Abstract

This paper examines causative factors behind mortality from acute myocardial infarction in women, which, at present, still remains high. Reports from the American Heart Association on women and cardiovascular disease indicate that “26% of women age 45 and older who have an initial recognized MI (heart attack) die within a year compared with 19% of men” (2014).

Prevention of death from acute myocardial infarction begins with its predecessor—namely cardiovascular/coronary artery disease (CVD). Specifically, CVD remains the leading cause of death in women, and cardiac compromise from this silent killer results in acute myocardial infarction. Review of the literature appraises both prodromal signs and symptoms and atypical clinical presentations of acute myocardial infarction in women. Moreover, risk factors, incidence and prevalence, and educational methodologies are examined. Here, research on identification and primary prevention leads to an awareness of a need to educate women, and theoretical implementation of an educational and interactive screening tool for the female population known here as the KNOW MI initiative is offered. This intervention could not only raise awareness and help educate women about myocardial infarctions, but also would promote patient awareness and self-efficacy in health care.

Keywords: acute myocardial infarction, cardiovascular disease, coronary artery disease, women, Healthy People 2020, healthcare
Introduction

The numbers are alarming—“[a]bout every 26 seconds, an American will have a coronary event and once every minute a coronary death occurs” (Kalman, et al., 2013). It is widely recognized that heart complications remain one of the leading causes of death worldwide. Both men and women increasingly suffer from morbidity due to risk factors, all of which can lead to cardiovascular death. Acute myocardial infarction (MI) is one of the secondary complications of cardiovascular compromise. Though research does include both genders when appraising acute myocardial infarction symptomology and mortalities, there is a specific need for further research, and more importantly outreach, for women and acute myocardial infarction. Women present with more atypical symptoms or, in some cases, no clinically significant signs and symptoms at all. In 2010 it was found that CVD was the reason for death in approximately 400,332 females, and that of the approximately 6.6 million females today, 2.6 million have a noteworthy medical history of myocardial infarction (American Heart Association, 2014). In fact, “[e]xperts assert that compared to men, woman have more unrecognized MIs and are more frequently misdiagnosed and discharged from emergency departments [ED] without appropriate treatment” (Kalman, et al., 2013). To help rectify this troubling fact, interventions should target both raised awareness and enhanced knowledge of the signs, risk factors, and symptoms of an acute myocardial infarction. As myocardial infarction is a complication of cardiovascular disease, evaluation of research will focus on CVD and MI in women.

Literature Review

Cardiovascular Disease in Women

Data suggests that “[c]ardiovascular disease is often overlooked as a women’s health issue” (Davidson, et al., 2011). In fact, cardiovascular disease claims more female than male
lives since 1984 (Tullmann & Dracup, 2005), and is the number one cause of death for women in the United States “killing 292,188 women in 2009—that’s 1 in every 4 female deaths” (Centers for Disease Control and Prevention, 2014).

Often called the “silent epidemic” (Murdaugh, 1990), until the late 1980’s, CVD research was predominantly focused on men (Kalman, et al., 2013). Cardiovascular disease in women in the form of coronary heart disease “commonly manifest(s) as acute myocardial infarction” in women, and causes significant morbidity and mortality (Luepker, Duval, Jacobs Jr, Smiths, & Berger, 2011). The term coronary artery disease is “subsumed under the term CVD, and is recognized as the leading cause of death in women in the US and the world” (Kalman, et al., 2013); alarmingly, deaths from CVD in women occur about once every minute. The statistics underscore the importance of this topic: “[o]ne in nine women from the ages of 45 to 64 has some form of cardiovascular disease…the ratio climbs to one in three for women over the age of 65” (Murdaugh, 1990). Thus, it is proven that cardiovascular disease is a relevant and central issue, and “[m]yocardial infarction is a key component of the burden of cardiovascular disease” (Roger, 2008).

In order to explicate upon the impact of acute myocardial infarction among women, it is necessary to discuss its compulsory pathological precursor(s): “[w]hen ischemia is prolonged and not immediately reversible, acute coronary syndrome develops and encompasses the spectrum of unstable angina, non-ST-segment-elevation myocardial infarction, and ST-segment-elevation myocardial infarction” (Bucher & Castellucci, 2011, p. 777). For the purposes of this paper, acute myocardial infarction includes both non-ST segment elevation myocardial infarction and ST segment elevation myocardial infarction presentations, unless otherwise indicated. An acute myocardial infarction occurs “because of sustained ischemia, causing irreversible cell
death (necrosis)” (Bucher & Castellucci, 2011, p. 778). Acute myocardial infarctions largely occur due to the development of thrombi.

**Incidence and Prevalence of Acute Myocardial Infarction in Women**

According to the Journal of the American College of Cardiology, about “30% of patients with STEMI are women…Compared with men, women…presented later after symptom onset, had longer door-to-fibrinolysis and door-to-balloon times, and less often received aspirin or beta blockers within 24 hours of presentation” (O’Gara et. al., 2013). Myocardial infarction can be considered a public health problem: studies have shown that the “burden of coronary heart disease is increasing in parallel with the increase in life expectancy” (Roger, 2008). In an article on the epidemiology of myocardial infarction, it “is essential as multifaceted approaches to reduce the burden of disease including drug discovery, clinical trials and policies…continue to shape the practice of cardiology” (Roger, 2008). And, continuing to help effect the field of cardiology can continue to help shape protocols regarding cardiac crises, such as MI. Moreover, targeting risk factors for cardiac heart disease can help prevent acute coronary syndromes in women.

Both women and men suffer from cardiovascular disease, but with differing rates. In fact, “[c]ardiovascular [ischemic heart] disease is the leading cause of death in the United States” (Zafari, 2014). Cardiovascular disease is a significant forerunner to myocardial infarction. Surveillance methodologies have varied over the years: from the Atherosclerosis Risk in Communities, the Worcester Heart Attack Study, the World Health Organization’s MONICA, or the Corpus Christi Heart Project, as cardiovascular disease becomes a more prevalent reality across populations, monitoring for cardiac burden is essential to target treatment (Roger, 2008).
One of the most pivotal studies of cardiovascular disease was the Framingham Heart Study. The data generated from this study “has generated transformational discoveries which shaped the practice of cardiology for more than half a century” (Roger, 2008). What is known from interpreting such data is that “[s]tudying the trends in the incidence and outcome of myocardial infarction…provides crucial insights into the determinants of heart disease which is essential to its treatment and prevention” (Roger, 2008).

Risk Factors

The etiology behind acute myocardial infarction can be due to a number of causative factors, if not a combination of them. According to a study on traditional cardiac risk factors and secondary prevention in hospitalized acute myocardial infarction patients, there is a “high prevalence of multiple traditional, and potentially modifiable, CHD risk factors among patients hospitalized for AMI” (Leifheit-Limson, et al., 2013). The following traditional risk factors were examined: hypertension, diabetes mellitus, hypercholesterolemia, obesity, and current habit of smoking. Secondary preventive measures examined in the article were antihypertensive medication, diabetes counseling, lipid-lowering mediation, diet/weight counseling, and smoking cessation counseling. By educating women on such risk factors, reduction in acute coronary syndromes can potentially be achieved.

To this end, it is important to note which factors are and are not modifiable. Research has shown that modifiable risk factors lay an integral role in both cardiovascular disease and acute myocardial infarction in women: “[c]linical guidelines recommend modification of…risk factors with both discharge medications and secondary prevention programs, based upon their demonstrated efficacy in randomized clinical trials” (Leifheit-Limson, et. al., 2013). Secondary prevention of traditional cardiac risk factors forges a clear path for targeted prevention of acute
myocardial infarction in women. Moreover, this targeted prevention encourages self-efficacy in the female population. Self-efficacy and awareness in patients can and should be encouraged—in the current age of preventive medicine and prophylactic measures, interventions should aim to intercede in the prodromal stages of disease and disorder. According to the National Heart, Lung, and Blood Institute (NHLBI) of the National Institutes of Health (NIH), the earlier healthy habits are established, the more long lasting and successful the health outcomes will be (NIH, 2011). Such early intervention promotes long term lifestyle changes over acute, short term ones, and could possibly aid in preventing acute coronary syndromes.

Regarding coronary artery disease, the research suggests that cigarette smoking seems to be the “dominant risk factor” (Murdaugh, 1990). Another modifiable risk factor for coronary artery disease is having a systolic blood pressure greater than 160 millimeters of Mercury (mmhg) and a diastolic blood pressure greater than 85 mmhg (Murdaugh, 1990); in fact, having higher blood pressure numbers increases the likelihood for developing CAD by two to three times (Murdaugh, 1990). Not surprisingly, consistent with this data hypertension has also been called the most “consistent” (Murdaugh, 1990) risk factor for women over the age of 35 developing CAD. Hyperlipidemia (having high levels of cholesterol) is another modifiable risk factor for CAD. As the female population is particularly predisposed to this risk factor, proper management and efforts to decrease high levels of cholesterol is essential. Two distinguishing and physiological non-modifiable risk factors in women are smaller coronary arteries and the decrease in estrogen after menopause (Kalman, et al., 2013). Regarding hormone levels, data implicates that “[f]urther research is needed to accurately evaluate the risk of current oral contraceptive use” (Murdaugh, 1990).
In an article on women’s early warning symptoms in acute myocardial infarction, statistical analyses (t-tests) were used to establish if acute and prodromal symptom scores were related to the following risk factors: “familial history of cardiovascular disease, age greater than 50 years, obesity (particularly a BMI greater than 29), hyperlipidemia, hypertension, diabetes, hysterectomy, smoker, second-hand smoke exposure, and lack of regular exercise before acute myocardial infarction” (McSweeney et al., 2003). The data is significant. Prodromal and acute symptom scores (clarified later in the text) were “significantly associated” with most risk factors (McSweeney et al., 2003). Interestingly, some research has shown that younger women are more likely to present with a greater prevalence of diagnosed comorbidities, including diabetes, heart failure, and hypertension (Izadnegahdar, et al., 2014). However, such a finding is not surprising—younger women with increased diagnosed comorbidities would physiologically naturally present with acute myocardial infarctions earlier in their life.

**Myocardial Infarction: Prodromal and Atypical Clinical Symptoms in Women**

Men and women present with acute myocardial infarction differently. Despite emerging research on the clinical signs and symptoms of acute myocardial infarction in women—both prodromal and acute “[d]ata remain[s] sparse on women’s prodromal symptoms before acute myocardial infarction” (McSweeney, et al., 2003). While prodromal symptoms in women are frequently overlooked and/or given minimal importance—the body of literature suggests, they are silent but deadly. In fact, appraisal of prodromal symptoms proves invaluable in determining early warning signs for an impending acute myocardial infarction. This is especially relevant as “[p]rodromal symptom score was the most important predictor of acute symptoms [of an MI]” in an article that looks at prodromal and acute early warning symptoms in women diagnosed with an acute myocardial infarction (McSweeney et al., 2003). Early identification and treatment is
imperative. If men present with “typical” clinical presentations, then women are often referred to as having “atypical” clinical presentations. In contrast to men, studies suggest that “[w]omen experience a greater diversity of MI symptoms” (Zbierajewski-Eischeid & Loeb, 2010). A study of women’s experiences with heart attacks found that “evidence suggests that the physical, psychological, and social ramifications of MI for women are significant, and different, from those of men” (Benson, Arthur, & Rideout, 1997). Women mentioned more “throat, neck or jaw pain compared to men and gave more consideration to breathlessness and other symptoms than men” (Granot, et al., 2004). Of note, back pain, nausea, and shortness of breath may be seen more in women, and diaphoresis (sweating) more in men (Granot, et al., 2004). In addition, data show that rather than individual symptoms being emphasized when appraising female acute myocardial infarction, presentation typically involves a cluster of symptoms (McSweeney, et al., 2010).

Cross-literature analysis of research data shows that consistencies exist. Prevalent prodromal symptoms among women include “fatigue, anxiety, chest discomfort, indigestion, shortness of breath, and sleeping difficulties” (Kalman, et al., 2013). Less common symptoms that women may experience include headaches that increase in discomfort or severity, shoulder discomfort, dizziness, or vision difficulties (Kalman, et al., 2013). The literature strongly suggests prodromal symptoms significantly predict an impending acute myocardial infarction. Compared to men, the research suggests that women experience more prodromal symptoms “six months to one year prior to having an acute myocardial infarction” (Kalman, et al., 2013). Such data, then, clearly supports the notion for increased awareness and education for women of the signs and symptoms of an impending MI. However, there is a paucity of research concerning objective methods with which to measure prodromal and acute symptoms in women diagnosed
with an acute myocardial infarction. The McSweeney Acute and Prodromal Myocardial Infarction Symptom Survey (MAPMISS), a telephone instrument, was developed to help establish “content validity” (McSweeney et. al., 2003) and listed 33 prodromal and 37 acute symptoms. Results from the MAPMISS indicated that about 78% of women detailed having at least one prodromal symptom for more than one month every day and/or several times a week before experiencing their acute myocardial infarction (McSweeney et. al., 2003). Results indicated that “[t]he most frequent prodromal symptoms experienced more than 1 month before AMI were unusual fatigue (70.7%), sleep disturbance (47.8%), and shortness of breath (42.1%)…Only 29.7% reported chest discomfort, a hallmark symptom in men” (McSweeney et. al., 2003).

Chest Pain

Chest pain, or angina pectoris, is of great clinical significance. Chest pain is often associated as a hallmark clinical symptom of ischemia in men, but “is often not of significant prognostic value in women” (McSweeney, et. al., 2003). Data from the MAPMISS indicate that only about 29.7% experienced “chest discomfort, which they described as aching (33%), tightness (33%), pressure (32%), sharpness (23%), burning (21%), fullness (18%), and tingling (18%)” (McSweeney, et. al., 2003); it is therefore important for clinicians when assessing women for possible or suspected acute myocardial infarction to use such descriptors. In addition, healthcare professionals should be attuned to non-normative qualitative descriptions of perceptions of pain in women. A further caveat of chest pain is severity. In an article that examines acute myocardial infarction and the severity of chest pain in men and women, the results proved noteworthy; “for women, the severity of chest pain was not associated with their symptom attribution as cardiac in origin” (Fukuoka, et al., 2007). Regarding presenting clinical
symptomatology, unstable angina, or angina not primarily relieved by rest, is particularly “important in that its presence predicts a much higher combined short-term risk of an acute myocardial infarction and mortality” (Granot, et al., 2004). In an article utilizing linguistic analysis on the gender perception of chest pain, men describe the pain during an acute myocardial infarction in concrete terms, while women described their pain diffusely (Granot, et al., 2004). In terms of the symptomatology of acute myocardial infarction, “[p]atients and clinicians most commonly identify chest pain, shortness of breath, and left arm pain as AMI symptoms…[h]owever, not all patients experience chest pain or perceive it as significant” (Fennessy, et al., 2010). It is even suggested that not having a significant amount of chest pain could be to blame for the vast amount of unrecognized acute myocardial infarctions in women (McSweeney et. al., 2003).

There were differences in the perception of pain with gender; the descriptive nature of chest pain has been described by women as being more “aching or pressure and less often as crushing substernal pain” (Kalman, et al., 2013). Pain in and of itself is not always experienced by women during an acute myocardial infarction, and in a study by McSweeney and Coon, 25% of women experienced no pain during the actual cardiac event (Kalman, et al., 2013). The research asserts that up to “85% to 95% of the general population identifies chest pain or discomfort as an AMI symptom” (Fukuoka, et al., 2007); however, in women, “nonchest-pain symptoms…may be falsely identified as musculoskeletal, gastrointestinal, or emotional in origin” (Zbierajewski-Eischeid & Loeb, 2010). In studies, women typically did not describe pain in the chest, but were more likely to comment on pain in the back, neck, chin, and/or stomach (Granot, et al., 2004) as noted earlier.

Fatigue
Another factor to consider is fatigue, which can most objectively be described as a “complex symptom that can result in physical and/or mental weariness, decreased functional capacity, and diminished quality of life” (Fennessy, et. al., 2010). In an article on gender differences in fatigue experienced during a myocardial infarction, fatigue is reported as a common symptom experienced in up to 70% of patients diagnosed with myocardial infarction (Fennessy, et. al., 2010). It is difficult to find normative and objectifiable means with which to measure fatigue; in the article, it is noted that fatigue was “often not quantified using instruments with established reliability and validity…[with] no context for changes” (Fennessy, et. al., 2010). The article details a study using the Profile of Mood States Fatigue (POMS-F) to analyze fatigue; results of the data from this study concluded that the majority of women from the data “experienced higher fatigue during the week prior to AMI [acute myocardial infarction]” (Fennessy, et. al., 2010). Further, the results from the data obtained conclude that “[w]omen reported higher POMS-F scores at baseline, indicating that fatigue levels might be increased during the period immediately before AMI” (Fennessy, et. al., 2010).

In an article detailing the importance of cluster analysis when appraising prodromal and acute myocardial infarction symptoms in women, it is noted that “[w]hen fatigue is viewed within a cluster of symptoms…clinicians may be more likely to recognize CHD as a differential diagnosis” that can lead to an acute myocardial infarction (McSweeney, Cleves, Zhao, Lefler, & Yang, 2010). Fatigue is particularly complex in the clinical setting, and may have “limited diagnostic use” (Fennessy, et. al., 2010) due to the high incidence of this symptom in most acute and chronic illnesses and co-morbidities. Often not reported in the medical record as depression is a “frequent covariate of fatigue” (Fennessy, et. al., 2010), depressive symptoms should be evaluated to ensure possible fatigue symptoms are not missed during diagnosis.
An Evolving Definition…

The research even goes so far as to suggest that there is no definitive picture of cardiovascular symptoms and acute myocardial infarction in women. This is not surprising; as the body of literature and research on female prodromal and atypical clinical presentations of acute myocardial infarction increases, this picture could potentially come into clearer focus. Markedly, the recognition among researchers is that the “definition of AMI is evolving…[due to] increasing numbers of patients [presenting] without classical ECG findings” (Luepker, et. al., 2011). Expanding the previously narrow definition of MI presentation in women can be helped via a cluster analysis. Significant comorbidities and patient health history prove invaluable when appraising myocardial infarction incidence.

Educational Methodology/Current Interventions for Women and Myocardial Infarction

It is recognized that the priority of “[e]liminating health disparities and improving cardiovascular health through prevention, detection, and treatment of risk factors are national public health and research priorities” (Leifheit-Limson, et al., 2013). In fact, “knowledge of typical female MI symptoms has been an issue permeating the literature for the past two decades” (Kalman, et al., 2013). In this regard, research for “younger and minority populations of acute myocardial infarction patients…is limited” (Leifheit-Limson, et. al., 2013).

There are public heart health awareness campaigns, as well as significant attempts to heighten awareness. Mortality in men from coronary heart diseases has decreased, due in part to national awareness campaigns; in contrast, though there have been women-focused campaigns, mortality has not significantly decreased (Zbierajewski-Eischeid & Loeb, 2010). With respect to cardiovascular disease in women, an emphasis on “gender-specific approach…is gaining momentum internationally” (Davidson, et. al., 2011).
The NHLBI provides educational resources for patients and healthcare professionals in both English and Spanish (Zbierajewski-Eischeid & Loeb, 2010). However, a known deficiency of the NHLBI is the lack of identification of target audiences (both patients and healthcare staff) to initiate obtaining the resources from the internet. The NHLBI together with organizations are sponsoring the Heart Truth, “aimed at giving women a personal and urgent wakeup call about their risk of heart disease” (Zbierajewski-Eischeid & Loeb, 2010). However, the focus is on heart disease, rather than on a primary deadly consequence of heart disease—acute myocardial infarction.

Another resource currently offering information regarding heart disease in women is the American Heart Association (AHA). The AHA is the sponsor of the Go Red for Women campaign (the “Red Dress Campaign”) (Zbierajewski-Eischeid & Loeb, 2010). The Go Red for Women campaign provides screening opportunities such as the Go Red Heart Checkup for Women which screens for heart disease and encourages women to schedule routine checkups and communicate with their provider (Zbierajewski-Eischeid & Loeb, 2010). Again, though such an intervention has utility, acute myocardial infarction as a theme is not emphasized in the campaign.

In an article on increasing education for women and acute myocardial infarction, two acronyms were developed to help women remember prodromal and acute myocardial infarction symptoms: “FACTSS (Fatigue, Anxiety, Chest discomfort, Tummy/Indigestion, Shortness of breath, and Sleeping difficulties)…and CURB (Chest sensation or pain, Unusual fatigue, Radiating pain to back jaw or arm, and Breathing difficulties)” (Kalman, et al., 2013). Based on analysis of data, this educational program did indeed increase women’s knowledge of prodromal
and myocardial infarction symptoms (Kalman, et al., 2013). Further research is needed from this campaign to truly discern its efficacy.

Where does one place responsibility for an unrecognized acute myocardial infarction? It is the responsibility of the clinician to assess for the vast variety of clinical signs and symptoms of an acute myocardial infarction in women, as well as the patient’s obligation to ensure complete details of her symptoms are communicated. An article on a “study of 78 emergency and critical care clinicians [mentions that] 85% of nurses and 66% of physicians stated that they assessed primarily for chest pain in persons with suspected AMI” (McSweeney et al., 2003). More importantly, “only 35% reported assessing for atypical symptoms, although 92% to 100% had previous experience with persons with atypical presentation” (McSweeney et al., 2003). In order for healthcare professionals to better identify acute myocardial infarction in women, it is crucial for providers to maintain “a high level of clinical suspicion and increasingly…sensitive biomarkers” (Pilote, 2014). Literature suggests that 26% to 54% of acute myocardial infarctions in women are unrecognized at the time (Kalman, et al., 2013). This is more significant when it is realized that women have a greater mortality rate than men after their first myocardial infarction: “38% of women die within one year after the first MI compared to 25% of men” (Kalman, et al., 2013). Such a markedly high rate of death in women is even more pronounced by the fact that within the last ten years, it was determined that “fewer than one in five physicians knew that women have a greater CVD mortality rate when compared to men” (Kalman, et al., 2013).

**Barriers**

Among potential barriers for women learning acute MI is health literacy. Health literacy, or, the “degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions” (Lancaster, 2014)
is intimately tied to effective intervention success. Illiteracy among populations can cause financial costs, preventable healthcare admissions, and poorer health outcomes.

Media as well plays a significant factor in knowledge of health and wellness among the population. Women typically associate a heart attack with the “classic” clutch to the chest or “Hollywood Heart Attack” as often seen in media portrayals: “women are more likely to attribute their symptoms to an MI if their symptoms match the media illustration of a heart attack, which are typically male-based symptoms” (Zbierajewski-Eischeid & Loeb, 2010). As such, the media has played, and will continue to be a significant contributor to female misunderstanding of heart attack symptoms. In addition, women may be more likely to associate the symptomatology of an acute myocardial infarction with other well known, more publicized acute health crises, such as the common cold or the flu: in a study on AMI symptoms in women and men, “[w]oman were twice as likely to attribute their symptoms to flu than men” (Fukuoka, et al., 2007).

Evidence for a Need/Target Audience

The target audience for the KNOW MI initiative would be providers and women—the campaign would increase awareness and knowledge of coronary artery disease, prodromal symptoms and presentation of clinical signs and symptoms of an acute myocardial infarction. From the appraisal of literature, there is a known and identified need within the female population. For example, “only 13% [of women] felt that the greatest danger to their health was heart disease” (Zbierajewski-Eischeid & Loeb, 2010). According to Cardiac Insider, due to the fact that many cardiac symptoms for women are “atypical, many women are unable to link their symptoms to heart disease [or cardiovascular compromise] which often leads them to delay seeking treatment” (Zbierajewski-Eischeid & Loeb, 2010). In an article on CVD awareness in women from 2009, 45% of women surveyed considered themselves to be “well informed about
heart disease” (Mosca, Mochari-Greenberger, Dolor, Newby, & Robb, 2009). Moreover, data from this study indicated that the knowledge of myocardial infarction warning signs did not “appreciably differ from 1997” (Mosca, et al., 2009).

It is noted from appraisal of research that “[f]ailure to recognize prodromal symptoms may be one reason women experience a greater proportion of sudden cardiac deaths than men do” (McSweeney et. al., 2003). In addition to early recognition of prodromal symptoms, lack of awareness about presenting clinical signs and symptoms of an acute myocardial infarction adds to the mortality rate in women from this cardiac event: “[f]rom 33% to 47% of patients with acute coronary syndrome (associated with AMI) present with symptoms other than chest pain…[and] the likelihood of experiencing atypical symptoms in the face of AMI is higher for women and increases with age” (Tullmann & Dracup, 2005).

It has already been established that prompt treatment from suspected myocardial infarction to treatment therapy is crucial. Literature concurs that “the average delay for treatment in women is one hour longer than for men, which is clinically significant” (Zbierajewski-Eischeid & Loeb, 2010). It is noted that the “compound problem of misperceptions of risk in women and frequently atypical symptom presentation lead to women having a less aggressive pattern of care and a delay in diagnosis and treatment” (Zbierajewski-Eischeid & Loeb, 2010). Awareness and early intervention is imperative for the female population in particular because if women do “seek treatment, [they] are more likely to receive less aggressive treatment and have a higher hospital mortality for AMI than do men” (Tullmann & Dracup, 2005). If treatment is delayed, the “efficacy of reperfusion therapies such as angioplasty and thrombolytics…is drastically reduced” (Tullmann & Dracup, 2005).
In a study on gender difference in pain perceptions in cardiac patients, results found that “the vast majority of the men attributed their chest pain to heart diseases, whereas 73% of the women did not” (Granot, et al., 2004). In addition, the article *Women’s Early Warning Symptoms of Acute Myocardial Infarction* details how women who sought medical assistance and who experienced prodromal symptoms prior to their acute myocardial infarction had clinicians either “minimize…or ignore their symptoms” (McSweeney, et. al., 2003). In an article that studied the knowledge of cardiovascular disease in the population, Tullmann and Dracup advise that “current education also needs to include more emphasis on atypical symptoms” (2005) especially in the elder population.

**The KNOW MI Initiative**

**Objectives/Expected Outcomes**

There is a great deal of literature to support the notion that “the delay of risk identification in women may be an important determinant of their higher mortality rates…[and] poor outcomes” (Zbierajewski-Eischeid & Loeb, 2010). To this end, a primary objective of the KNOW MI initiative is two-fold—increased awareness and enhanced knowledge of acute myocardial infarction prodromal and clinical symptoms. Moreover, identifying those at risk and promoting education could help encourage calling 911 during an emergent cardiac event, or even prevent acute coronary syndromes.

The educational screening tool is in accordance with Healthy People 2020 goals. In particular, this specific cardiovascular intervention aids the goal to “prevent illness by detecting early warning signs or symptoms before they develop into a disease (primary prevention) [and] detect[ing] a disease at an earlier, and often more treatable, stage (secondary prevention)” (United States Department of Health and Human Services [HHS], Healthy People 2020, 2014). These
initiatives are based on the premise that improved health equality can be enhanced through increased awareness and knowledge for women. This increased awareness aids the goals of “preventable death” and improved “life expectancy” (HHS, Healthy People 2020, 2014).

Another Healthy People 2020 goal encouraged by the educational screening tool is to “improve health-related quality of life and well-being for all individuals” (HHS, Healthy People 2020, 2014). An expected outcome of this educational screening tool would be improved well-being and quality of life for females through less incidence and prevalence of mortality from acute myocardial infarctions. Moreover, inclusion of ways in which female individuals can reduce their risk could potentially “increase quality and years of healthy life” (HHS, Healthy People 2020, 2014).

The KNOW MI tool is in accordance with the AHA 2020 Impact Goal of “improving cardiovascular health and achieving an additional 20% reduction in death from CVD” (Franklin & Cushman, 2011). Notably, prevention of various diseases and disorders can be divided into three subtypes: primordial/primary (prevention of risk factors), secondary (treatment of risk factors), and tertiary (prevention of recurrent cardiovascular events) (Franklin & Cushman, 2011). The KNOW MI educational screening intervention aims to chiefly offer primordial and secondary prevention through general knowledge of risk factors and targeted ways to reduce the risk of an MI.

**Design Process**

The design of the KNOW MI initiative tool was predicated on the body of research garnered on coronary artery disease in women, risk factors, prodromal, and clinical signs and symptoms of myocardial infarction in women. The relative atypical clinical picture of women and cardiovascular disease and acute myocardial infarction dictated the content of the
screening/educational tool. To ease simplicity and compactness, only necessary and pertinent information could be included in the tool.

The KNOW MI screening tool uses the modifiable cardiovascular disease risk factors listed on the World Heart Federation website (2014). The positive lifestyle changes highlighted in the intervention tool were derived from the NIH’s site on “How to Prevent and Control Coronary Heart Disease Risk Factors” (NIH, 2011). The well-known Framingham Heart Study’s “Risk Assessment Tool for Estimating Your 10-Year Risk of Having a Heart Attack” provides an interactive tool whereby the female population can write in their respective health information to “calculate” their risk and probability for having a heart attack in 10 years. The 10-year risk factor calculator uses regression coefficients and hazard ratios as a primary model and means for determining probability of heart attack.

The prodromal and presenting signs and symptoms of an acute myocardial infarction were taken from the review of research. An acute MI algorithm was initially designed to provide a simplistic, relatively straightforward approach for females to refer to in the event of a suspected myocardial infarction. However, female acute myocardial infarction, by its very nature (typically clustered signs and symptoms and inconsistent presentation) unfortunately does not lend itself readily to the algorithm modality. Thus, the algorithm was re-examined and an even simpler, box-like instruction on the KNOW MI tool was utilized.

It is important to note that the impending signs and symptoms of an acute myocardial infarction defined within the tool were “possible” and not definitive for an imminent heart attack. Further, it is denoted on the tool that the range of symptoms can be experienced anywhere from weeks, to months, to even years as research suggests. In keeping with the KNOW MI campaign
initiative to promote patient self-efficacy, information is directed to what the specified individual can do to increase their likelihood of positive health outcomes and survival.

**Adaptations/Limitations**

A known limitation to the data collection process and literature appraisal is the fact that currently “[n]o national level surveillance exists for AMI (or coronary heart disease in general), except for mortality, in the US” (Talbott, et al., 2013). Mortality rates for tracking surveillance of acute myocardial infarction are, essentially, impractical when working towards preventive or prophylactic care in women.

It is recognized that knowledge for women is sometimes not enough to promote change, however, “effective education is the first step to behavior modification and a healthier lifestyle” (Kalman, et al., 2013). In this regard, the KNOW MI tool could help promote patient self-efficacy and motivation to better predict improved health outcomes. To this end, it is important to note the significance of behavior and motivation to change when implementing interventions. A noted limitation of the KNOW MI tool is the need for individual motivation and incentive. It is already recognized in the literature that altering health behavior is difficult, especially in the “absence of symptoms…[t]he payoffs may seem remote compared to the immediate pleasures of indulgence” (Murdaugh, 1990). The Health Belief Model (HBM), an “individual-level model…useful in planning programs in which the motivation of learners might be a concern” (Lancaster, 2014) can be applied to the intervention to specifically and individually promote change in the learner. The educational screening tool specifically aims to motivate change in the female population through emphasis on perceived threat/susceptibility and perceived benefit from the tool to cultivate cues to action and promote self-efficacy.
Data suggests that at some point in time, “women recognized their symptoms as abnormal but they did not acknowledge their seriousness until after the use of a variety of coping mechanisms and self-treatment behaviors to reduce threat and maintain control over the situation” (Dempsey, Dracup, & Moser, 1995). In an article on women’s decision-making process on whether to receive care for symptoms of an acute myocardial infarction, data showed that women, on average, delayed receiving treatment for about 5.4 hours (Dempsey, et al., 1995). A meta-synthesis study found three causative factors (psychosocial, sociodemographic, and clinical) that promoted delay in seeking treatment for women—factors both “multifaceted and complex…[including] perceived seriousness of the symptoms [and] beliefs of low self-perceived vulnerability to heart attack” (Lefler & Bondy, 2004). Utilizing the theory of the HBM, hopefully women can better understand the severity of an MI and the benefits of seeking treatment as soon as possible.

Regarding adaptations, the use of acronyms may prove a useful and operational future modification of the KNOW MI tool: “using acronyms in an educational program to increase women’s knowledge about cardiovascular disease is effective” (Kalman, et al., 2013). Furthermore, even the use of a pun as the intervention name could help with enhanced retention of the tool’s primary goal—to reduce mortality from myocardial infarctions in women and increase knowledge of symptoms. In contrast, medical jargon could impose a further barrier when appraising the KNOW MI intervention tool. Without the aid or assistance of a medical professional such as a nurse practitioner, physician, physician’s assistant, or registered nurse to interpret such jargon, the essential meaning and impact of the tool could become lost or obscured. Moreover, the tool could include non-modifiable risk factors for enhanced consciousness of risk in women.
There are several known limitations to the KNOW MI intervention. Prominently, one must have access to care and know her total cholesterol level, HDL cholesterol level, and specific systolic blood pressure number. Lack of knowledge of these parameters for subgroups of the female population could create a potential barrier. A possible additional future modification for the KNOW MI tool is integration of the second version of the Framingham’s Heart Study Risk Factor Calculator using a female’s relative Body Mass Index (BMI). A female’s BMI is substituted for the cholesterol levels in the Risk Factor Calculator to determine heart attack risk.

Another limitation to the screening tool is the need to access a computer or electronic device to input numbers and “calculate” scores. While the tool denotes the specific site to input an individual’s physiologic numbers, access may be limited for some members of the female population. Future modifications could include a more simplified means of computing one’s risk for an acute myocardial infarction. Presently, the literature suggests the relative superiority of the Framingham Heart Study as a gold standard for risk calculation. Finally, a limitation of the screening tool is a constraint from the Framingham Heart Study’s Risk Factor Calculator—the Calculator is only for adults 20 years and older with no known heart disease or diabetes. This fact calls into question the contemporary need for a newer, more advanced risk factor calculator that takes the entire female population into account: as diabetes and heart failure are significant co-morbidities in most of the current cardiac population, this limitation possibly identifies the present tool as not realistic or efficient. A future modification or alternative screening tool could use the 30-Year Risk Factor Calculator from the Framingham Heart Study. The current intervention tool focuses on a 10-year risk as individuals are more likely to respond to health threats that seem more immediate or short-term.
An adaptation that could pose significant benefits is the revision of the tool into an application on a smartphone or other mobile device. Such an adaptation of the tool is in keeping with the current trend; “[i]n the past decade, technology growth in healthcare has exploded, and along with the tide of newly emerging technology comes the smartphone and accompanying applications” (Haze & Lynaugh, 2013). The intervention could be revised to assimilate into the smartphone application modality. In essence, the “app” would not be replacing care, but rather aiding in some of the tool’s primary motives—that of enhanced awareness and self-management in health practices. Such an app would be in keeping with other established apps on smartphones that “focus on self-management, to monitor [patients’] own conditions” (Haze & Lynaugh, 2013). Smartphone apps are predicted to emerge as a leading form of adjunct therapy for patients in healthcare (Haze & Lynaugh, 2013). This adjunctive therapy, then, can aid with health promotion in patients. In all, the revision of the KNOW MI tool into an app on smartphones is a logical progression; it is more cost effective, forgoes the need for a computer to compute a score, provides relatively easy internet access with which to learn more about CVD and MI for women, and does not readily require the need to see a healthcare professional to gain access to the tool.

Another possible adaptation of the tool could be translation into other languages or modifications made for other ethnic and racial cultures to help patients with language or culture barriers. Such an adaptation would help address the finding that “awareness among racial and ethnic minorities lags behind…[showing that] demographics and acculturation status [is] significantly associated with awareness and knowledge of CVD” (Mosca, et al., 2009). Markedly, “African American women have a significantly higher rate of CVD compared with Caucasian women, yet their rate of awareness [i]s substantially lower” (Mosca, et al., 2009).
Further, the number one leading cause of death for Chinese women is now heart disease, but awareness is still limited (Mosca, et al., 2009).

**Implications for Healthcare and Nursing Practice**

Educational interventions in nursing offer patients the option to be more health literate and thus self-efficacious about their healthcare. As nurses are at the forefront of clinical care and at the patient’s bedside, they are in an optimum position to intervene. In support of this notion, the literature suggests that “[n]urses should stay vigilant and have a high index of clinical suspicion for MI in adult female patients in general and postmenopausal patients in particular” (Zbierajewski-Eischeid & Loeb, 2010). Patients that are high risk should be given an immediate EKG. Following the trend of increasing interdisciplinary teamwork in the hospital and clinical setting, it is essential for nurses and healthcare providers to work together to target suspected myocardial infarctions in women.

In particular, nurses can educate and thus empower women: “[n]urses are the ideal healthcare providers to address th[e] knowledge gap” (Zbierajewski-Eischeid & Loeb, 2010). During routine screenings and discharge from the hospital, nurses are in an advantageous position to attend to health concerns. The research suggests that in discharge teaching to post-acute myocardial infarction female patients, there are “missed opportunities” (Leifheit-Limson, Spertus, et al., 2013) for teaching of modifiable secondary risk factors to prevent future repeat acute myocardial infarctions. Research suggests that “[w]omen educated by nurses are of major importance as stated in the new AHA guidelines” (Kalman et al., 2013). It is important to take advantage of opportunities to educate women. In addition, a strength of the KNOW MI tool is the amalgam of various critical cardiovascular health information in one design.
The tool would have some of its biggest impacts in the field of health promotion. Nurses in particular play a key role in this area: “[t]he World Health Organization defines health promotion as a process of enabling people to increase control over and to improve their health…[and to] facilitate that process, we must provide people with appropriate information” (Hartford, 2009). Nurses are, by their very nature, informed teachers who are “highly educated, experienced health professionals…accessible through many settings [and are] high level thinkers with exceptional skills and considerable ability to communicate, negotiate, coordinate, and collaborate in order to deliver care” (Hartford, 2009). To this end, the KNOW MI intervention provides a teaching-learning opportunity for the nurse and patient. This process allows for enhanced interaction between the patient and nurse, and the chance for patients to ask questions. These strongpoints could potentially help the KNOW MI tool to have a greater impact on the patient population.

Knowledge and awareness of acute myocardial infarctions symptomatology can be improved in not only patients, but healthcare professionals as well. Regarding training for cardiac events such as heart attacks, gender discrepancies (particularly symptoms experienced by females) are not addressed in the mandatory Advanced Cardiac Life Support (ACLS) certifications for healthcare professionals.

Nurses are patient advocates. Advocacy for patients is an important factor for patient wellness in the pre-and post-MI phases: in a phenomenological study, results in individuals who had experienced an acute myocardial infarction showed that within the first year of recovery, feelings of “being in an afflicted body [and]…struggling for normalization” were recurrent themes (Junehag, et al., 2013). Post-MI, nurses can help facilitate inclusion in rehabilitation and recovery support groups. To this end, nurses are helping facilitate healing of not only the
patient’s physiological self, but her psychological state as well. Nurses can also help assist patients to adjust and modify health behaviors. In one example, Murdaugh claims that nurses can “collaborate with dietitians in developing successful programs” (1990) to help with healthy eating.

Research and literature studies already confirm that early identification and “shortening the time interval from symptom onset to initiation of reperfusion therapy, particularly in the first few hours, is critical to the reduction of mortality and morbidity in acute myocardial infarction” (Fukuoka, et al., 2007). An approach to shorten the critical time interval between symptom recognition and treatment onset is two-fold: aiding awareness in women and increasing symptomatology recognition. Growing evidence suggests that for women, the “lower perceived risk and less classic symptom presentation” (Fukuoka, et al., 2007) together contributes to the mortality rate in women from acute myocardial infarction. Risk reduction efforts can be improved through increased awareness and therefore preventive action (Mosca, et al., 2009).

Beyond nursing practice, the KNOW MI intervention could have implications for improved inpatient hospitalization rates. In an article on trends in the rate of acute myocardial infarctions, the data concluded that “AMI hospitalization rates for young people have not declined over the past decade” (Gupta, et al., 2014). Though this study is limited by examination of solely younger patients, aged 30-54, the implications of these data are strengthened by the fact that most myocardial infarctions occur with greater propensity in the female population aged over 54. The younger population hospitalized with AMI’s proved to have “more comorbidity, longer length of stay, and higher in-hospital mortality” (Gupta, et al., 2014). The KNOW MI campaign could both decrease inpatient mortality and reduce healthcare costs.
More significantly, the KNOW MI initiative could help dissolve the widely held belief that female acute myocardial infarction is an indefinable and often elusive cardiac event. The demarcation that the KNOW MI tool would be a campaign is indicative of a long-term intervention in healthcare. The KNOW MI educational screening tool ideally would be implemented in primary care settings (annual physicals for example), hospital settings especially during intake and discharge, as well as at health fair events, and public locations such as community centers. Bridging the gap between generating an intervention and actually dispersing it into the hands of the population is imperative. This tool, too, could help emergency department providers and staff look for more atypical presentation(s) of acute MI in women.

Conclusions and Recommendations

The denotation of women’s cardiovascular symptoms being “atypical” deserves re-examination. Such arbitrary nomenclature could contribute to obscurity and further misunderstanding for women and acute myocardial infarction. In fact, it is even noted that “[r]esearchers have speculated that this label contributes to misunderstandings in clinicians and lay individuals, lead[ing] to inaccurate diagnosis, and caus[ing] women to delay [in] seeking treatment” (McSweeney, et. al., 2003). Gender-based analysis is important in acute MI in women: “the picture of ‘normal’ cardiac symptoms is skewed toward a male diagnostic picture” (Kalman, et al., 2013). Women should be assessed from a less narrowed and more open-ended framework—one that takes into account the cluster-like symptomatology of acute myocardial infarction presentation. Qualitative as well as quantitative data can also prove beneficial to the future of AMI research in women.

Though the field of cardiovascular research regarding the female population is expanding, a greater body of knowledge is needed in efforts to assess the current level of
awareness and knowledge of female cardiovascular health. What is known is that “[t]he more aware women are of female prodromal and MI symptoms, the better prepared they will be to be proactive in seeking appropriate care” (Kalman, et al., 2013). With advances in research and increased awareness, female cardiovascular health should be directed towards a kind of “preventive cardiology and lifestyle medicine to reflect on current knowledge and propose concepts for…large-scale randomized clinical trials and quasi-experimental studies” (Franklin & Cushman, 2011). Such a direction would help increase the body of knowledge about female cardiovascular health, and, more importantly, help guide treatment and direct interventions to decrease female mortality from cardiac compromise. As discussed in an article on long-term myocardial infarction trends, “[t]he diagnosis of AMI is evolving” (Parikh, et al., 2009), and just as such diagnosis and treatment for acute myocardial infarction evolves, so should applicable, relevant, and patient-specific interventions evolve. The KNOW MI tool would represent one such tool. The heart of the matter is this: identification of those at risk, enhanced awareness, and knowledge can be potential life-savers for women from MI, and targeted prevention is the key.
References


Framingham Heart Study. Cardiovascular disease (10-year risk). Retrieved Dec 2, 2014 from


McSweeney, J.C., Cleves, M.A., Zhao, W., Lefler, L.L., & Yang, S. (2010). Cluster analysis of
women’s prodromal and acute myocardial infarction symptoms by race and other characteristics. *Journal of Cardiovascular Nursing, 25*(4), 311-322. doi: 10.1097/JCN.0b013e3181cfba15


