Published in final edited form as:

Womens Health Issues. 2017 ; 27(6): 660–665. doi:10.1016/j.whi.2017.07.002.

Using the McSweeney Acute and Prodromal Myocardial Infarction Symptom Survey to Predict the Occurrence of Short-Term Coronary Heart Disease Events in Women

Jean C. McSweeney, PhD, RN, FAHA, FAAN [Professor and Associate Dean for Research],
College of Nursing, University of Arkansas for Medical Sciences, 4301 W. Markham St., Slot
529, Little Rock, AR, United States, 72205

Mario A. Cleves, PhD [Professor],
College of Medicine, University of Arkansas for Medical Sciences, 15 Children's Way, Slot
512-20B, Little Rock, AR, United States, 72202

Ellen P. Fischer, PhD [Associate Professor],
Department of Psychiatry, University of Arkansas for Medical Sciences, 4301 W. Markham St.,
Slot 755, Little Rock, AR, United States, 72205; Research Health Scientist, Central Arkansas
Veterans Healthcare System Center for Mental Healthcare and Outcomes Research, 2200 Fort
Roots Drive, Bldg. 58 (152/NLR), North Little Rock, AR, United States, 72114-1706

Christina M. Pettey, PhD, RN, FAHA [Assistant Professor], and
College of Nursing, University of Arkansas for Medical Sciences, 4301 W. Markham St., Slot 529,
Little Rock, AR, United States, 72205

Brittany Beasley, BSN, RN [Research Assistant]
College of Nursing, University of Arkansas for Medical Sciences, 4301 W. Markham St., Slot 529,
Little Rock, AR, United States, 72205

Abstract

Background—Few instruments capture symptoms that predict cardiac events in the short-term.

Aims—To examine the ability of the McSweeney Acute and Prodromal Myocardial Infarction Symptom Survey to predict acute cardiac events within three months of administration and to

Corresponding Author: Jean McSweeney, PhD, RN, FAHA, FAAN, Professor and Associate Dean for Research, College of Nursing, University of Arkansas for Medical Sciences, 4301 W. Markham St., Slot 529, Little Rock, AR, 72205, Fax number (501) 296-1765, Telephone number (501) 296-1982, McSweeneyJeanC@uams.edu.

Potential referees: 1. Ann Rosenfeld, RN, PhD, FAAN, University of Arizona College of Nursing, 1305 N. Martin Avenue, PO Box 210203, Tucson, AZ 85721-0203, arosenfeld@nursing.arizona.edu
2. Patricia Crane, RN, PhD, East Carolina University College of Nursing, 4210C Health Sciences Building, Mail Stop 162, Greenville, NC 27858-4353, CRANEPI4@ECU.EDU
3. Sandi Dunbar, RN, PhD, FAAN, Emory University, 1599 Clifton Road NE, Rm 5.407, Atlanta, GA 30322, sbdunba@emory.edu

Conflicting Interests: The Authors declare that there is no conflict of interest

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

identify the prodromal symptoms most associated with short-term risk in women without known coronary heart disease.

Methods—The McSweeney Acute and Prodromal Myocardial Infarction Symptom Survey was administered to 1097 women referred to a cardiologist for initial coronary heart disease evaluation. Logistic regression models were used to examine prodromal symptoms individually and in combination to identify the subset of symptoms most predictive of an event within three months.

Results—Fifty-one women had an early cardiac event. In bivariate analyses, four of 30 prodromal symptoms were significantly associated with event occurrence within 90 days. In adjusted analyses, women reporting arm pain/discomfort and unusual fatigue were more likely (OR=4.67; 95% CI=2.08, 10.48) to have a cardiac event than women reporting neither.

Conclusions—The McSweeney Acute and Prodromal Myocardial Infarction Symptom Survey may assist in predicting short-term coronary heart disease events in women without known coronary heart disease.

Keywords

coronary heart disease; myocardial infarction; women's health; early diagnosis

Introduction

Although mortality rates are declining, coronary heart disease (CHD) remains the leading cause of death among women (Benjamin et al., 2017). In the United States, an estimated 7.4 million adult women over the age of 20 (5.3%) have CHD, a subset of cardiovascular disease (CVD) that accounts for more than 50% of all CVD events in adults under the age of 75 (Benjamin et al., 2017). According to Benjamin et al., 2017, rates of disability and mortality after a CHD event are higher in women than in men; this is especially true in ethnic minority populations. (Benjamin et al., 2017) Nevertheless, in 2012, less than half of women recognized CHD as the leading cause of death in women. Knowledge about CHD mortality is especially low among minority women (Mosca, Hammond, Mochari-Greenberger, Towfighi, & Albert, 2013). Indeed, among minority women, current levels of awareness of CHD as the leading cause of death are similar to the level of awareness among White women in 1997 (Mosca et al., 2013).

Awareness of the most common symptoms of CHD in women is also low (Mosca et al., 2013). Symptom awareness is an essential precursor to early interventions that can either prevent or delay progression of CHD. Delays in seeking and providing treatment for symptoms lead to poorer outcomes and are attributed to lack of recognition of symptoms by both affected women and their healthcare providers (McSweeney et al., 2016; Banks & Malone, 2005; De et al., 2013; Kirchberger, Heier, Wende, von, & Meisinger, 2012).

While CHD is treatable if detected early, few instruments are available to measure the prodromal symptoms (PS) of CHD commonly reported by women (McSweeney, O'Sullivan, Cody, & Crane, 2004; McSweeney, Cleves, Zhao, Lefler, & Yang, 2010). Prodromal symptoms are early warning symptoms generally experienced months to a year prior to an acute CHD event, such as acute myocardial infarction or the need for immediate

intervention, e.g., coronary bypass surgery or stent placement (McSweeney et al., 2004; McSweeney et al., 2003). They are new or pre-existing symptoms that are intermittent and increase in intensity and/or frequency prior to an event and subside or disappear after an event (McSweeney et al., 2004; McSweeney et al., 2003). In contrast, acute symptoms are continuous and occur immediately surrounding the CHD event (McSweeney et al., 2004; McSweeney et al., 2003).

While there are models that predict the likelihood of CVD or CHD events, these models estimate long-term risk over five to ten years rather than short-term risk (Stone et al., 2014; Benjamin et al., 2017; Dawber, Meadors, & Moore, Jr., 1951; Kannel, Feinleib, McNamara, Garrison, & Castelli, 1979; Ridker, Buring, Rifai, & Cook, 2007; Reiner et al., 2011; Kavousi et al., 2014). Long-term calculators include the Framingham risk score, the Reynolds risk score, Life's Simple 7, and those in the 2013 American College of Cardiology/American Heart Association (ACC/AHA) Guidelines, Adult Treatment Panel III (ATP III) Guidelines, Coronary Artery Calcium with Multi-Ethnic Study of Atherosclerosis, and European Society of Cardiology Guidelines for CVD Prevention (Stone et al., 2014; Benjamin et al., 2017; Dawber et al., 1951; Kannel et al., 1979; Ridker et al., 2007; McClelland et al., 2015; Reiner et al., 2011).

Being able to assess short-term risk in women is imperative to decrease delay(s) in diagnosis and treatment (McSweeney et al., 2016). This requires both awareness of common PS in women and the availability of a psychometrically sound instrument to assess them. The McSweeney Acute and Prodromal Myocardial Infarction Symptom Survey (MAPMISS) was designed to assess prodromal and acute cardiac symptoms in women (McSweeney et al., 2004). It has been in use for several years and has been described in detail elsewhere (McSweeney et al., 2013; McSweeney et al., 2004; McSweeney et al., 2003). In previously published analyses, we showed that MAPMISS PS were significantly associated with the risk of CHD events over a two-year follow-up period (McSweeney et al., 2013). The predictive utility of MAPMISS PS over periods shorter than two years has not yet been evaluated. This manuscript presents findings on the ability of the MAPMISS to predict CHD events within three months of initial administration. We also provide information on the subset of MAPMISS PS items that provides the most parsimonious screen for short-term CHD-event risk in women referred to a cardiologist for a first evaluation.

Methods

Study design

We conducted a longitudinal cohort study to investigate which symptoms in the prodromal section of the MAPMISS are most strongly predictive of the occurrence of an acute CHD event within three months. We defined a CHD event as one or more of the following: angioplasty, stent placement, coronary artery bypass graft, diagnosis of acute myocardial infarction (MI), or cause of death listed as acute MI or CHD. Interventions were included in the CHD event definition because treatment interrupted and/or prevented imminent progression to acute MI. This article reports on events that occurred during the first three months following baseline; results for the two-year follow-up period are reported elsewhere (McSweeney et al., 2014).

Study Population

Caucasian and African American women who were either self- or physician-referred to cardiology for initial cardiovascular evaluation at four private or university-associated cardiology clinics in Arkansas and one in Kentucky were eligible to participate in the study. We elected to recruit from cardiology clinics so as to recruit women most at risk for developing CHD. The two southern states were selected because of their high rates of and risk for CHD. Interested women were consented if they had no prior history of or diagnosis of CHD, were 21 years of age or older, were cognitively intact, fluent in English, able to converse on the telephone, and had access to a telephone.

Instruments

We used the Short Blessed cognitive screen to rule out dementia in potential participants. The Short Blessed, which has established reliability and validity, consists of six weighted questions: a) current year, b) current month, c) memorization and recall of a six-word phrase, d) estimation of current time, e) counting backwards from twenty to one, and f) naming the months of the year in reverse order (Katzman et al., 1983). Women scoring 16 or higher on the Short Blessed were excluded from the study. Scores of 10 or greater are associated with dementia (Katzman et al., 1983), but this does not take into account how race, ethnicity (Bohnstedt, Fox, & Kohatsu, 1994), and age impact cognition scores (Bleecker, Bolla-Wilson, Kawas, & Agnew, 1988). Because this population included older Black and White women, the authors chose to use a more liberal score of 16 as the cut off (McSweeney, Pettey, Fischer, & Spellman, 2009).

The MAPMISS was developed based on prodromal and acute symptoms identified through qualitative interviews with a racially and ethnically diverse sample of women who had experienced a myocardial infarction (McSweeney et al., 2004). Development of the MAPMISS is fully described elsewhere (McSweeney et al., 2004). The reliability of the MAPMISS as a screening tool has been established in Caucasian and African American women (test-retest reliability $r=0.92$, $p<0.001$; concordance correlation coefficient= 0.92 , $p<0.001$) (McSweeney et al., 2013; McSweeney et al., 2004). Content validity of the MAPMISS was evaluated during the development process of the instrument by seven content experts (McSweeney et al., 2004). The MAPMISS contains 30 PS.

Data collection

We obtained Institutional Review Board approval at both sites and all participants provided informed consent. Flyers were distributed in the check-in packets at participating clinics. If a patient expressed interest in the study, clinic staff copied the medical record face sheet which contained contact information; this sheet was kept in a secured location. A research assistant (RA) picked up the face sheets three times a week and used the contact information to telephone potential participants. The RA explained the study and obtained verbal informed consent and HIPAA (Health Insurance Portability and Accountability Act) authorization as approved by each site's Institutional Review Board. Next, the RA administered the Short Blessed cognitive screen to assess cognition (Katzman et al., 1983). If the participant scored less than 16 on the screen, the RA scheduled administration of the MAPMISS at a time convenient for the participant (Katzman et al., 1983).

The RA administered the MAPMISS by telephone using computer-assisted telephone interview technology. Entering participant responses directly into the MAPMISS that was programmed for computer administration reduced errors. Safe guards were built into the program that required the RA to enter a response for each question before being able to move on to the next question, and as a result there were no missing data.

The baseline interview included questions about PS, cardiovascular (CV) risk, CV medication use, and sociodemographics. The RA asked about the occurrence of each of the 30 PS in the preceding 90 days. For each of the symptoms reported, they then asked about the intensity and frequency with which it occurred. Baseline interviews took approximately 60 minutes to complete. Three months after the baseline interview, the RA re-contacted the participant by telephone. If a participant reported having experienced an acute event in the 3-month period, the RA obtained the name of the hospital or clinic where she had been treated for it. The RA obtained written authorization to collect medical record data regarding events that occurred between the baseline interview and the 3 month follow-up to verify the event.

Each participant received a \$40 gift card for completing the first interview and a \$15 gift card for completing the 3 month follow-up interview. Detailed recruitment and retention results for this study are reported elsewhere (McSweeney et al., 2009).

Statistical Methods

Summary statistics for categorical variables are presented as counts and percentages and compared across groups using Pearson's Chi-Square test. Logistic regression models were used to compute odds ratios and corresponding 95% confidence intervals for the association between the occurrence of a cardiac event (dependent variable) and the presence/absence of MAPMISS PS. Following bivariate analysis, models were adjusted for age, race and additional significant patient characteristics and risk factors. We evaluated MAPMISS PS both individually and in combination. Overall the most-parsimonious logistic regression models were constructed using stepwise logistic regression and best-subset selection methods (Hosmer & Lemeshow, 2000). These two approaches yielded identical results. Data management and analysis were performed using Stata® version 13 (Stata Corporation, College Station, Texas).

Results

A total of 1097 women completed the MAPMISS survey. Of these, 51 (4.7%) had a cardiac event/intervention within three months of their initial visit. Among the women who experienced an event, 20 (39.2%) received a stent; 13 (25.5%) had both stent placement and angioplasty; 12 (23.5%) had bypass surgery; 3 (5.9%) had angioplasty alone; 2 (3.9%) had an MI plus angioplasty and stent placement, while 1 (2.0%) had an MI and angioplasty. There were no deaths attributed to cardiac events during the first 3 months. Selected characteristics of the 1097 women in this study, stratified by the presence or absence of an early cardiac event, are shown in Table 1. Women who experienced early events (i.e., events within three months of the initial visit to a cardiologist), were generally older, were of lower socioeconomic status, and had more comorbidities, such as diabetes and hyperlipidemia, than those who did not experience an early event.

Table 2 presents the odds ratios and 95% confidence intervals for the associations between each PS and cardiac events within 90 days of baseline assessment, unadjusted and adjusted for race and all covariates significant in the bivariate analyses. Unadjusted analyses indicate that 4 of the 30 PS were significantly associated ($p < 0.05$) with the occurrence of a cardiac event. Notably, women with cardiac events were approximately twice as likely to complain of pain/discomfort in the jaw or teeth, unusual fatigue, arm pain/discomfort and aching in the arms as women without an event. After adjusting for race, age and other significant variables from Table 1, only pain/discomfort in the jaw or teeth and arm pain/discomfort remained significantly associated with a cardiac event within 90 days of baseline assessment (OR=2.49, 95% CI= 1.19, 5.21, and OR=2.44, 95% CI= 1.30, 4.58, respectively). Although not significant at the 5% level, women with cardiac events were almost twice as likely to complain of unusual fatigue and ache in the arms.

Using the best subset regression method, a parsimonious multivariable model was constructed (Table 3). Arm pain/discomfort and unusual fatigue were retained in the final model when adjusting for age and race. Women reporting either or both of these symptoms were 4.67 times as likely to have a cardiac event within 90 days of baseline as women who did not report either symptom (95% CI=2.08, 10.48). When adjusting for race, age and other significant variables from Table 1, arm pain/discomfort and pain/discomfort in the jaw or teeth were retained in the final model. Women reporting either or both of these symptoms were 3.37 times as likely to have a cardiac event as women who did not report either symptom (95% CI=1.14, 9.92).

Discussion

When assessed individually in unadjusted analyses, four of the 30 PS in the MAPMISS were significantly associated with the occurrence of a cardiac event within 90 days of baseline. Most critically, after adjustment for age and race in the parsimonious model (Table 3), women in this study reporting arm pain/discomfort and/or unusual fatigue were nearly 5 times as likely to have a cardiac event within 90 days as women who did not report either symptom. In the fully adjusted model (Table 2), women with cardiac events were almost twice as likely to complain of unusual fatigue and of ache in the arms. These associations approached statistical significance and may be of clinical importance. It is noteworthy that the symptoms that were most predictive of early events are not necessarily those most commonly associated with CHD. To our knowledge, these findings correlating specific PS with short-term CHD events have not been reported previously.

Another recent study that recruited patients from the emergency department found that women with an acute CHD event were likely to present without chest pain (Rosenfeld et al., 2015). Awareness of these prodromal and acute non-chest symptoms is critical for all clinicians. Nurses often have the first and most frequent contact with patients and should be cognizant of these symptoms so they can recommend or order further diagnostic tests and treatment. Health providers should be aware that these symptoms may indicate early CHD in their female patients and act swiftly to diagnose and/or treat it, thus reducing morbidity and mortality.

One limitation of this study is that participants were predominantly Caucasian, from the south central region of the U.S., and self-selected for participation. Further research will be needed to determine whether the same symptoms are predictive in women of other races/ethnicities and from other parts of the U.S. and across the globe. In addition, the number of events was relatively small. A larger study with a greater number of events might identify other combinations of PS that are indicative of short-term CHD-event risk.

The ability to accurately assess the risk of CHD events in the short-term is critical to efforts to reduce mortality as well as the morbidity and disability that commonly occur in women following a CHD event. One out of every seven deaths in the U.S. in 2011 was attributable to CHD (Benjamin et al., 2017). A higher proportion of women aged 45 or older who have an initial recognized MI will die within one year (26%) than will their male counterparts (19%) (Benjamin et al., 2017). Clinical guidelines are available to help clinicians identify the women who present with the most predictive symptoms and are at the greatest risk (Mosca et al., 2011). More thorough adherence to these guidelines is essential to prevent or delay occurrence of an MI and to provide guideline-driven tailored treatment (Mosca et al., 2011). A growing body of research indicates that women are more likely than men to present without chest pain prior to MI (Coventry, Finn, & Bremner, 2011; Khan et al., 2013). Women are more likely to present with unusual fatigue, nausea, neck pain/discomfort, right arm pain/discomfort, jaw pain/discomfort, dizziness, and syncope than men (Coventry et al., 2011; McSweeney et al., 2014). Findings from a recent Korean study suggests that these differences are widespread (Hwang, Zerwic, & Jeong, 2011).

Conclusions

This study has demonstrated the ability of the MAPMISS to detect critical PS prior to occurrence of a CHD event in women. Findings highlight the range of symptoms that should spark clinicians' concern as well as the constellations of symptoms indicative of greatest risk of an early event. Routine administration of the MAPMISS may lead to improved clinical outcomes and cost-savings by helping clinicians target referrals for diagnostic testing and provide early intervention and treatment to women at high risk. Further research is needed in racially diverse samples. If the findings are similar, the MAPMISS could be condensed to reduce clinician and patient burden while retaining predictability. Condensing the MAPMISS would reduce the amount of time patients need to complete the questions and also reduce health care providers' administration time.

Acknowledgments

Jean Mcsweeney, PhD, RN, FAHA, FAAN had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Funding: This work was supported by the National Institutes of Health/National Institute of Nursing Research (1 RO1 NR04908). The funding agency did not have any role in deciding the study design; data collection, analysis, or interpretation of the data; writing, or in the decision to submit this manuscript for publication.

References

- Banks AD, Malone RE. Accustomed to enduring: experiences of African-American women seeking care for cardiac symptoms. *Heart Lung*. 2005; 34(1):13–21. DOI: 10.1016/j.hrtlng.2004.08.001 [PubMed: 15647730]
- Benjamin EJ, Blaha MJ, Chiuve SE, Cushman M, Das SR, Deo R, et al. Heart Disease and Stroke Statistics-2017 Update: A Report From the American Heart Association. *Circulation*. 2017; 135(10):e146–e603. DOI: 10.1161/CIR.0000000000000485 [PubMed: 28122885]
- Bleecker ML, Bolla-Wilson K, Kawas C, Agnew J. Age-specific norms for the Mini-Mental State Exam. *Neurology*. 1988; 38(10):1565–1568. [PubMed: 3419600]
- Bohnstedt M, Fox PJ, Kohatsu ND. Correlates of Mini-Mental Status Examination scores among elderly demented patients: the influence of race-ethnicity. *J Clin Epidemiol*. 1994; 47(12):1381–1387. [PubMed: 7730847]
- Coventry LL, Finn J, Bremner AP. Sex differences in symptom presentation in acute myocardial infarction: a systematic review and meta-analysis. *Heart Lung*. 2011; 40(6):477–491. DOI: 10.1016/j.hrtlng.2011.05.001 [PubMed: 22000678]
- Dawber TR, Meadors GF, Moore FE Jr. Epidemiological approaches to heart disease: the Framingham Study. *Am J Public Health Nations Health*. 1951; 41(3):279–281. [PubMed: 14819398]
- De LG, Gibson MC, Hof AW, Cutlip D, Zeymer U, Noc M, et al. Impact of time-to-treatment on myocardial perfusion after primary percutaneous coronary intervention with Gp IIb-IIIa inhibitors. *J Cardiovasc Med (Hagerstown)*. 2013; 14(11):815–820. DOI: 10.2459/JCM.0b013e32835fcb38 [PubMed: 23519096]
- Hosmer, DW., Lemeshow, S. *Applied Logistic Regression*, Second Edition. Second. New York: Wiley-Interscience Publication; 2000.
- Hwang SY, Zerwic JJ, Jeong MH. Impact of prodromal symptoms on prehospital delay in patients with first-time acute myocardial infarction in Korea. *J Cardiovasc Nurs*. 2011; 26(3):194–201. DOI: 10.1097/JCN.0b013e3181f3e2e0 [PubMed: 21099696]
- Kannel WB, Feinleib M, McNamara PM, Garrison RJ, Castelli WP. An investigation of coronary heart disease in families. The Framingham offspring study. *Am J Epidemiol*. 1979; 110(3):281–290. [PubMed: 474565]
- Katzman R, Brown T, Fuld P, Peck A, Schechter R, Schimmel H. Validation of a short Orientation-Memory-Concentration Test of cognitive impairment. *Am J Psychiatry*. 1983; 140(6):734–739. [PubMed: 6846631]
- Kavousi M, Leening MJ, Nanchen D, Greenland P, Graham IM, Steyerberg EW, et al. Comparison of application of the ACC/AHA guidelines, Adult Treatment Panel III guidelines, and European Society of Cardiology guidelines for cardiovascular disease prevention in a European cohort. *JAMA*. 2014; 311(14):1416–1423. DOI: 10.1001/jama.2014.2632 [PubMed: 24681960]
- Khan NA, Daskalopoulou SS, Karp I, Eisenberg MJ, Pelletier R, Tsadok MA, et al. Sex differences in acute coronary syndrome symptom presentation in young patients. *JAMA Intern Med*. 2013; 173(20):1863–1871. doi:10.1001/jamainternmed.2013.10149. [PubMed: 24043208]
- Kirchberger I, Heier M, Wende R, von SW, Meisinger C. The patient's interpretation of myocardial infarction symptoms and its role in the decision process to seek treatment: the MONICA/KORA Myocardial Infarction Registry. *Clin Res Cardiol*. 2012; 101(11):909–916. DOI: 10.1007/s00392-012-0475-8 [PubMed: 22618810]
- McClelland RL, Jorgensen NW, Budoff M, Blaha MJ, Post WS, Kronmal RA, et al. 10-Year Coronary Heart Disease Risk Prediction Using Coronary Artery Calcium and Traditional Risk Factors: Derivation in the MESA (Multi-Ethnic Study of Atherosclerosis) With Validation in the HNR (Heinz Nixdorf Recall) Study and the DHS (Dallas Heart Study). *J Am Coll Cardiol*. 2015; 66(15):1643–1653. DOI: 10.1016/j.jacc.2015.08.035 [PubMed: 26449133]
- McSweeney J, Cleves MA, Fischer EP, Moser DK, Wei J, Pettet C, et al. Predicting coronary heart disease events in women: a longitudinal cohort study. *J Cardiovasc Nurs*. 2014; 29(6):482–492. DOI: 10.1097/JCN.0b013e3182a409cc [PubMed: 24231895]
- McSweeney JC, Cleves MA, Fischer EP, Rojo MO, Armbya N, Moser DK. Reliability of the McSweeney Acute and Prodromal Myocardial Infarction Symptom Survey among black and white

women. *Eur J Cardiovasc Nurs*. 2013; 12(4):360–367. DOI: 10.1177/1474515112459989 [PubMed: 23045304]

McSweeney JC, Cleves MA, Zhao W, Lefler LL, Yang S. Cluster analysis of women's prodromal and acute myocardial infarction symptoms by race and other characteristics. *J Cardiovasc Nurs*. 2010; 25(4):311–322. DOI: 10.1097/JCN.0b013e3181cfba15 [PubMed: 20539165]

McSweeney JC, Cody M, O'Sullivan P, Elbersson K, Moser DK, Garvin BJ. Women's early warning symptoms of acute myocardial infarction. *Circulation*. 2003; 108(21):2619–2623. DOI: 10.1161/01.CIR.0000097116.29625.7C [PubMed: 14597589]

McSweeney JC, O'Sullivan P, Cody M, Crane PB. Development of the McSweeney Acute and Prodromal Myocardial Infarction Symptom Survey. *J Cardiovasc Nurs*. 2004; 19(1):58–67. [PubMed: 14994783]

McSweeney JC, Pettey CM, Fischer EP, Spellman A. Going the distance: overcoming challenges in recruitment and retention of Black and White women in multisite, longitudinal study of predictors of coronary heart disease. *Res Gerontol Nurs*. 2009; 2(4):256–264. DOI: 10.3928/19404921-20090803-01 [PubMed: 20077981]

McSweeney JC, Rosenfeld AG, Abel WM, Braun LT, Burke LE, Daugherty SL, et al. Preventing and Experiencing Ischemic Heart Disease as a Woman: State of the Science: A Scientific Statement From the American Heart Association. *Circulation*. 2016; 133(13):1302–1331. DOI: 10.1161/CIR.0000000000000381 [PubMed: 26927362]

Mosca L, Benjamin EJ, Berra K, Bezanson JL, Dolor RJ, Lloyd-Jones DM, et al. Effectiveness-based guidelines for the prevention of cardiovascular disease in women—2011 update: a guideline from the American heart association. *Circulation*. 2011; 123(11):1243–1262. DOI: 10.1161/CIR.0b013e31820faaf8 [PubMed: 21325087]

Mosca L, Hammond G, Mochari-Greenberger H, Towfighi A, Albert MA. Fifteen-year trends in awareness of heart disease in women: results of a 2012 American Heart Association national survey. *Circulation*. 2013; 127(11):1254–29. DOI: 10.1161/CIR.0b013e318287cf2f [PubMed: 23429926]

Reiner Z, Catapano AL, De BG, Graham I, Taskinen MR, Wiklund O, et al. ESC/EAS Guidelines for the management of dyslipidaemias: the Task Force for the management of dyslipidaemias of the European Society of Cardiology (ESC) and the European Atherosclerosis Society (EAS). *Eur Heart J*. 2011; 32(14):1769–1818. DOI: 10.1093/eurheartj/ehr158 [PubMed: 21712404]

Ridker PM, Buring JE, Rifai N, Cook NR. Development and validation of improved algorithms for the assessment of global cardiovascular risk in women: the Reynolds Risk Score. *JAMA*. 2007; 297(6):611–619. DOI: 10.1001/jama.297.6.611 [PubMed: 17299196]

Rosenfeld AG, Knight EP, Steffen A, Burke L, Daya M, DeVon HA. Symptom clusters in patients presenting to the emergency department with possible acute coronary syndrome differ by sex, age, and discharge diagnosis. *Heart Lung*. 2015; 44(5):368–375. DOI: 10.1016/j.hrtlng.2015.05.008 [PubMed: 26118542]

Stone NJ, Robinson JG, Lichtenstein AH, Bairey Merz CN, Blum CB, Eckel RH, et al. 2013 ACC/AHA Guideline on the Treatment of Blood Cholesterol to Reduce Atherosclerotic Cardiovascular Risk in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Circulation*. 2014; 129(25 Suppl 2):S1–S45. DOI: 10.1161/01.cir.0000437738.63853.7a [PubMed: 24222016]

Abbreviations

U.S	United States
CHD	coronary heart disease
MAPMISS	McSweeney Acute and Prodromal Myocardial Infarction Symptom Survey
CVD	cardiovascular disease
PS	prodromal symptoms

RA	research assistant
CV	cardiovascular
MI	myocardial infarction
HIPAA	Health Insurance Portability and Accountability Act

Biographies

Dr. McSweeney is the Associate Dean for Research and Co-Director of the PhD Program in the College of Nursing at the University of Arkansas for Medical Sciences (UAMS). Her research focuses on prodromal and acute cardiac symptomatology in women.

Dr. Cleves is Professor and Biostatistics Section Chief, Department of Pediatrics, University of Arkansas for Medical Sciences. His research focuses on early nutrition and child development, effects of genetics and environment on congenital malformations, and identification of women's MI symptoms.

Dr. Fischer is Associate Professor, Departments of Psychiatry and of Epidemiology, University of Arkansas for Medical Sciences, and Research Health Scientist, VA HSR&D Center for Mental Healthcare and Outcomes Research. Her research focuses on access to healthcare for vulnerable populations.

Dr. Pettay is an Assistant Professor at the University of Arkansas for Medical Sciences College of Nursing. Her research interests include cardiovascular disease, health disparities, and genetics.

Brittany Beasley is a graduate assistant and PhD candidate at the University of Arkansas for Medical Sciences College of Nursing. She works with Dr. McSweeney in the field of prodromal and acute cardiac symptomatology in women.

Implications for Practice and/or Policy

To date, only long-term (10-year) calculators like the Framingham risk score have been available to assist clinicians in determining which patients need preventative treatment to reduce the risk of developing CVD and CHD (Dawber et al., 1951; Kannel et al., 1979; Kavousi et al., 2014). We have shown previously that MAPMISS PS are significantly associated with the risk of CHD events over a two-year period (McSweeney et al., 2010). Findings from this study support the usefulness of the MAPMISS in predicting women's short term risk for CHD events. This should be useful in assisting primary care clinicians in determining which women should undergo further diagnostic evaluation.

Table 1
Women's Demographics and Risk Factors N=1097

	All N = 1097	Cardiac Event/intervention		p-value
		Yes N = 51	No N = 1046	
Race				0.2266
African American	148 (13.5)	4 (7.8)	144 (13.8)	
Caucasian	949 (86.5)	47 (92.2)	902 (86.2)	
Age at interview				<0.0001
Age <= 50yrs	427(38.9)	6 (11.8)	421 (40.2)	
Age > 50yrs	670 (61.1)	45 (88.2)	625 (59.8)	
BMI				0.2080
Under weight	8 (0.7)	0 (0.0)	8 (0.8)	
Normal weight	274 (25.0)	7 (13.7)	267 (25.5)	
Over weight	317 (28.9)	19 (37.3)	298 (28.5)	
Obese	498 (45.4)	25 (49.0)	473 (45.2)	
Education				0.0086
High school or less	394 (35.9)	28 (54.9)	366 (35.0)	
College graduate or some vocational school	571 (52.1)	21 (41.2)	550 (52.6)	
Post graduate or doctorate degree	132 (12.0)	2 (3.9)	130 (12.4)	
Income				<0.0001
\$30,000 or less	633 (57.7)	40 (78.4)	593 (56.7)	
More than \$30,000	431 (39.3)	6 (11.8)	425 (40.6)	
Don't know/Refused	33 (3.0)	5 (9.8)	28 (2.7)	
Marital status				0.0149
Never Married	83. (7.6)	2 (3.9)	81 (7.7)	
Married	667 (60.8)	26 (51.0)	641 (61.3)	
Divorced/Separated	232 (21.1)	11 (21.6)	221 (21.1)	
Widowed	115 (10.5)	12 (23.5)	103 (9.8)	
Diabetes				<0.0001
No	871 (79.4)	28 (54.9)	843 (80.6)	
Yes	226 (20.6)	23 (45.1)	203 (19.4)	
Hypertension				0.0699
No	479 (43.7)	16 (31.4)	463 (44.3)	
Yes	618 (56.3)	35 (68.6)	583 (55.7)	
Hyperlipidemia				0.0001
No	565 (51.5)	13 (25.5)	552 (52.8)	
Yes	532 (48.5)	38 (74.5)	494 (47.2)	

	Cardiac Event/intervention			<i>p</i> -value
	All N = 1097	Yes N = 51	No N = 1046	
Current Smoker				0.6750
No	612 (55.8)	27 (52.9)	585 (55.9)	
Yes	485 (44.2)	24 (47.1)	461 (44.1)	
Recent physical activity				0.0377
None	554 (50.5)	33 (64.7)	521 (49.8)	
Any	543 (49.5)	18 (35.3)	525 (50.2)	
Hysterectomy				0.0027
No	590 (53.8)	17 (33.3)	573 (54.8)	
Yes	507 (46.2)	34 (66.7)	473 (45.2)	
Post-menopause				0.2569
No	622 (56.7)	25 (49.0)	597 (57.1)	
Yes	475 (43.3)	26 (51.0)	449 (42.9)	
Family history of CHD				0.9909
No	24 (2.2)	1 (2.0)	23 (2.2)	
Yes	1053 (96.0)	49 (96.1)	1004 (96.0)	
Don't know	20 (1.8)	1 (2.0)	19 (1.8)	

Table 2

Odds Ratios (OR) and 95% Confidence Intervals (CI) for the Association of Each Prodromal Symptom with Adverse Cardiac Outcomes Within 90 Days of Baseline.

Prodromal Symptom	Unadjusted		Adjusted for race and significant variables in Table 1*	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Jaw/teeth discomfort	2.15 (1.10, 4.21)	0.0257	2.49 (1.19, 5.21)	0.0151
Unusual fatigue	2.11 (1.09, 4.08)	0.0261	1.88 (0.94, 3.76)	0.0720
Arm(s) discomfort	2.00 (1.14, 3.54)	0.0163	2.44 (1.30, 4.58)	0.0057
Ache in arms	1.93 (1.06, 3.53)	0.0317	1.85 (0.95, 3.58)	0.0698
Cough	1.91 (0.98, 3.74)	0.0581	1.69 (0.81, 3.49)	0.1594
Difficulty breathing at night	1.82 (0.83, 3.98)	0.1338	1.49 (0.62, 3.59)	0.3713
Shortness of breath	1.70 (0.95, 3.04)	0.0720	1.59 (0.85, 2.96)	0.1431
Leg discomfort	1.68 (0.89, 3.17)	0.1079	1.39 (0.69, 2.77)	0.3547
Arms numb	1.67 (0.84, 3.33)	0.1456	1.76 (0.82, 3.74)	0.1442
Arms weak/heavy	1.65 (0.91, 3.01)	0.1007	1.71 (0.88, 3.32)	0.1112
Back discomfort	1.64 (0.92, 2.91)	0.0910	1.75 (0.94, 3.23)	0.0763
Hands tingling	1.55 (0.87, 2.75)	0.1394	1.76 (0.92, 3.35)	0.0874
Sleep disturbance	1.47 (0.83, 2.59)	0.1822	1.43 (0.78, 2.64)	0.2463
Arms tingling	1.43 (0.76, 2.69)	0.2690	1.63 (0.80, 3.33)	0.1763
Frequent indigestion	1.42 (0.77, 2.60)	0.2603	1.56 (0.81, 3.01)	0.1874
Top of shoulder discomfort	1.35 (0.69, 2.63)	0.3753	1.29 (0.63, 2.64)	0.4820
Neck/throat discomfort	1.21 (0.65, 2.24)	0.5463	1.18 (0.60, 2.31)	0.6256
General chest discomfort	1.19 (0.53, 2.71)	0.6717	1.38 (0.58, 3.31)	0.4654
Left breast discomfort	1.19 (0.65, 2.19)	0.5710	1.55 (0.80, 3.02)	0.1967
Vision change	1.13 (0.50, 2.56)	0.7683	1.05 (0.44, 2.51)	0.9155
Headaches, change in intensity	1.12 (0.52, 2.43)	0.7742	1.25 (0.54, 2.89)	0.6071
Headaches, change in frequency	1.06 (0.53, 2.09)	0.8744	1.06 (0.50, 2.25)	0.8697
Discomfort centered high in chest	1.06 (0.55, 2.01)	0.8692	1.11 (0.55, 2.21)	0.7722
Loss of appetite	1.05 (0.48, 2.27)	0.9100	1.05 (0.46, 2.40)	0.9156
Change in thinking	1.02 (0.54, 1.95)	0.9433	0.99 (0.50, 1.97)	0.9740
Dizziness	0.86 (0.47, 1.60)	0.6351	0.91 (0.47, 1.76)	0.7874
Anxiety	0.83 (0.46, 1.51)	0.5507	0.89 (0.46, 1.69)	0.7172
Abdominal pain	0.75 (0.29, 1.93)	0.5538	0.62 (0.23, 1.65)	0.3353
Heart racing	0.64 (0.37, 1.13)	0.1279	0.81 (0.44, 1.49)	0.5006
Right side chest discomfort	0.29 (0.04, 2.15)	0.2268	0.28 (0.04, 2.18)	0.2264

* Adjusted for race, age, education, income, marital status, diabetes, hyperlipidemia, physical activity and hysterectomy

Table 3

Odds Ratios and 95% Confidence Intervals (CI) from the Parsimonious Model of the Association Between Prodromal Symptom and Adverse Cardiac Outcome Within 90 days.

Adjusted for age and race only		
Prodromal Symptom	Odds Ratio (95% CI)	<i>p</i>-value
Arm(s) discomfort	2.51 (1.36, 4.61)	0.0031
Unusual fatigue	2.04 (1.03, 4.02)	0.0408
Combined	4.67 (2.08, 10.48)	<0.0001
Adjusted for race, age and other significant variables from Table 1		
Arm(s) discomfort	2.8 (1.21, 4.30)	0.0111
Jaw/teeth	2.18 (1.05, 4.52)	0.0367
Combined	3.37 (1.14, 9.92)	0.0277

* Adjusted for race, age, education, income, marital status, diabetes, hyperlipidemia, physical activity and hysterectomy