFSS Healthcare Access Core section: “Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare or Indian Health Services?”; “Do you have one person you think of as your personal doctor or

health care provider?"; "About how long has it been since you last visited a doctor for a routine checkup?"; and, "Was there a time in the past 12 months when you needed to see a doctor but could not because of cost?" Additionally, one question from the Healthcare Access Module was assessed: "Was there a time in the past 12 months when you did not take your medication as prescribed because of cost? Do not include over-the-counter (OTC) medication." Barriers to care were defined as not having health insurance coverage, not having a personal doctor or health care provider, not having had a routine checkup within two years, being unable to visit a doctor due to cost in the past 12 months, and not taking medications as prescribed due to cost in the past 12 months.

Sociodemographic characteristics explored in the analysis included age (18–44 and 45–64 years), sex, race/ethnicity (Non-Hispanic White, Non-Hispanic Black, Hispanic, and Non-Hispanic Other or Multiracial), education level (less than college degree and college graduate) and income level (<\$25,000; \$25,000–\$49,999; \$50,000–\$74,999; ≥\$75,000; and missing or refused). In addition, a subgroup of participants with history of a cardiovascular condition(s) was defined as having ever been told by a health professional that they had angina, coronary heart disease, heart attack, or stroke. Refer to the Appendix for a list of BRFSS survey questions utilized in the analysis.

Descriptive analysis was conducted by estimating the prevalence of individual risk factors (hypertension, high cholesterol, diabetes, obesity, and current smoking) and number of risk factors (0, 1, 2, or ≥ 3) among the sample. These estimates were stratified by age, sex, and race/ethnicity. Additionally, the prevalence of the five barriers to care were determined, and stratified by number of risk factors. Among those with multiple (≥ 3) risk factors, estimates of barriers to care were stratified by age, sex, race/ethnicity, and furthermore by insurance status

(insured vs. uninsured). All prevalence estimates were age-standardized using the 2000 U.S. Census standard population with age distributions of 18–24, 25–34, 35–44, and 45–64 years.¹⁴ Logistic regression models were used to assess socio-demographic characteristics associated with each of the five barriers to care. The multivariable models included variables for age, sex, race/ethnicity, education, income, and insurance coverage.

All analyses were conducted using Statistical Analysis System (SAS) version 9.4, and sampling weights were applied to all estimates to account for the complex survey design.

Results

A total of 365,196 respondents participated in the 2013 BRFSS survey among the 39 states and territories that opted to use the Healthcare Access Module. Approximately one-third were eliminated from the sample based on age (≥ 65 years), and an additional 26,104 (10.7%) respondents with missing data for any of the five CVD risk factors were excluded. The final sample used for analysis consisted of 216,961 participants.

Prevalence estimates of the five CVD risk factors were generated for the overall sample and also stratified by age, sex, and race/ethnicity. Overall, obesity was the most prevalent risk factor reported by participants at 28.4%, closely followed by high cholesterol (26.4%) and hypertension (26.0%). About 20% of participants were considered current smokers, and 7.5% reported having diabetes. Close to one-third (31.7%) of the sample reported having one risk factor, 17.7% reported two risk factors, and 12.5% reported three or more risk factors. The older age group (45–64 years) was much more likely to report having each of the individual risk factors compared to the younger age group (18–44 years) with the exception of current smoking, which was slightly higher in the younger age group. The older age group was nearly four times as likely to report having three or more risk factors compared to the younger age group (18–44

years: 5.6% vs. 45–64 years: 21.3%). Males had greater prevalence of all individual risk factors when compared to females; the greatest difference between the two groups was observed for hypertension (Males: 27.3% vs. Females: 21.2%). Additionally, 12.6% of males reported having three or more risk factors compared to 10.3% of females. Non-Hispanic Blacks (NHB) had the highest prevalence of obesity (38.1%), hypertension (33.6%), and diabetes (10.3%) when compared to the other race/ethnicity groups, and were also most likely to report having three or more risk factors (16.6%). The Non-Hispanic Other or Multiracial (NHO) group reported the highest prevalence of high cholesterol (25.5%) and Non-Hispanic Whites (NHW) were most likely to be current smokers (22.8%).

Figure 1 presents the age-standardized prevalence of barriers to care stratified by number of risk factors (0, 1, 2, and ≥ 3). The prevalence of not having a regular provider and not having a checkup within two years appears to decrease as the number of risk factors increases from 0 to ≥ 3 . Among those with 0 risk factors, 29.5% of respondents reported not having a regular provider (vs. 20.1% of those with ≥ 3 risk factors) and 22.4% reported no checkup within two years (vs. 14.6% of those with ≥ 3 risk factors). Cost-related barriers were observed to trend in the opposite direction, where the prevalence of being unable to visit a provider due to cost and not taking medications as prescribed due to cost increased with increasing number of risk factors. The prevalence of being unable to visit a provider due to cost rose from 13.1% among those with 0 risk factors to 28.9% among those with ≥ 3 risk factors. The prevalence of being unable to take medications due to cost more than tripled when comparing these two groups (0 risk factors: 6.5% vs. ≥ 3 risk factors: 25.8%). There was no clear trend observed between not having insurance and number of risk factors. The proportion of not having insurance increased slightly from those with

0 risk factors (17.3%) to those with 1 risk factor (22.3%), then leveled off with the progression to 2 and ≥ 3 risk factors.

The sample was then subset to only participants with three or more risk factors, resulting in a new sample size of 32,635. First, the prevalence of no health insurance was estimated by age, sex, and race/ethnicity (estimates not shown in a table). Those who reported not having insurance were more likely to be in the younger age group (18–44 years: 23.6% vs. 45–64 years: 15.3%) and more likely to be male (Male: 23.6% vs. Female: 21.6%). NHB and Hispanics were most likely to be uninsured at 28.6% and 27.0%, respectively, when compared to the other race/ethnicity groups. Prevalence estimates of the remaining barriers to care were then assessed overall and by insurance status (insured vs. uninsured), again stratifying by age, sex, and race/ethnicity. The overall estimates in Table 2 suggest that over a quarter of those with multiple risk factors report being unable to visit a provider due to cost (28.9%) and not taking medications as prescribed due to cost (25.8%). The younger age group was more likely to report all barriers to care when compared to the older age group. Males were more likely to indicate not having a regular provider and not having a checkup within two years when compared to females, while females had a higher prevalence for both cost-related barriers. The greatest difference between sexes was observed for not taking medications as prescribed due to cost, where females were about 12% more likely to report this barrier compared to males (Males: 20.9% vs. Females: 32.7%). When compared to other race/ethnicity groups, it was determined that NHO were most likely to report not having a regular provider (25.6%) and NHW were most likely to not have had a checkup within two years (17.2%), while Hispanics and NHB were most likely to experience the cost-related barriers.

As expected, those who are uninsured were much more likely to report barriers to care when compared to those who have health insurance. Table 2 shows that the barrier most frequently indicated by the uninsured group was being unable to visit a provider due to cost (63.3%), followed by not taking medications as prescribed due to cost (46.6%). Likewise, cost-related barriers were more common than access-related barriers in the insured group. Even among those covered by a health insurance plan, 18.8% reported being unable to visit a provider due to cost and 20.3% claimed to not take medications as prescribed due to cost.

Furthermore, a subgroup of participants with history of cardiovascular conditions (n=6,497) was identified and compared with the overall group with multiple risk factors. Regardless of insurance status, this subgroup was less likely than the overall group to not have a regular provider (11.8% vs. 20.1%) and to not have had a checkup within two years (9.6% vs. 14.6%), but were equally or more likely to experience cost-related barriers. While those with a history of CVD reported a comparable prevalence for being unable to visit a provider due to cost to the overall group (29.2% vs. 28.9%), this subgroup was more likely to report not taking medications as prescribed due to cost (29.1% vs. 25.8%).

Table 3 presents the associations of sociodemographic characteristics with the five barriers to care as determined by logistic regression models. Significant associations with age, sex, race/ethnicity, education, income, and insurance status were observed for all barriers to care based on unadjusted odds ratios. Those in the younger age group (18–44 years), those with less than a college degree, and lower income levels were significantly more likely to experience all barriers to care compared to the older age group (45–64 years), college graduates, and those with household income of at least \$75,000. Females had significantly lower odds of not having a regular provider and not having a checkup within two years when compared to males, but

significantly greater odds of experiencing both cost-related barriers. Lack of insurance was not significantly associated with sex based on unadjusted ORs. NHB and Hispanics had significantly greater odds of no insurance, not having a regular provider, and both cost-related barriers when compared to NHW.

After controlling for all socio-demographic characteristics, only some associations remained. The younger age group continued to have significantly greater odds of all barriers to care compared to the older age group. Unchanged associations with sex persisted as well. Additionally, the adjusted odds of no insurance were significantly lower in females compared to males (OR=0.82; 95% CI: 0.73, 0.93). Hispanics continued to have significantly greater odds of no insurance when compared to NHW (OR=1.29; 95% CI: 1.06, 1.58), and all race/ethnicity groups experienced greater odds of not having a regular provider compared to NHW. Both NHB and Hispanics had significantly lower odds of no checkup within two years than NHW (NHB: OR=0.48, 95% CI: 0.38, 0.61; Hispanics: OR=0.67, 95% CI: 0.53, 0.86). Cost-related barriers were no longer associated with race/ethnicity after controlling for the other characteristics in the multivariable models. Education was associated with no insurance, no regular provider, and no checkup within two years, in which those with less than a college degree were significantly more likely to experience these barriers compared to college graduates. All income levels had significantly greater odds of not having insurance, being unable to visit a provider due to cost, and not taking medications as prescribed due to cost when compared to the highest income category of at least \$75,000.

Discussion

A considerable proportion (12.5%) of the non-elderly adult population reported having at least three risk factors for cardiovascular disease. Those with multiple risk factors were more

likely to indicate regular interaction with the healthcare system than those with fewer or no risk factors. However, this group experiences substantial cost-related barriers when seeking care, even after accounting for insurance status. Significant disparities in affordability issues were observed, such that younger adults, females, and those with lower income levels were more likely to report cost-related barriers than their counterparts. Conversely, males were significantly more likely than females to experience access-related issues, as were certain race/ethnicity groups.

Affordability of care and prescription medications presents a major obstacle to ensuring proper management and treatment among individuals with multiple risk factors for CVD. Cost-related barriers were found to be an even greater concern for those with a history of cardiovascular conditions including myocardial infarction, coronary heart disease, angina, and stroke. Smolderen et al.¹⁵ determined that patients were more likely to delay seeking care during an acute myocardial infarction (AMI) if they had financial concerns about accessing care compared to a group without financial concerns. Additionally, AMI patients who report avoidance of care due to cost have greater prevalence of angina and increased rates of re-hospitalization.¹⁶ Nearly 30% of the subgroup with CV conditions in the current study reported not taking medications as prescribed due to cost within the past 12 months. Underuse of medications due to cost has also been shown to increase hospitalization rates among patients with CVD,¹⁷ and non-adherence for any reason is linked to higher risk of mortality.¹⁸

Young females (18–44 years) were identified as a group most likely to experience financial barriers to care and medications, which may inhibit efforts to prevent the onset of cardiovascular disease. Age and gender disparities in CVD care and outcomes have been well documented. The mortality rate for CVD has been consistently higher in women than men over

the past couple decades,¹⁹ and younger women collectively experience worse health outcomes as a result of AMI compared to older women.²⁰ Several factors may contribute to increased risk for young women, including inaccurate assessment of personal cardiovascular risk, inconsistent responsiveness of the healthcare system, and lack of preventive health behaviors.²¹ In addition, women are more likely than men to delay seeking care for AMI.²² While awareness of heart disease risk among women has increased over the past several years, there is still plenty of room for improvement.²³ Addressing cost-related barriers to care could be a gateway for reducing disparities in CV health among young women.

While females were more likely to express financial difficulties, males reported greater access-related barriers. Men were significantly more likely to lack insurance and a regular provider, and were also less likely to have had a recent checkup. Disparities between racial/ethnic groups were also observed when assessing access to care. Lack of insurance was a significant issue among Hispanics, while lack of a regular provider was a barrier for both Non-Hispanic Blacks and Hispanics. These findings are consistent with recently reported disparities in access to care among adults with hypertension.²⁴ Uninsured adults have been found to embody worse cardiovascular health than those with insurance,¹¹ and are also more likely to delay seeking care for AMI.¹⁵ Furthermore, Spatz et al.²⁵ reported higher mortality rates among AMI patients without a usual source of care compared to those with a secure source of care.

A number of barriers to care inhibit individuals from attaining the appropriate preventive and treatment services needed to optimize health outcomes. The Affordable Care Act seeks to address these issues through expansion of health insurance coverage for Americans and highlighting the importance of preventive care. Key features of the ACA are likely to improve coverage for certain socio-demographic groups. Young adults are now permitted to remain on

parent plans until the age of 26, and many low-income individuals and families will benefit from Medicaid expansion.¹² While implementation of the ACA is associated with increased health coverage for young adults, improvements in perceived affordability of care and health status are yet to be observed in this population.²⁶ However, enhancing access to preventive services appears to be a promising hallmark of the ACA for all ages based on evidence of increasing trends in routine checkups and more frequent utilization of blood pressure and cholesterol screenings.^{27,28}

The current study adds to the literature in a number of ways. This is the first study to our knowledge that assesses barriers to care among adults at high risk for CVD using a national, geographically-diverse population. And by focusing on a sample of younger adults (18–64 years), we were able to highlight the most common healthcare barriers experienced in a group that holds greater potential for prevention of CVD onset. While previous research has assessed the BRFSS Healthcare Access Core questions, there are no studies known to have evaluated items from the corresponding module. Drawing from the module allowed us to investigate the magnitude of the sample experiencing financial barriers to prescription medication adherence, which is a serious implication for cardiovascular outcomes. Another strength is the consideration of a range of risk factors used to define a group at high risk for CVD. Fang et al.²⁴ previously identified disparities in access to care among adults with hypertension alone, however we account for additional major risk factors in our analysis.

Certain limitations should be acknowledged while interpreting the findings from this study, many of which can be attributed to issues resulting from self-reported data. All risk factors were self-reported and therefore relied on participant awareness and accurate recall of these conditions. Prior research has shown that about three-quarters of adults with hypertension are

aware of their condition, and that those without insurance are more likely to be unaware.²⁹ Therefore, lack of awareness may have impacted prevalence estimates of at least some risk factors under investigation. Since we are not capturing those who are unaware in the sample, our findings may be an underrepresentation of the true extent of healthcare barriers. Another limitation was the exclusion of about 10% of the sample due to missing data on any of the five risk factors of interest. There could be differences in barriers to care between those with missing versus complete data. However, we avoided further exclusion of records when conducting logistic regression analysis by including a category for missing income data. Participants often choose not to report their income level, which can considerably reduce the number of observations included in a regression model.

Financial barriers to care are significant issues facing non-elderly adults with multiple risk factors for CVD, impacting the ability to monitor and control their conditions in the healthcare setting. Individuals who are young, female, and low-income are most likely to bear the consequences of cost-related barriers. Affordability becomes an even greater problem in treating serious cardiovascular conditions such as myocardial infarction and stroke. Accordingly, preventive action should take precedence, especially for those at elevated risk. The Affordable Care Act offers a partial solution by expanding health coverage and enforcing cost-free preventive services for new insurance plans. Further research is recommended to monitor trends in barriers to care as more Americans are affected by ACA provisions. Nevertheless, additional solutions should be explored to achieve reduced costs and improved health outcomes related to cardiovascular conditions.

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Appendix

BRFSS Survey Questions

| Cardiovascular Risk Factors | |
|--|---|
| Measure | Question Text |
| Hypertension | Have you EVER been told by a doctor, nurse, or other health professional that you have high blood pressure? If “Yes” and respondent is female, ask: “Was this only when you were pregnant?” |
| High Cholesterol | i) Blood cholesterol is a fatty substance found in the blood. Have you EVER had your blood cholesterol checked? ii) Have you EVER been told by a doctor, nurse or other health professional that your blood cholesterol is high? |
| Diabetes | Has a doctor, nurse, or other health professional EVER told you that you have diabetes? If “Yes” and respondent is female, ask: “Was this only when you were pregnant?” |
| Obesity (BMI) | i) About how much do you weigh without shoes? ii) About how much do you weigh without shoes? |
| Current Smoking | i) Have you smoked at least 100 cigarettes in your entire life? ii) Do you now smoke cigarettes every day, some days, or not at all? |
| History of Cardiovascular Conditions | |
| Measure | Question Text |
| Myocardial infarction | Has a doctor, nurse, or other health professional ever told you that you had a heart attack, also called a myocardial infarction? |
| Angina/Coronary Heart Disease | Ever told you had angina or coronary heart disease? |
| Stroke | Ever told you had a stroke? |
| Barriers to Care | |
| Measure | Question Text |
| Insurance coverage | Do you have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicare, or Indian Health Service? |
| Regular provider | Do you have one person you think of as your personal doctor or health care provider? |
| Last checkup | About how long has it been since you last visited a doctor for a routine checkup? A routine checkup is a general physical exam, not an exam for a specific injury, illness, or condition. |
| Cost barrier to visiting provider | Was there a time in the past 12 months when you needed to see a doctor but could not because of cost? |
| Cost barrier to taking medications as prescribed | Was there a time in the past 12 months when you did not take your medication as prescribed because of cost? Do not include over-the-counter (OTC) medication. |
| Socio-demographic Characteristics | |
| Measure | Question Text |
| Age | What is your age? |
| Sex | Sex (gender) of respondent. |
| Ethnicity | Are you Hispanic, Latino/a, or Spanish origin? |
| Race | Which one or more of the following would you say is your race? Note: Select all that apply. |
| Education | What is the highest grade or year of school you completed? |
| Income | Is your annual household income from all sources...? (ranges provided) |

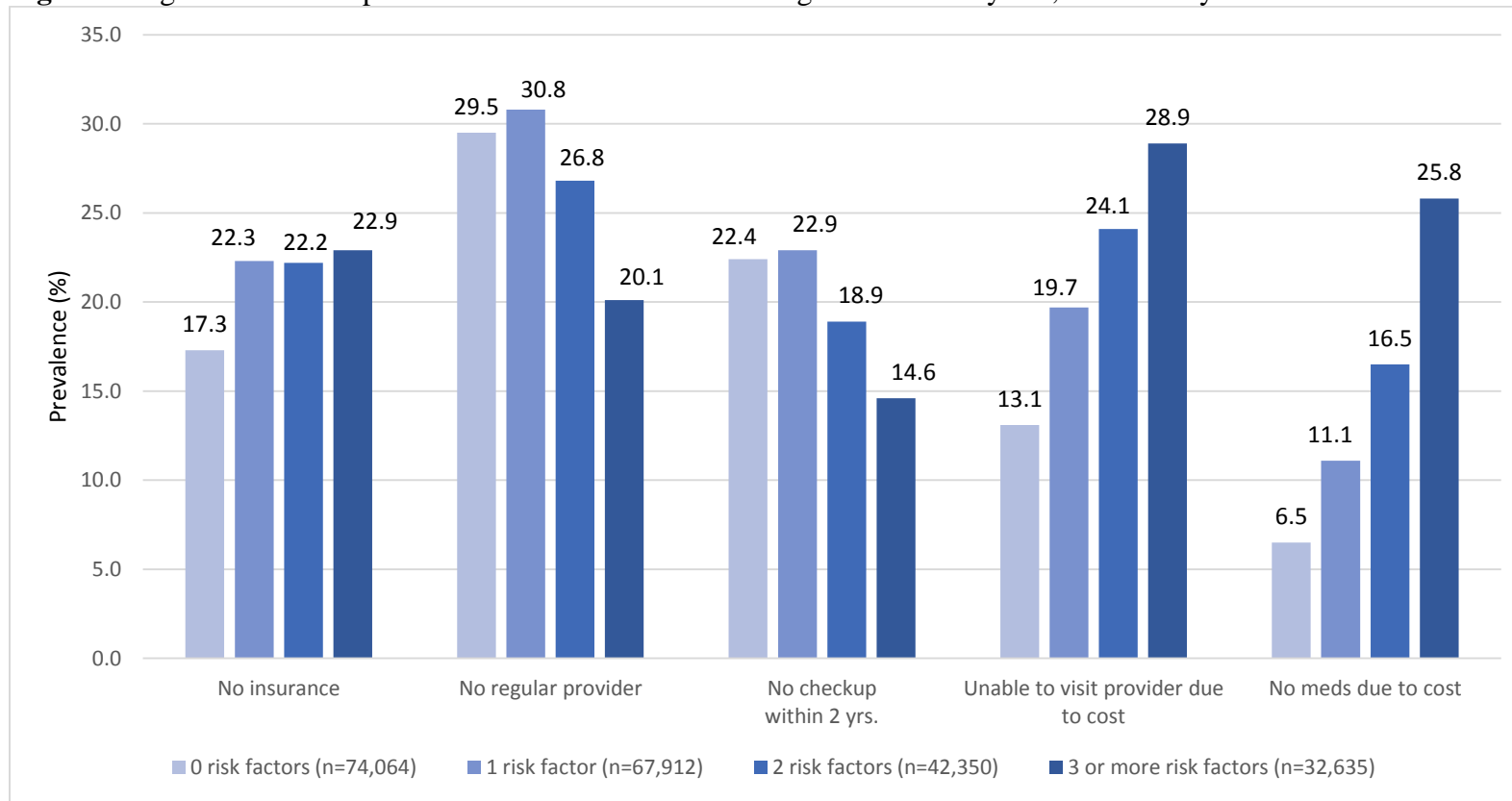
Tables and Figures

Table 1: Age-standardized prevalence of cardiovascular risk factors among adults 18–64 years

| Characteristics | Unweighted N | Type of Risk Factor | | | | | Number of Risk Factors | | | |
|-----------------|--------------|----------------------------|--------------------------------|------------------------|-----------------------|----------------------|------------------------|---------------------|---------------------|---------------------|
| | | Hypertension % (95% CI) | High Cholesterol % (95% CI) | Diabetes % (95% CI) | Obesity % (95% CI) | Smoker % (95% CI) | 0 % (95% CI) | 1 % (95% CI) | 2 % (95% CI) | ≥3 % (95% CI) |
| Overall | 216,961 | 26.0 (25.7–26.3) | 26.4 (26.1–26.8) | 7.5 (7.3–7.8) | 28.4 (28.1–28.8) | 20.4 (20.1–20.8) | 38.1 (37.7–38.5) | 31.7 (31.3–32.0) | 17.7 (17.4–18.0) | 12.5 (12.3–12.8) |
| Age: | | | | | | | | | | |
| 18-44 | 88,257 | 14.4 (14.0–14.8) | 13.6 (13.2–14.0) | 2.9 (2.7–3.0) | 24.9 (24.4–25.4) | 21.0 (20.6–21.5) | 48.8 (48.2–49.3) | 32.8 (32.3–33.4) | 12.8 (12.4–13.2) | 5.6 (5.4–5.9) |
| 45-64 | 128,704 | 40.8 (40.2–41.3) | 42.8 (42.3–43.3) | 13.5 (13.1–13.9) | 33.0 (32.5–33.5) | 19.7 (19.3–20.1) | 24.6 (24.1–25.0) | 30.2 (29.7–30.7) | 24.0 (23.5–24.4) | 21.3 (20.8–21.7) |
| Sex: | | | | | | | | | | |
| Male | 96,349 | 27.3 (26.8–27.8) | 26.3 (25.8–26.8) | 7.0 (6.7–7.2) | 28.5 (27.9–29.0) | 22.8 (22.3–23.3) | 35.9 (35.3–36.5) | 33.1 (32.5–33.6) | 18.4 (18.0–18.9) | 12.6 (12.3–13.0) |
| Female | 120,612 | 21.1 (20.7–21.5) | 22.9 (22.5–23.4) | 6.7 (6.4–6.9) | 28.0 (27.5–28.5) | 18.0 (17.6–18.4) | 43.3 (42.7–43.8) | 30.8 (30.3–31.3) | 15.6 (15.2–16.0) | 10.3 (10.0–10.6) |
| Race/ethnicity: | | | | | | | | | | |
| NH white | 161,711 | 22.9 (22.6–23.3) | 24.7 (24.3–25.0) | 5.5 (5.3–5.6) | 26.7 (26.3–27.1) | 22.8 (22.4–23.2) | 39.6 (39.1–40.0) | 32.6 (32.2–33.0) | 17.1 (16.8–17.4) | 10.8 (10.5–11.0) |
| NH black | 19,018 | 33.6 (32.6–34.6) | 23.6 (22.5–24.6) | 10.3 (9.6–11.0) | 38.1 (36.9–39.3) | 21.8 (20.8–22.8) | 31.7 (30.5–32.8) | 32.0 (30.8–33.2) | 19.7 (18.8–20.7) | 16.6 (15.8–17.4) |
| Hispanic | 20,340 | 24.0 (23.0–25.0) | 24.9 (23.9–25.9) | 9.4 (8.7–10.2) | 31.4 (30.3–32.5) | 14.1 (13.3–15.0) | 39.7 (38.6–40.8) | 32.2 (31.0–33.3) | 16.5 (15.6–17.4) | 11.6 (10.8–12.4) |
| NH other | 13,315 | 23.4 (21.8–24.9) | 25.5 (23.9–27.1) | 8.6 (7.6–9.7) | 19.1 (17.8–20.4) | 17.0 (15.7–18.3) | 46.8 (45.0–48.5) | 27.6 (26.0–29.2) | 15.1 (13.7–16.5) | 10.5 (9.4–11.6) |

Age standardization based on 2000 U.S. standard population, with age groups 18–24, 25–34, 35–44, and 45–64 years.

Figure 1: Age-standardized prevalence of barriers to care among adults 18–64 years, stratified by number of risk factors



Age standardization based on 2000 U.S. standard population, with age groups 18–24, 25–34, 35–44, and 45–64 years.

Table 2: Age-standardized prevalence of barriers to care by insurance status among adults 18–64 years with ≥ 3 risk factors (n=32,635)

| Characteristics | No regular provider % (95% CI) | | | No checkup within 2 yrs. % (95% CI) | | | Unable to visit provider due to cost % (95% CI) | | | No meds due to cost % (95% CI) | | |
|-----------------------|-----------------------------------|---------------------|---------------------|--|---------------------|---------------------|--|---------------------|---------------------|-----------------------------------|---------------------|---------------------|
| | Overall | Insured | Uninsured | Overall | Insured | Uninsured | Overall | Insured | Uninsured | Overall | Insured | Uninsured |
| Overall | 20.1 (18.4–21.9) | 11.9 (10.4–13.5) | 46.2 (42.7–49.6) | 14.6 (13.2–16.1) | 9.9 (8.5–11.2) | 30.4 (27.1–33.7) | 28.9 (27.1–30.7) | 18.8 (16.9–20.6) | 63.3 (59.9–66.7) | 25.8 (24.0–27.7) | 20.3 (18.1–22.6) | 46.6 (42.8–50.4) |
| Age: | | | | | | | | | | | | |
| 18-44 | 22.8 (20.8–24.7) | 14.0 (12.3–15.8) | 51.1 (46.6–55.6) | 15.4 (13.9–16.9) | 10.3 (9.0–11.7) | 32.0 (27.9–36.1) | 30.9 (28.8–33.0) | 20.0 (17.9–22.1) | 66.4 (62.0–70.7) | 27.7 (25.6–29.8) | 21.3 (19.2–23.5) | 49.9 (45.1–54.8) |
| 45-64 | 10.3 (9.5–11.1) | 6.0 (5.4–6.6) | 34.2 (30.8–37.6) | 9.0 (8.3–9.7) | 6.2 (5.5–6.8) | 25.0 (22.2–27.9) | 22.8 (21.8–23.8) | 16.2 (15.2–17.1) | 59.5 (56.3–62.7) | 21.3 (20.3–22.3) | 17.7 (16.6–18.7) | 42.4 (39.3–45.6) |
| Sex: | | | | | | | | | | | | |
| Male | 23.3 (20.9–25.6) | 14.8 (12.5–17.1) | 50.6 (45.9–55.3) | 17.1 (15.0–19.1) | 11.7 (9.6–13.7) | 34.6 (30.1–39.1) | 25.5 (23.1–27.8) | 15.8 (13.3–18.3) | 57.5 (52.8–62.1) | 20.9 (19.9–21.8) | 15.8 (14.7–16.8) | 39.9 (37.9–42.0) |
| Female | 15.3 (12.9–17.8) | 7.9 (6.0–9.7) | 40.0 (35.3–44.7) | 10.7 (9.0–12.5) | 7.3 (5.6–8.9) | 23.7 (19.5–27.9) | 33.4 (30.6–36.2) | 22.9 (20.0–25.7) | 71.8 (67.3–76.4) | 32.7 (31.5–33.9) | 26.6 (25.2–28.0) | 55.7 (53.8–57.5) |
| Race/ethnicity: | | | | | | | | | | | | |
| NH white | 17.5 (15.4–19.5) | 11.2 (9.2–13.2) | 39.6 (35.1–44.0) | 17.2 (15.2–19.1) | 12.0 (10.1–13.9) | 35.8 (31.4–40.2) | 27.7 (25.4–29.9) | 18.3 (16.0–20.7) | 64.0 (59.8–68.3) | 25.1 (24.4–25.8) | 19.3 (18.4–20.2) | 49.0 (47.9–50.2) |
| NH black | 22.5 (18.2–26.7) | 13.2 (8.9–17.4) | 47.1 (39.5–54.6) | 9.5 (6.2–12.8) | 5.4 (2.5–8.3) | 20.2 (13.8–26.7) | 31.0 (26.7–35.2) | 19.6 (15.3–24.0) | 61.8 (54.3–69.4) | 28.1 (27.4–28.8) | 19.6 (18.4–20.8) | 47.9 (46.9–49.0) |
| Hispanic | 24.7 (20.0–29.5) | 11.6 (8.5–14.7) | 59.5 (52.0–66.9) | 11.1 (8.2–14.2) | 4.6 (3.0–6.2) | 29.6 (20.9–38.2) | 33.9 (28.9–39.0) | 22.8 (17.6–28.0) | 62.6 (53.7–71.4) | 26.9 (23.9–30.0) | 22.1 (18.9–25.3) | 42.7 (36.8–48.7) |
| NH other | 25.6 (19.0–32.3) | 19.8 (13.4–26.3) | 54.5 (40.3–68.7) | 14.9 (9.7–20.1) | 14.5 (8.2–20.8) | 19.4 (9.3–29.5) | 20.5 (15.7–25.3) | 12.6 (9.2–15.9) | 62.4 (47.3–77.5) | 23.6 (20.6–26.7) | 22.2 (18.9–25.5) | 38.0 (28.2–47.8) |
| ≥ 1 CV Condition | 11.8 (10.3–13.4) | 7.4 (6.0–8.7) | 35.5 (29.7–41.4) | 9.6 (8.0–11.1) | 6.4 (4.9–7.8) | 26.4 (21.0–31.7) | 29.2 (27.1–31.2) | 22.0 (19.9–24.0) | 66.7 (60.8–72.5) | 29.1 (26.9–31.2) | 24.7 (22.5–26.9) | 52.7 (46.6–58.8) |

Age standardization based on 2000 U.S. standard population, with age groups 18–24, 25–34, 35–44, and 45–64 years.

Table 3: Logistic regression odds ratios of barriers to care among adults 18–64 years with ≥ 3 risk factors

| Characteristic | No insurance OR (95% CI) | | No regular provider OR (95% CI) | | No checkup within 2 yrs. OR (95% CI) | | Unable to visit doctor due to cost OR (95% CI) | | No meds due to cost OR (95% CI) | |
|--|-----------------------------|-----------------------|------------------------------------|----------------------|---|----------------------|---|----------------------|------------------------------------|----------------------|
| | Unadjusted | Adjusted | Unadjusted | Adjusted | Unadjusted | Adjusted | Unadjusted | Adjusted | Unadjusted | Adjusted |
| 18–44 yrs. (vs. 45–64 yrs.) | 1.71 (1.51, 1.95) | 1.63 (1.42, 1.87) | 2.56 (2.23, 2.95) | 2.20 (1.89, 2.55) | 1.83 (1.59, 2.12) | 1.60 (1.37, 1.86) | 1.52 (1.35, 1.70) | 1.30 (1.13, 1.48) | 1.42 (1.26, 1.60) | 1.29 (1.13, 1.47) |
| Female (vs. Male) | 1.00 (0.89, 1.12) | 0.82 (0.73, 0.93) | 0.60 (0.52, 0.68) | 0.55 (0.48, 0.64) | 0.71 (0.62, 0.82) | 0.71 (0.62, 0.82) | 1.45 (1.31, 1.60) | 1.39 (1.24, 1.56) | 1.66 (1.49, 1.84) | 1.55 (1.39, 1.74) |
| Race/ethnicity (vs. NH white) | | | | | | | | | | |
| NH black | 1.38 (1.19, 1.59) | 1.08 (0.93, 1.26) | 1.41 (1.19, 1.66) | 1.28 (1.07, 1.54) | 0.57 (0.45, 0.71) | 0.48 (0.38, 0.61) | 1.26 (1.10, 1.44) | 0.93 (0.80, 1.08) | 1.26 (1.10, 1.45) | 0.98 (0.85, 1.14) |
| Hispanic | 1.87 (1.56, 2.24) | 1.29 (1.06, 1.58) | 2.28 (1.88, 2.78) | 1.76 (1.43, 2.17) | 0.93 (0.74, 1.17) | 0.67 (0.53, 0.86) | 1.68 (1.43, 1.97) | 1.10 (0.91, 1.33) | 1.34 (1.13, 1.60) | 0.96 (0.79, 1.15) |
| NH other | 1.05 (0.72, 1.51) | 0.87 (0.57, 1.34) | 1.95 (1.37, 2.76) | 2.01 (1.42, 2.83) | 1.05 (0.72, 1.55) | 1.00 (0.64, 1.56) | 0.99 (0.74, 1.33) | 0.89 (0.66, 1.22) | 1.10 (0.82, 1.47) | 1.01 (0.75, 1.36) |
| < College degree (vs. College grad) | 2.90 (2.47, 3.40) | 1.54 (1.29, 1.85) | 2.05 (1.73, 2.43) | 1.38 (1.14, 1.67) | 1.62 (1.37, 1.92) | 1.23 (1.02, 1.49) | 2.30 (2.03, 2.60) | 1.15 (1.00, 1.32) | 1.96 (1.73, 2.22) | 1.13 (0.98, 1.30) |
| Household income (vs. \geq \$75,000) | | | | | | | | | | |
| <\$25,000 | 10.21 (7.56, 13.79) | 8.95 (6.50, 12.34) | 2.60 (2.11, 3.21) | 1.32 (1.03, 1.69) | 1.93 (1.57, 2.36) | 1.28 (1.01, 1.62) | 9.42 (7.59, 11.70) | 5.58 (4.38, 7.12) | 5.91 (4.83, 7.25) | 4.10 (3.28, 5.12) |
| \$25,000–\$49,999 | 5.43 (3.94, 7.49) | 4.94 (3.54, 6.90) | 1.85 (1.45, 2.36) | 1.21 (0.93, 1.57) | 1.52 (1.20, 1.91) | 1.19 (0.93, 1.52) | 4.77 (3.79, 6.00) | 3.35 (2.61, 4.31) | 3.27 (2.63, 4.06) | 2.59 (2.05, 3.26) |
| \$50,000–\$74,999 | 1.97 (1.24, 3.13) | 1.91 (1.19, 3.06) | 1.03 (0.71, 1.49) | 0.94 (0.68, 1.29) | 1.09 (0.84, 1.42) | 1.01 (0.76, 1.34) | 2.19 (1.62, 2.96) | 1.91 (1.43, 2.55) | 1.88 (1.46, 2.42) | 1.71 (1.32, 2.22) |
| Missing income data | 6.06 (4.34, 8.47) | 5.71 (4.03, 8.08) | 1.92 (1.45, 2.54) | 1.26 (0.92, 1.74) | 1.32 (1.00, 1.75) | 1.00 (0.74, 1.35) | 4.93 (3.81, 6.38) | 3.20 (2.41, 4.25) | 3.20 (2.50, 4.08) | 2.48 (1.92, 3.20) |
| Health insurance (vs. No insurance) | - | - | 0.13 (0.11, 0.15) | 0.15 (0.13, 0.18) | 0.20 (0.18, 0.24) | 0.22 (0.18, 0.26) | 0.13 (0.11, 0.14) | 0.17 (0.14, 0.19) | 0.28 (0.25, 0.32) | 0.37 (0.32, 0.42) |