HHS Public Access

Author manuscript

Eur J Cardiovasc Nurs. Author manuscript; available in PMC 2016 February 17.

Published in final edited form as:

Eur J Cardiovasc Nurs. 2013 August ; 12(4): 360–367. doi:10.1177/1474515112459989.

Reliability of the McSweeney Acute and Prodromal Myocardial Infarction Symptom Survey among Black and White Women

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Abstract

Background—Coronary heart disease (CHD) mortality rates are higher among women, particularly Black, than men. Women's mortality rates may reflect difficulty in recognizing CHD prodromal symptoms (PS) but reliable screening instruments for women are scarce. The McSweeney Acute and Prodromal Myocardial Infarction Symptom Survey (MAPMISS) has been shown to capture women's PS presentation, but has limited testing among Black women.

Aim—To assess the test-retest reliability of the MAPMISS PS section for Black and White women.

Methods—The sample was recruited from women enrolled in a longitudinal study examining the predictive validity of the MAPMISS. The MAPMISS was re-administered to 42 women (22 White, 20 Black) 3–5 days after baseline assessment.

Results—Women endorsed an average of 7.5 PS (SD =4.8; range: 0–20) initially and 7.6 (SD = 4.7; range: 0–20) at re-test. Over half of the women (54.8%) of both races endorsed the same number of PS at test and retest; for 69%, the number endorsed at both testings differed by no more than 1. Percent agreement and Kappa statistics on the number of PS endorsed were excellent overall and by race. PS test and retest scores, reflecting PS intensity and frequency, were highly

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correlated overall (r=0.92, p<0.001) and separately for White (r=0.93, p<0.001) and Black women (r=0.91, p<0.001). Racial differences were insignificant.

Conclusions—Findings indicate a) the MAPMISS PS score has excellent test-retest reliability (r=0.92) when administered to women without a history of CHD, and b) test-retest reliability is as strong for Black (r=0.91) as for White women (r=0.93).

Keywords

MAPMISS; prodromal symptoms; coronary heart disease; women

INTRODUCTION

In 2008, an estimated 17.3 million people worldwide died from cardiovascular diseases (CVD), of which 7.3 million were from coronary heart disease (CHD).{1504} Globally, CVD is the number one killer in both sexes but CVD causes a larger number of deaths among women over 60 than men of comparable age (7.4 million vs. 6.3 million respectively).{1504}

In the United States (U.S), CHD is the leading cause of death among both men and women.[1] although, women's CHD mortality rates vary by race as Black women have higher mortality rates than White women and those from other minority groups.[2] One reason for women's higher mortality rates may be related to women's CHD presentation. Women may not recognize their symptoms as cardiac in nature and therefore not seek medical care in a timely manner. In fact, CHD in women is often unrecognized and undiagnosed as reflected in women's high rates of silent myocardial infarctions. Sixty-four percent of women who experience sudden death attributed to CHD as compared with 50% of men had unrecognized CHD symptoms prior to death.{1596} Lack of recognition of the potential cardiac origin of women's prodromal and acute symptoms can lead to delayed diagnosis and treatment,[5] contributing to women's higher mortality.{1504}

Many patients and providers consider chest pain to be the main prodromal symptom of CHD and impending MI; however, women are more likely than men to present with minimal or no chest pain, even during an acute MI.[10,11] Milner and colleagues,[12] who studied 2073 patients admitted to the hospital for MI, reported that women were less likely than men to have a chief complaint of chest pain (54% vs. 69%, respectively). Patel et al.[13] found that women more frequently experienced back, jaw and neck pain, nausea and/or vomiting, and dyspnea, while men more frequently presented with chest pain and diaphoresis. Other studies have also reported that women with MI often present to the emergency room complaining of back pain, shortness of breath, or vague symptoms such as fatigue and anxiety.[14–16] Despite these findings, clinicians often do not recognize the difference in MI symptom presentation between genders and continue to assess for chest pain as the major MI symptom. In addition, many commonly used screening instruments, e.g., the Rose Angina Questionnaire (RQ), the Seattle Angina Questionnaire (SAQ) and the recently developed Symptoms of Acute Coronary Syndrome Inventory (SACSI), focus primarily on prodromal chest-pain related symptoms and have had very limited psychometric testing with women. The seven-item RQ was originally designed to be used with men and its validity has

been tested for men only.[17–19] Although the instrument has been used extensively with both men and women, reliability data have not been published for women. The SAQ, perhaps the most widely used angina questionnaire, captures exertion and its relationship to the frequency and intensity of angina. Initial studies to establish SAQ validity were conducted primarily with male veterans.[20,21] No validity has been reported for women. The SACSI, designed to capture the most common symptoms associated with chest pain, has been used in two separate studies; however, the validity and reliability of the instrument have not been established.[22,23] Thus, the most widely used instruments to assess for prodromal CHD and MI symptoms have been tested primarily with men and their usefulness in women has not been established. Because CHD is the number one cause of mortality in women, it is critical to have psychometrically sound screening instruments that are relevant and reliable for women in order to foster early recognition of CHD and early treatment to prevent or delay progression to MI or death.

The McSweeney Acute and Prodromal Myocardial Infarction Symptom Survey (MAPMISS) is one of the few instruments that capture women's distinct presentation of acute and prodromal symptoms of CHD and MI.[24] The MAPMISS was developed based on symptom reports from women of various ages, ethnicities, and races, and employs the language women most commonly used to describe their symptom experience.[25,26] It has been used with over 3000 racially diverse women in three studies funded by the National Institute of Nursing Research. Initial psychometric testing indicated that the MAPMISS has high content validity and acceptable test-retest reliability for women with known CHD.[26] However, although the MAPMISS was developed for use with an ethnically diverse population, the initial validation sample was comprised primarily of White women and, to-date, no further validation studies have been completed.

Test-retest reliability is of particular interest because the MAPMISS relies on women's recall of their symptoms. It is especially important to assess the reliability of the MAPMISS when administered to Black women because they are at higher risk and have worse CHD outcomes than White women.[2,27] This article reports the test-retest reliability of the prodromal symptom section of the MAPMISS for Black and White women without a diagnosis of CHD participating in an ongoing study of the instrument's predictive ability. Because the sample was composed only of women who did not have a diagnosis of CHD or MI when their baseline assessment was made, evaluation of test-retest reliability was feasible for the prodromal symptom section of the MAPMISS but not the acute symptom section.

METHODS

Instrument

Development of the MAPMISS has been described in detail elsewhere.[26,28] Briefly, qualitative interviews were conducted with over 60 racially diverse women who had experienced a MI. During these interviews, women identified a variety of prodromal and acute symptoms, which formed the basis of the MAPMISS. A series of studies were then completed to develop, pilot, and refine the symptoms and questions. The resulting MAPMISS is composed of three sections: an acute symptom section, a prodromal symptom

section, and a section to elicit information on sociodemographics, comorbidities, and risk factors. Acute symptoms are defined as symptoms that are unrelenting during an acute episode of MI and do not resolve prior to treatment. Prodromal symptoms (PS) are defined as symptoms that (1) are new or increase in intensity or frequency before the MI, (2) are intermittent before the MI, and (3) disappear or return to previous levels after the MI.[28(p2620)] These definitions are based on women's qualitative descriptions.

The MAPMISS PS section currently includes 30 PS. They are of special interest because this section can be used to screen during a health care encounter and thus should facilitate earlier diagnosis and treatment. Women rate each of their reported PS as to intensity (mild, medium, severe), frequency, and time of onset (in the last month, 2 months, or 3 months). A prodromal symptom score, based on product of the intensity and frequency of a symptom, is then calculated (range: 0–21). Finally, an overall PS score is calculated by summing the individual symptom scores (range: 0–630).

Sample

The test-retest reliability assessment sample was recruited from among women taking part in a larger, multi-site longitudinal study of the predictive validity of the MAPMISS. Institutional review board approval was obtained from all participating sites. Participants in the larger study were women who had been referred to a cardiologist for initial evaluation of symptoms suggestive of CHD but did not have a current CHD diagnosis. Eligibility criteria were (1) self-identification as Black/African American or Caucasian, (2) age 21 years or older, (3) no previous diagnosis of heart disease, (4) and access to a telephone. Recruitment sites were private practices and university-affiliated clinics in two Southern states, since women in the South are at greater risk of CHD than women in other regions of the US.[29] Recruitment from regional referral centers maximized the likelihood of being able to recruit Black and White women from a wide range of socioeconomic backgrounds and from both rural and urban areas.

Recruitment and Data Collection Procedures

Women identified as potential participants for the parent study were contacted by a research assistant (RA) who explained the study, obtained verbal consent and HIPPA authorization, verified eligibility, and administered the Blessed Orientation Memory Concentration screen to ensure that potential participants were cognitively intact.[27] Initially, every woman who completed the baseline interview was asked whether she was willing to be contacted for a re-test within 3–5 days.

For both the parent sample and the test-retest subsample, a trained RA administered the MAPMISS by telephone, using computer-assisted telephone interview (CATI) technology. CATI programming prevents the interviewer from progressing to the next question until all fields have been completed, thus minimizing missing data. Baseline interviews, covering PS during the previous 3 months, comorbidities and risk factors, took approximately 60 minutes to complete. Re-test interviews, covering only the PS questions, took approximately 20 minutes to complete. The average interval between test and retest administration was 3.10

days (SD=0.73, median = 3.0, range: 2–7 days). Participants received $40 for the baseline interview and $10 for the re-test interview.

The final sample size was based on an a-priori power calculation and interim analyses. The a-priori power calculation, which assumed 80% power and a two-sided alpha of 5%, indicated that a sample of 70 women would be sufficient to detect a minimum Kappa of 0.30 and a minimum concordance correlation coefficient of 0.30 when data from all women were analyzed together. Having 35 women in each race group would allow for detection of a minimum Kappa of 0.42 and a minimum concordance correlation coefficient of 0.40. All of these Kappa and correlation coefficients are much smaller than desirable levels of agreement. An interim analysis of data from the first 42 test-retest participants showed that observed Kappas and concordance correlation coefficients substantially exceeded the values used in the power calculations. In that context, no further retest data were collected.

Statistical Methods

We created four symptom-score variables for each participant at each assessment: two symptom-specific variables and two summary variables. The symptom-specific variables created for each of the 30 MAPMISS PS were: (1) a dichotomous symptom-endorsement score (endorsed=1, not endorsed=0) and (2) an interval, intensity by frequency (IxF) symptom score (range 0–21) generated by multiplying the symptom's reported intensity/severity (0–3; 3=most severe) by its reported frequency (<monthly to daily, 0.167–7; 7=daily). Summary variables were (1) number of symptoms endorsed (range: 0–30) and (2) an overall PS score generated by summing a participant's IxF scores across the 30 symptoms (range: 0–630).

Percent agreement and Kappa statistics were computed to assess the agreement between the number of symptoms endorsed at the baseline and retest administrations of the MAPMISS. Kappa, a measure of agreement on categorical outcomes, is considered a more robust indicator of agreement than simple percent agreement because it takes into account agreement that would be expected to occur simply by chance.[30] Corresponding 95% confidence intervals (CI) for kappa were computed using a bootstrap-based bias-corrected confidence intervals approach.[31,32] Pearson correlation coefficients and Lin's concordance correlation coefficient (CCC)[33] were calculated to assess agreement for interval and continuous variables, paralleling percent agreement and Kappa, respectively. Both concordance and agreement were examined for all women combined and for White women and Black women separately.

Data management and analysis were performed using Stata® version 11.[34] Kappa statistics and confidence intervals were computed using the Stata program KAPCI.[35]

RESULTS

The characteristics of the 42 women in the study are summarized in Table 1. Participants averaged 52 years in age; the majority (54.8%) were over 50 years of age, and over half (52.4%) were married. The sample was fairly evenly divided between White women (53%) and Black women (47%). The majority (57.1%) reported that they did not routinely

participate in physical activity, and slightly over 30% were obese (BMI>30). Educational levels ranged from less than high-school to post-graduate work; 45% of the women had a high school education or less. There were no significant differences between Black and White women on any of these characteristics except for education. Black participants reported a broader range of educational achievement than did White participants.

Number of symptoms endorsed

The MAPMISS includes 30 PS. These women referred for cardiovascular evaluation endorsed an average of 7.5 symptoms (SD =4.8; median = 7; range: 0–20) during the baseline interview and an average of 7.6 symptoms (SD = 4.7; median=7; range: 0–20) at re-test. Only 2 women (4.8%) endorsed none of the MAPMISS symptoms at baseline. On average, Black women endorsed fewer symptoms than White women at both baseline (test) and retest (means = 7.00 vs. 7.86 at test and 6.9 vs. 8.32 at retest). As can be seen from the percent agreement and Kappa statistics in Table 2, test-retest reliability for the number of symptoms endorsed was excellent, overall and by race. The majority of the women (23/42, 54.8%) endorsed the same number of symptoms at test and at retest; for 69% (29/42), the number of symptoms endorsed at test and retest differed by no more than 1. This was the pattern for both Black women (45.0% [9/20]) and 70.0% [14/20]) and White women (63.6% [14/22]) and 68.2% [15/22]). Differences by race were not statistically significant.

Prodromal Scores

Overall PS score data are shown in Table 3 for all 42 women, as well as by race. Although mean PS scores (possible score range 0–630) were higher for White women than for Black women, median values were quite similar.

PS test and retest scores were highly correlated and agreed both overall ($r=0.92$, $p<0.001$; CCC=0.92, $p<0.001$) and for White women ($r=0.93$, $p<0.001$ (CCC=0.93)) and Black women separately ($r=0.91$, $p<0.001$ (CCC=0.90)). The majority of the women (24/42, 64.3%) had PS scores within 7 points of each other at test and retest, and 35.7% (15/42) had PS scores within 2 points of each other. For Black women, these figures were 70% (14/20) and 35% (7/20); for White women, they were 59.1% (13/22) and 36.4% (8/22). Differences by race were not statistically significant.

Symptom-specific analyses

To further examine variations in test-retest reports, agreement on intensity × frequency (IxF) scores (possible range: 0–21) were calculated for each of the 30 MAPMISS PS separately. Table 4 shows the number of women endorsing each symptom at test and the number endorsing each symptom at retest. It also shows percent agreement on the IxF scores at test and retest. These latter figures include all 42 women regardless of symptom score; i.e., the calculations include IxF scores of 0. Kappa statistics were not computed for IxF scores because the number of women endorsing any given symptom was relatively small and kappa tends not to be reliable when samples are small.

Percent agreement varied by question, ranging from 67% to 100%. As would be expected, as the average number of women endorsing a specific symptom increased, the proportion of

endorsers with perfect test/retest agreement decreased. Nonetheless, average percent agreement for the 10 most frequently endorsed symptoms was strong overall (76.7%) as well as for Black women (74.5%) and White women (78.6%) separately.

DISCUSSION

Because the MAPMISS score is based on women's self-reports of the number, intensity and frequency of symptoms experienced, the stability of those reports over time is critically important. Our earlier research showed that the PS score had good test-retest reliability with a sample of primarily White women who had experienced an acute MI in the previous 12 months.[26] The current study adds to this psychometric evidence in several important ways. First, it provides evidence that the MAPMISS PS score has excellent test-retest reliability ($r=0.92$)[36] when administered to women without a history of cardiovascular disease who have been referred for cardiovascular evaluation. This is especially important because it supports the utility of the MAPMISS PS in screening women at risk of adverse cardiac events. Second, the current study provides evidence that test-retest reliability is as strong for Black women ($r=0.91$) as for White women ($r=0.93$), supporting the use of the MAPMISS PS scale with this highly vulnerable population.

Test/retest reliability was higher in this study than in the previous study of MAPMISS test/retest reliability.[26] In that study, the Pearson correlation coefficient was 0.72 for the PS score, nearly 20 points lower than the correlation coefficient for either Black women or White women in the current study. Two major differences between the two study samples are likely to have contributed to this difference. Participants in the earlier study had all experienced an acute MI in the previous 12 months and were reporting on PS for that event, while participants in the current study had not experienced an MI and were reporting on symptoms that had led to their referral for cardiovascular assessment. In addition, the interval between initial and retest administration of the MAPMISS was longer in the earlier study (7–14 days) than in the current study (3–5 days).

The Black women in this sample reported fewer PS than white women. Previous studies have reported the opposite. For instance, McSweeney et al. (2010) found that Black women reported significantly more PS than did White women (7.48 vs. 5.84, respectively). However, all women in that study had experienced an MI. In the current sample, none of the women had been diagnosed with CHD at the time of the test or re-test. It may be that fewer Black women in this sample will be diagnosed with CHD than White women, but this can only be determined at the conclusion of the two-year follow-up in the parent study.

Health care providers frequently must resort to expensive and often invasive diagnostic tools such as echocardiograms, stress tests, angiography and CT scans to assess CHD risk. Chest pain is the symptom that often triggers use of these tests and it may be essential for authorization of the tests by third party payers. That reduces the likelihood that such tests will be ordered for women who have a non-chest pain presentation. The MAPMISS has great potential as a screening instrument that is easy to administer, can be used in any clinical setting, and effectively and reliably captures the severity and frequency of symptoms in women at risk for developing progressive CHD or MI. It assesses for a variety of non-

chest pain symptoms reported by women[26,28] and does not require authorization from third-party payers.

Limitations

This test-retest study had several limitations. The short period (mean of 3.1 days) between test and re-test administrations may be considered a limitation or a strength. By definition, PSs may change from day-to-day, raising questions about the appropriateness of assessing test-retest reliability. However, the MAPMISS PS section asks about women's experience of various symptoms over the preceding 3 months. Except in the case of women whose symptoms emerge for the first time or significantly change during the few days between test and retest, a woman's 3-month experience would be expected to be much the same over 3–5 days (i.e., to be temporally stable), making test-retest analysis appropriate. A short interval between test and re-test increases the risk of recall bias. However, while conducting the re-test 2–3 weeks after the baseline assessment would minimize this likelihood, it would also increase the likelihood of actual changes in symptom status. Recall bias is a concern, but less so with symptom reports than with reports of attitudes or conditions that are either clearly desirable or undesirable. When examining the pros and cons of longer and shorter test-retest intervals, the advantages of a shorter interval were felt to outweigh their disadvantages.

This report addresses a critical psychometric characteristic of the MAPMISS: test-retest reliability. Strong test-retest reliability, reflecting the instrument's precision, is an essential pre-requisite to utility. However, the ultimate utility of the MAPMISS will depend not only on its reliability but on its validity, in this case, on the extent to which it accurately predicts the development of CHD events. The parent study addresses two-year predictive validity; upon its completion, predictive validity findings will be disseminated to supplement current findings.

Despite the study's limitations, the findings make an important contribution to an understanding of the psychometric properties of the MAPMISS PS scores and thus to the instrument's overall utility. The data on test-retest reliability in Black women are especially important because Black women have higher mortality rates from CHD than both White women and men.

Summary

The current study indicates that the MAPMISS has solid test/retest reliability for Black women as well as White women. Findings suggest that the MAPMISS will prove useful in assessing women's PS. Additional studies will be needed to address the psychometric properties of the acute section of the MAPMISS and to establish the predictive validity of MAPMISS PS score. Identifying those women that are at high risk for developing CHD in order to provide timely treatment and thus improve health care outcomes for women is essential worldwide.

Acknowledgments

Acknowledgement of Financial Support:

The National Institute of Nursing Research supported this work, R01 NR04908.

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Table 1

Characteristics of Sample (N=42)

	Total		White n=22		Black n=20		p-value
Age in years							
Mean (SD)	52.0	(13.9)	53.4	(13.9)	50.4	14.0	
Median	50.7		51.2		49.8		0.4960
	N	%	N	%	N	%	
Total	42		22		20		
Less than 50 years	19	45.2	9	40.9	10	50.0	
50 or more years	23	54.8	13	59.1	10	50.0	0.7569
Physical activity							
No	24	57.1	13	59.1	11	55.0	
Yes	18	42.9	9	40.9	9	45.0	1.0000
BMI							
Normal	13	31.0	9	40.9	4	20.0	
Overweight (25<BMI<30)	16	38.0	9	40.9	7	35.0	0.1666
Obese (BMI>30)	13	31.0	4	18.2	9	45.0	
Marital status							
Never married	4	9.5	0	0.0	4	20.0	
Married	22	52.4	14	63.6	8	40.0	
Divorced/separated	11	26.2	6	27.3	5	25.0	
Widowed	5	11.9	2	9.1	3	15.0	0.1278
Education level							
5th–8th grade	1	2.4	0	0.0	1	5.0	
9th–11th grade	4	9.5	0	0.0	4	20.0	
12th or GED	14	33.3	11	50.0	3	15.0	
Some college/vocational school	15	35.7	5	22.7	10	50.0	
College graduate	7	16.7	5	22.7	2	10.0	
Post graduate work	1	2.4	1	4.5	0	0.0	0.0079

Eur J Cardiovasc Nurs. Author manuscript; available in PMC 2016 February 17.

Table 2

Percent Agreement and Kappa Statistics on the Number of Symptoms Endorsed, Overall and by Race

Group	Agreement (%)	Kappa	SE	95% CI
All women	93.3%	0.823	0.028	0.787, 0.859
White women	94.2%	0.854	0.039	0.809, 0.899
Black women	92.3%	0.785	0.041	0.725, 0.844

Table 3

Prodromal Symptom Scores at Test and Retest, Overall and by Race

	Overall		White Women		Black Women	
	Test	Retest	Test	Retest	Test	Retest
Mean	65.83	69.54	74.62	77.71	56.16	60.57
(SD)	(63.4)	(67.2)	(76.8)	(78.1)	(44.3)	(53.3)
Median	54.0	52.5	54.37	54.5	53.25	48.25
Range	0–315	0–322	0–315	0–322	1–148	0–189

Table 4

Number of women endorsing specific symptoms at test/retest and percent agreement on symptom-specific intensity by frequency (IxF) scores, overall and by race

	Number of women endorsing symptom		Percent agreement on IxF score*		
Question	**Test**	**Retest**	**All**	**White**	**Black**
Pain, right side chest	1	1	100.0	100.0	100.0
General chest pain	3	4	97.6	95.5	100.0
Difficulty breathing at night	1	2	97.6	95.5	100.0
Abdominal pain	2	3	97.6	100.0	95.0
Dizziness	1	0	97.6	100.0	95.0
Pain, legs	8	9	95.2	100.0	90.0
Indigestion	10	10	92.9	95.5	90.0
Arms numb	5	2	92.9	95.5	90.0
Pain, jaw/teeth	4	3	90.5	95.5	85.0
Pain, neck/throat	9	10	90.5	90.9	90.0
Headaches, intensity change	9	9	88.1	86.4	90.0
Pain centered high in chest	11	10	85.7	95.5	75.0
Arms weak/heavy	9	8	85.7	86.4	85.0
Ache in arms	9	9	85.7	86.4	85.0
Vision	7	6	85.7	86.4	85.0
Pain, top of shoulder	10	10	83.3	95.5	70.0
Cough	6	7	83.3	77.3	90.0
Appetite	8	9	83.3	95.5	70.0
Arms tingling	10	10	83.3	86.4	80.0
Headaches, frequency change	13	13	83.3	77.3	90.0
Changes in thinking	10	12	83.3	72.7	95.0
Arms, change in pain intensity	21	21	81.0	90.9	70.0
Sleep changes	15	18	78.6	81.8	75.0
Anxiety	14	18	78.6	77.3	80.0

	Number of women endorsing symptom		Percent agreement on IxF score*		
Question	**Test**	**Retest**	**All**	**White**	**Black**
Hands tingling	14	12	78.6	86.4	70.0
Pain, left breast	17	17	76.2	77.3	75.0
Pain, back between/under shoulder blades	16	15	76.2	77.3	75.0
Tired	29	26	73.8	77.3	70.0
Heart racing	20	21	73.8	72.7	75.0
Shortness of breath	21	24	66.7	68.2	65.0

* Agreement is on the exact score (0–21)