GENDER DIFFERENCES IN MORTALITY AFTER
ACUTE MYOCARDIAL INFARCTION

by

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Abstract

Women die after AMI at a rate approximately double that of men (Brister et al., 2000), as evidenced by an abundant number of epidemiological and clinical studies. Contentious debate about this alarming problem has been fueled by inadequate conceptualization of the problem, and misread evidence resulting from selection bias. The purpose of this study was to examine gender differences in the associations between sociodemographics and comorbidities (CHF, hypertension, diabetes) and short-term mortality after AMI. Surprisingly, there is no published study to date that has examined the effects of these factors on mortality after AMI in the Canadian context. The study was of exploratory, descriptive design and secondary analysis was used. The AMI cohort (n = 1, 365) was the total population of patients (342 women, 827 men) in 1994 diagnosed with AMI ICD 9 Code 410 and admitted to a BC hospital. A logistic regression model was used to assess independently the effects of age and gender and to control the effects of possible confounders (CHF, hypertension, diabetes, SES) on the outcome variable (mortality). Significantly more women (19.9%) died after AMI compared to men (10.5%; odds ratio 1.81, 95% CI 1.24 – 2.64) within the initial hospitalization. CHF was a significant predictor of mortality (odds ratio 1.76, 95% CI 1.05 – 2.93), hypertension, diabetes, and SES Quintile were not significant predictors. The results of this study have implications for critically needed research on gender differences in mortality after AMI, judicious screening/monitoring of women, follow-up, and population health.
# TABLE OF CONTENTS

Abstract ........................................................................................................ ii  
List of Tables ............................................................................................... v  
List of Figures ............................................................................................... v  
Acknowledgements ....................................................................................... vi  

CHAPTER ONE - INTRODUCTION ...................................................................... 1  
Research Problem ......................................................................................... 1  
The issue of gender differences ..................................................................... 2  
Research purpose .......................................................................................... 4  

CHAPTER TWO - LITERATURE REVIEW ............................................................. 5  
Acute Myocardial Infarction: An Overview .................................................... 5  
Comorbidities: CHF, hypertension, and diabetes ......................................... 6  
Mortality ......................................................................................................... 7  
Summary ........................................................................................................ 8  
Epidemiological Research Studies .................................................................. 8  
  CHF, hypertension, and diabetes ................................................................. 8  
  Poverty and health outcomes ..................................................................... 11  
  Social health-care context ........................................................................ 13  
Summary of State of Knowledge .................................................................. 14  

CHAPTER THREE - METHODS ........................................................................ 15  
Theoretical Framework .................................................................................. 15  
Summary of Research Study ......................................................................... 17  
Research Design ............................................................................................. 18  
Cohort Formation .......................................................................................... 18  
Data Files Utilized .......................................................................................... 19  
Sorting Cases and Linkages .......................................................................... 20  
Operational Definitions of Variables ............................................................ 20  
Data Analysis ................................................................................................ 21  
Limitations of Measurement ......................................................................... 22  

CHAPTER FOUR - DATA ANALYSIS AND FINDINGS ....................................... 24  
Mortality Rates ............................................................................................... 24  
Age, Gender, CHF, Hypertension, SES Quintile, and Mortality .................... 25
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of Study</td>
<td>28</td>
</tr>
<tr>
<td>Discussion</td>
<td>29</td>
</tr>
<tr>
<td>Assumptions</td>
<td>29</td>
</tr>
<tr>
<td>Comparison of women and men by sociodemographics and comorbidities</td>
<td>29</td>
</tr>
<tr>
<td>Mortality rates</td>
<td>30</td>
</tr>
<tr>
<td>Research questions</td>
<td>30</td>
</tr>
<tr>
<td>Screening/monitoring of women</td>
<td>32</td>
</tr>
<tr>
<td>Follow-up</td>
<td>32</td>
</tr>
<tr>
<td>Population health</td>
<td>33</td>
</tr>
<tr>
<td>Study limitations</td>
<td>34</td>
</tr>
<tr>
<td>Recommendations</td>
<td>35</td>
</tr>
<tr>
<td>Screening/monitoring of women</td>
<td>35</td>
</tr>
<tr>
<td>Follow-up</td>
<td>36</td>
</tr>
<tr>
<td>Future research</td>
<td>37</td>
</tr>
<tr>
<td>References</td>
<td>39</td>
</tr>
<tr>
<td>Appendices</td>
<td>46</td>
</tr>
<tr>
<td>A - Access to Personal Information Approval</td>
<td>46</td>
</tr>
<tr>
<td>B - Ethical Approval</td>
<td>50</td>
</tr>
</tbody>
</table>
LIST OF TABLES

1. Sociodemographics and Comorbidities.......................................................... 24
2. Mortality by Age Group.................................................................................... 25
3. Multiple Logistic Regression Model #1............................................................ 26
4. Multiple Logistic Regression Model #2............................................................ 27

LIST OF FIGURES

1. Theoretical framework: Influence of gender, poverty, CHF, hypertension and diabetes on health................................................................. 17
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Acute myocardial infarction (AMI) is a problem of epidemic proportion, with an incidence rate of 180 per 100,000 in Canada, in 1998/1999, totaling 60,338 hospital discharges (Canadian Institute of Health Information, 2001). AMI is a cardiac event that is one stage in the complex process of cardiovascular disease (CVD). CVD is a chronic disease that is a continuing process made up of the following stages: risk, symptoms, AMI or coronary bypass surgery (event), outcomes such as rehabilitation, recurrence of symptoms that lead to re-admission, and throughout all stages personal adjustments for client and family. Further to personal adjustments, burden and threat to quality of life, CVD is the leading cause of hospitalization for women (excluding childbirth) and men, costing Canada a total of $7.8 billion annually (Moore, Mao, Zhang, & Clarke, 1993). Most troubling, women die after AMI at a rate approximately double that of men (Brister et al., 2000).

The issue of gender differences

Despite the magnitude of the problem and the associated personal and economic burden to both client and family, the issue of gender differences in mortality after AMI is still not clearly understood perhaps because of: 1) lack of gender sensitivity by researchers, 2) limited numbers of women enrolled in clinical trials, and 3) inadequate conceptualization of the problem by researchers. Early researchers (Puletti, Sunseri, Curione, Erba, & Borgia, 1984) called the differences between men and women "sex differences;" later, researchers changed this labelling to "gender differences," thus indicating the beginning of a growing gender sensitivity and recognition that men and women are more than an aggregation of cells and body parts, and that the differences between them have significant effects on outcomes such as mortality. The National Forum on Health (1997), in recognition of the paucity of research on women with
CVD, indicated in their report that we should: 1) collect better data on women, 2) include more women in clinical trials, and 3) do more follow-up on women.

Historically, women have been excluded from target populations of randomized clinical trials because of the risk of teratogenicity, their hormonal fluctuations and their advanced age (Levey, 1991). As a result, most of the research has been done on white, middle-class men (Moser, Dracup, & Marsden, 1993). Today, enrollment of women in randomized clinical trials has improved only slightly, from 20% during 1966-1990 to 25% during 1991-2000, remaining well below women’s AMI incidence rate (Lee, Alexander, Hammill, Pasquali, & Peterson, 2001). As a result of this enrollment bias, researchers are faced with the challenge of needing to both ‘catch-up’ in our understanding of women and to ‘tease out’ the important differences in gender using rigorous methods to ensure equitable care. It follows that although significant gains have been made in treatment modalities such as medications, thrombolysis, angioplasty, coronary bypass and cardiovascular services for AMI, the evidence resulting from this androcentric research has been generalized to all populations, guiding the clinical diagnosis and treatment of women. Could this male orientation to treatment be contributing to women’s higher mortality after AMI?

The biomedical sciences have typically conceptualized the problem of risk for mortality after AMI by focusing on factors such as the comorbidities of hypertension, congestive heart failure (CHF) and diabetes mellitus (Greenland et al., 1990; Nohria, Vaccarino, & Krumholz, 1998). Risk for mortality after AMI is theorized to be significantly affected by the social and economic determinants of health. Yet few studies have empirically investigated the impact of these determinants on risk for mortality after AMI. Gornel (1999) notes that this lack of study demonstrates the limited vision of biomedical science. The biomedical science view is

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1 Women typically present with CVD at an average age that is ten years greater than that of men (Greenland et al: 1990; Herman, Greiser, & Pohlabein, 1997).
consistent with the "closer to home" perspective (Epp, 1986) that believes that health is an individual's responsibility. Although Epp views a person's health in context, and strategizes that strengthening community services and coordinating public policy will improve health these strategies have not been fully implemented since the release of the report. The social determinants of health perspective acknowledges the significant influence of context on health outcomes and includes factors such as socioeconomic status (poverty), dangerous or stressful work, lack of social support and low perceived power. These factors and conditions have a substantial role in many diseases, including CVD (Labonte, 1992, 1994; Registered Nurses Association of British Columbia, 1993), and are particularly relevant to the problem of women and poverty. People living in poverty are more at risk to develop disease and premature death (Wilkinson, 1996); a group particularly at high risk are lone parent families-- 56% of single parent mothers with children are poor (Ross, Scott, & Smith, 2000).

Nurses play an important role in determining risk when caring for the AMI client in all stages, including prevention, treatment, adaptation, coping and ongoing maintenance of this chronic disease (Jillings, 1988). Nurses in their various roles need to be able to identify high-risk clients in their daily clinical practice for program planning and health care policy and should be guided by evidence from rigorous research that reflects the complexities of people's lives. Kazanjian (1998) believes that to understand women's health researchers must recognize and examine the complexities and diversity in women's lives by developing and utilizing more inclusive models and that government databases provided an opportunity to examine from a population health perspective women's health in context. In aid of this endeavour, the B.C. Linked Health Database provides an opportunity to examine the broad influence of socio-demographics and gender differences in mortality after AMI. The purpose of this study extends earlier research that examined gender differences in the effect of comorbidities.
(CHF, hypertension, and diabetes) on mortality after AMI to include the effect of socio-economic status.

Research Purpose

The purpose of this study was to answer the research question: Are there gender differences in mortality after AMI? In addition, the following secondary questions were addressed:

1) Is there an association between (a) gender and (b) CHF and mortality after AMI?
2) Is there an association between (a) gender and (b) hypertension and mortality after AMI?
3) Is there an association between (a) gender and (b) diabetes and mortality after AMI?
4) Is there an association between (a) gender, (b) SES, (c) CHF, (d) hypertension, and (e) diabetes and mortality after AMI?

At the outset of the work it was worthwhile to clarify the key and relevant concepts. Caring is the mental, emotional and physical effort involved in looking after, responding to and supporting others. This work is done by caregivers, often women as mothers, daughters and wives in the context of individual relationships (Baines, Evans, & Neysmith, 1991). Co-morbidity is a disease that worsens or affects a primary disease (Venes et al., 2001); for example, CHF, hypertension, and diabetes worsens AMI. Gender refers to the differences between women and men and implies a social and cultural context (Brister et al., 2000).
CHAPTER TWO: LITERATURE REVIEW

In exploring the theoretical and empirical literature related to gender differences in mortality after AMI, a review was conducted to conceptualize the problem and to allow the adoption of the right "lens." The majority of the theoretical literature reviewed is from nursing, the social sciences, and psychology while the empirical research is from the biomedical sciences, epidemiology and medicine. The databases of Medline, CINAHL (Cumulative Index to Nursing and Allied Health Literature), HEALTHSTAR and Psychinfo were used including the years 1989 to 2001. The key words used were cardiovascular diseases, gender, heart diseases, myocardial infarction, poverty, women, sex factors, social problems and socioeconomic factors. In addition to a systematic search, relevant literature was identified by the ancestry or “pearling” approach (reviewing published reference lists) and by browsing web pages known to publish statistics and papers on AMI and related health promotion endeavours. I begin with a discussion of AMI including mortality statistics, sequelae such as treatments, rehabilitation, co-morbidities and mortality. Next, I focus on the research to date, including a critique of pertinent research traditions and a discussion of the health-care context that includes limited gender sensitivity and a lack of awareness or appreciation of the social determinants of health.

Acute Myocardial Infarction: An Overview

Cardiovascular disease is the leading cause of mortality in Canada, accounting for 79,457 deaths, 39,619 women and 39,838 men in 1997; one half of the deaths are from ischemic heart disease (IHD), of which AMI, caused by coronary heart disease, is a sub-category (Statistics Canada, 1999). The major risk factors for coronary heart disease in both genders are smoking, hypertension, high cholesterol, diabetes mellitus and a sedentary lifestyle. The Canadian Heart Health Survey, conducted between 1986-1992, found that 62% of Canadian women and 66% of men aged 18-74 years had one or more major risk factors for coronary heart disease. Seventy-six percent of Canadians with less than 11 years of education (education is associated with
socioeconomic status) had at least one major risk factor compared to 59% of Canadians with more than 11 years of education (Health Canada, 1995).

Early and aggressive treatment of AMI is critical because medications, early percutaneous intervention, and revascularization reduces significantly mortality and morbidity in both women and men (Mitka, 2000). Once discharged from hospital, cardiac rehabilitation programs have long been viewed as the ‘window of opportunity’ to assist clients and their family to adjust and make changes in their behaviour (Jillings, 1988); benefits include economic savings ($9200 per quality-adjusted life-year gained) (Levin, Perk, & Hedback, 1991; Oldridge et al., 1993); reduction in mortality rates by 25% (Oldridge, Guyatt, Fischer, & Rimm, 1988), and improvement in quality of life. Women who smoke (Cannistra, Balady, O’Malley, & Weiner, 1992) and older women who use public transportation (Ades, Waldmann, McCann, & Weaver, 1992) are less likely to attend cardiac rehabilitation programs. Overall, women are less likely than men to return to work following AMI or to resume full function (Eaker, Johnson, Loop, & Wenger, 1992).

Comorbidities: CHF, Hypertension, and Diabetes

Hypertension and diabetes mellitus in the AMI subject cause organ damage that leads to kidney failure and CHF. As a result of organ damage, the comorbidities of CHF, hypertension, and diabetes indicate a poor prognosis that manifests in worse outcomes: increased morbidity, mortality and impaired quality of life. Traditionally, because of large samples and long (30-year) follow-up the Framingham Heart Study has provided researchers and clinicians with guidance when assessing the prognostic influence of risks for mortality following AMI (Wong, Cupples, Ostfeld, Levy, & Kannel, 1988). Wong et al. reported that women were only at one half the risk of coronary death compared with men when adjustments were made for the presence of hypertension, high cholesterol and diabetes mellitus. However, a critique of their study reveals that the cases were self-selected by ability to survive to and attend post-infarction biennial
examinations, limiting the generalizability of the findings to those, for example, with less severe infarctions and those able to attend follow-up (for example, having access, time allowances, and transportation). Because women have worse short-term mortality rates (Greenland et al., 1990; Herman et al., 1997; Puletti et al., 1984), and poor women often are unable to attend follow-up appointments, they are probably not adequately represented in this study. The researchers also only documented coronary (ischemic) deaths, excluding subjects who died from CHF, an important independent prognostic indicator. Strengthening this argument, in Greenland et al.'s study, CHF was highly predictive of mortality during hospitalization and CHF and diabetes mellitus were highly predictive of mortality at one year. Clearly, the comorbidities of CHF, hypertension, and diabetes should be considered when assessing risk for mortality after AMI as they indicate more advanced disease processes and therefore poorer outcomes.

Mortality

Women die after AMI at a rate approximately double that of men, as evidenced by 30-day and 1-year mortality rates (Greenland et al., 1990; Puletti et al., 1984; Zuanetti, Latini, Maggioni, Santoro, & Franzosi, 1993). The mortality rates in women during initial hospitalization range from a low of 13.9% versus 5.8% in men (Zuanetti et al.) to a high of 42.4% in women versus 16.6% in men (Puletti et al.). The majority of the studies report follow-up mortality rates of the hospital survivors, unlike Greenland et al. that also reported a cumulative mortality rate--at one year 31.8% of the women had died versus 23.1% of the men. Other than Framingham, no study has looked beyond one year of follow-up to determine a long-term prognosis. Also, there is little information about the stage at which women are most at risk if they survive the acute phase after AMI.
Summary

In summary, the advances in prevention, diagnosis, intervention and rehabilitation associated with better outcomes in mortality after AMI have been developed based on research that has been done mainly on male subjects. We now know that women die more often following AMI than men: differences in socioeconomic status, psychosocial profiles, presenting symptoms, disease progression and poorer response to treatment suggests that the phenomenon of AMI in women is not fully understood.

Epidemiological Research Studies

CHF, hypertension, and diabetes

The following is an analysis of the empirical research on gender differences in mortality after AMI, examining the effect of comorbidities including congestive heart failure (CHF), hypertension and diabetes, and socioeconomic status. This discussion is not meant to be a summary, but instead a critical analysis and explanation of the salient conceptual and methodological strengths, weaknesses and gaps that determine the current state of knowledge.

There is extensive literature available that examines CHF, hypertension, and diabetes mellitus and the effects these factors have on outcomes following AMI. Within this literature exists a lengthy and somewhat prolonged debate on the question of whether the presence of CHF, hypertension, and diabetes explain fully the higher mortality of women after AMI. Two main weaknesses of the empirical research that has been done to date are: 1) the use of secondary studies that may possess selection bias and 2) the use of the biomedical model that inadequately conceptualizes the problem of gender differences in mortality after AMI. The majority of the empirical research that has been done is epidemiological secondary studies; the populations are drawn from other large primary intervention studies of thrombolysis or streptokinase, for example Becker et al., 1994: TIMI II and Maggioni et al., 1993: GISSI-2. A methodological weakness of using evidence from secondary intervention studies is that there may be selection
bias and women and men may respond differently to thrombolytic agents (Reeder & Hoffmann, 1998). Selection bias can occur as subjects are chosen to suit the inclusion criteria of the primary study, limiting generalizability of the results. Also the majority of large intervention studies are situated in American major centre hospitals that exclude subjects from other catchment areas (that include poorer socioeconomic subjects).

A second weakness is that the majority of the epidemiological studies that hypothesized that there are gender differences in mortality after AMI used a theoretical framework based on the biomedical sciences that reflects inadequate conceptualization of the problem by researchers. In contrast, studies in Italy (Puletti et al., 1984), Israel (Greenland et al., 1990), Germany (Herman et al., 1997) and presumably Canada's hospitals have subjects from all socio-economic groups, producing greater heterogeneity and reflecting the substantial effect of the socio-demographics.

There are several research studies of note that relied on heterogeneous (all SES groups) populations (Greenland et al., 1990; Herman et al., 1997; Puletti et al., 1984; Zuanetti et al., 1993) to examine gender differences in the influence of comorbidities (CHF, hypertension, and diabetes) on mortality after AMI. Puletti et al. were among the first researchers to find that middle-aged (56-70 years) women have a significantly higher short-term mortality rate after AMI. Their sample of 106 women did not have a higher incidence of hypertension or diabetes than men; however, the researchers noted that the women in the sample were more often on diuretics and antiarrhythmics prior to AMI that may suggest they had CHF at baseline. Herman et al. used the World Health Organization MONICA-Bremen Acute Myocardial Infarction Register 1985-1990 to study short-term survival (28 day) after AMI. Their study also examined the use of medications by their study population and found that the women (n=362) were more often on cardiac medications (inotropics and diuretics) prior to their AMI.
Greenland et al.'s (1990) landmark study took place in Israel during 1981-1983 and was one of the first studies to use a large sample of women (1,524). As is characteristic of Israeli populations, the majority of the women were immigrants from Europe and Africa, and regional hospitals serve the population immediately surrounding the centre, thereby avoiding selection bias. Demographic and medical data during hospitalization and for one year follow-up were collected from consecutive AMI patients enrolled from fourteen hospitals throughout Israel from November 1981 to August 1983. The results of this study are that female gender is independently and significantly associated with increased mortality after covariate-adjustment for major prognostic factors (age, prior AMI, CHF) both during hospitalization and at one year after discharge. The researchers commented that there might be differences in the sociological roles of Israeli women, or they may be discharged earlier from hospital to return to home duties; these factors may have contributed to their poorer prognosis. These differences in roles and length of hospital stay were not explored in their study. A major factor that emerged as an important predictor of mortality in women in separate multivariate analyses for each gender was the presence of diabetes mellitus. Diabetes was not a significant predictor of mortality in men. The researchers did not differentiate whether the women were Type I or Type II diabetics nor identify the duration of their disease.

In a study of Zuanetti et al. (1993) the researchers did differentiate between Type I and Type II diabetes. Prevalence of both types of diabetes in women was significantly higher than in men (8.8% versus 1.9% for insulin-dependent and 23.7% versus 13.8% for non-insulin-dependent), and mortality was markedly higher in insulin-dependent diabetic women and only slightly higher in Type II diabetics (24.0% and 15.8%, respectively versus 13.9% for non-diabetics). Patients were randomly assigned to either a fibrinolytic agent or the control group; the type of fibrinolytic agent did not affect mortality. The researchers concluded that in women, insulin-dependent diabetes is, in itself, a strong risk factor for death after AMI and that even after
fibrinolysis the mortality rate in diabetics remains high. The researchers did not examine the duration of diabetes (Type I or Type II) and its influence on mortality. The researchers also did not examine the possible effect of glycemic control on prognosis.

In Seattle, Washington researchers (Maynard, Every, Martin, Kudenchuk, & Weaver, 1997) prospectively linked data from the state to the Myocardial Infarction Triage and Intervention registry. They found that women were 20% more likely to die in hospital after AMI and more often had CHF, hypertension, or diabetes. Although survival at one year follow-up was similar in both genders, 44% of the women who survived the initial hospitalization for AMI were rehospitalized during the first year for cardiac reasons and more than twice as many women as men were hospitalized for CHF in the six months after hospital discharge for AMI. With such a high re-admission rate for cardiac reasons, especially CHF, a longer follow-up may have revealed an even poorer long-term prognosis for women.

Poverty and health outcomes

Health is no longer seen as the absence of disease but as "a basic and dynamic force in our daily lives, influenced by our circumstances, our beliefs, our culture and our social, economic and physical environments" (Epp, 1986, p. 3). We now know that health is determined as much by the social conditions in which people live as by biological, genetic and lifestyle factors (Dugas & Knor, 1995; Epp). Low socio-economic status affects health outcomes through multiple mechanisms including health behaviour, access to adequate health care, resources and psychosocial stress (Knox & Czajkowski, 1997). Research on Canadian women shows us that poor Canadian women already have worse health than people not living in poverty, which is seen as a response to work roles, living conditions and social status (Wuest, 1994). The Canadian Fact Book on Poverty reports that in 1997, 56% of single parent mothers with children were poor, up from 53.9% in 1981 and 1989 (Ross et al., 2000). Caregivers in poor families often carry double loads of caring and working: who, then, cares for the caregivers when they are ill? Does this
double load also place the poor AMI client at higher risk for mortality? Furthermore, who cares for the poor AMI client that is a single parent or widow? As women are frequently older when they suffer their first AMI, they are also likely to be widowed and therefore living alone (Tunstall-Pedoe, Morrison, Woodward, Fitzpatrick, & Watt, 1996).

The poor who are at risk of heart disease, subsequent AMI and mortality have fewer choices, are more likely to lack family support and do not have economic resources to attend cardiac rehabilitation programs or to purchase services (for example, house cleaning) when they are ill. Although income is a recognized health determinant there is a paucity of research on the effect of SES on mortality rates after AMI. As a result, there is a great deal that is unknown about this complex sociological phenomenon. Presumably, SES has an influence on what resources, support systems and access that a client has available both before and after an illness such as AMI. Does it follow that SES has a significant influence on access to cardiac procedures that the client receives after AMI? Several studies (Kostis et al., 1994; Morrison, Woodward, Leslie, & Tunstall-Pedoe, 1997; Vaccarino, Parsons, Every, Barron, & Krumholz, 1999) examined this research question. The results of the study by Kostis et al. were that women who suffer AMI are more likely to have Medicaid or Medicare insurance coverage than are men, are less likely to have invasive cardiac procedures (catheterization, revascularization) and up to the age of 70 have higher death rates than men. In a more recent and disturbing study by Vaccarino et al., the National Registry of Myocardial Infarction 2 (includes all SES groups) revealed that among young patients (less than 50 years of age), the mortality rate of women was more than twice that of men (2.9% versus 6.1%) during hospitalization, younger women were also more likely than younger men to have a history of stroke, CHF or diabetes.

Contrary to the assumption that universal health-care systems mean equitable access to care, a study on a Canadian cohort of 51,591 subjects showed that increases in neighbourhood income from the lowest to the highest quintile were associated with a 23% increase in rates of
coronary angiography, a 45% reduction in waiting times and a strong inverse relationship between income and mortality at one year (Alter, Naylor, Austin, & Tu, 1999). British researchers (Morrison et al., 1997) found that the largest social class gradient for women is in the proportion of deaths occurring more than 28 days after an AMI. Although the results of these studies are compelling, it is important to remember that there was an absence of randomization that would be necessary to make strong causal inferences. The better outcomes of subjects with invasive strategies may have been due to selection of lower risk patients for such procedures.

**Social health-care context**

The caring for the young, the disabled and the elderly is shifting back to the home in a move "Closer to Home" (Royal Commission on Health Care and Costs, 1991). Compounding the problem of poverty, the result is that this caring is provided by women within the family context, often in communities lacking critically needed community support services. Fiscal restraint and shorter hospital stays may save the state money in the short-term, but they cost women as caregivers poorer health outcomes (Stingl & Wilson, 1996), and will in the long-term cost the state more as morbidity and mortality rates rise and more elderly women require institutional care. The National Forum on Health in 1997 confirmed the public’s values of equity, compassion, collective responsibility, individual responsibility, respect for others, efficiency and effectiveness. The Forum identified that the social and economic determinants of health (for example poverty, family structure) have major impacts on the health of individuals, groups and communities and recognized that these trends are increasing; more women are in the work force (many are caregivers) and there are higher rates of poverty among young women who are single parents and elderly women, especially widows. We may argue that although health-care policy speaks to equitable care, the reality is that the problem of poor women, lone parent families and elderly widows in cardiovascular health clearly needs to be examined in the current economic and social context because they are mutually dependent.
Summary of State of Knowledge

In summary, the phenomenon of gender differences in mortality after AMI requires more research to give health professionals further understanding of its complexities to provide the best possible equitable care to clients. The problems women after AMI face are, in part, due to limited enrollment of women in clinical studies and lack of gender sensitivity. Women may receive medications whose efficacy was determined by testing on men, they may receive fewer interventions than men, their prognosis may be viewed inaccurately as optimistic, and they tend to miss rehabilitation because of access barriers such as lack of transportation.

Compounding the problems of AMI in women are the effects of poverty. It seems likely that poverty further exacerbates the problems of differential treatment and limited follow-up. The problem for poor women is a lack of recognition in the literature that a person’s sociodemographics may affect their risk for mortality after AMI. This lack of recognition makes poverty “the invisible killer,” invisible to policymakers but very real to the poor women who deal with the biases, barriers, lack of resources and lack of choices that it signifies. An important first step in addressing this problem was to examine the interaction effect between gender and SES on mortality after AMI, that is: (a) gender affects mortality, (b) SES affects mortality, and (c) they interact so that poor women may have poorer outcomes than poor men. It is only when we begin to understand women’s CVD health problems by doing more research using adequate conceptualization, theoretical frameworks and by studying their problems in context will we be able to begin to help them.
CHAPTER THREE: METHODS

Theoretical Framework

The first part of this work included a discussion of gender differences in mortality after AMI with an emphasis on women, poverty and heart disease from a sociological perspective reflecting the current state of knowledge. Further study was necessary to explore gender differences in AMI mortality. Although it is well documented that co-morbidities such as CHF, hypertension, and diabetes have effects on mortality after AMI, health-care providers, in both primary and secondary prevention, need to further understand gender differences using a sociological perspective to know which factors increase the risk of mortality.

To answer the research question of whether there are gender differences in mortality after AMI, a descriptive study was proposed. The theoretical background guiding this study was a socio-environmental framework. Changing demographics and the lack of impact of the sick-care model on health determinants (Evans, Barer, & Marmor, 1996; Rachlis & Kushnir, 1994; Registered Nurses Association of British Columbia, 1993) influence our views on health, and increasingly population health and a socio-environmental framework are becoming important (Labonte, 1992, 1994; R.N.A.B.C.; Reutter, Neufeld, & Harrison, 1998; Wilkinson, 1996). The socio-environmental framework, which encompasses both medical and behavioural approaches to explore and examine causal factors such as health determinants (poverty, family structure) in population health and the health-care system (Labonte), was used in the study to determine the broad influence of these factors on a person's risk for mortality after AMI.

I argue that due to the complexities of the issues involved, we need to move beyond testing theories restricted to specific single frameworks, paradigms and time frames that limit our view of the conceptualization of the problem of gender differences in mortality after AMI. While attempting to capture the significance of the presence of poverty and comorbidities (CHF, hypertension, diabetes) and their effects on mortality after AMI, we should remember that
cardiovascular disease is chronic and an event such as AMI is only one point in time on a continuing process of risk, AMI or coronary bypass surgery (event), rehabilitation, possible recurrence of symptomatology leading to re-admission and ongoing adjustment of client and family. What makes women what they are and how they respond and deal with AMI? The interaction of physical, sociological, psychological, and human dimensions of women in varying contexts is very complex, and there is still much that is not known. A theoretical framework can adequately provide a general explanation of a phenomenon but does not fully address a woman's self-regulatory needs, motivations, or her intuitive make-up or ways of knowing (Belenky, Clinchy, Goldberger, & Tarule, 1986). However, given that there is much that is not known about the phenomenon of women and heart disease, discovering more about the conditions that place women at highest risk for mortality after AMI may lead to related research on access, equity, barriers (internal and external), cultural differences and societal values that can alert both health-care professionals and policy makers.

Whereas it is acknowledged that there are gaps and limitations in the literature on gender differences in mortality after AMI, the literature review that was conducted for this study indicated some of the factors associated with increased risk for mortality after AMI. These included age, CHF, hypertension, diabetes (physiological risk factors), and poverty (risk conditions). These and other yet undetermined factors and risk conditions such as culture and 'the double loads of women' may lead to inadequate access to care and follow-up, leading to increased risk for women for mortality after AMI (see Figure 1).
The Socioenvironmental Approach to Health

The study examined gender differences in mortality after AMI and the interaction effects of gender and SES on comorbidities (CHF, hypertension, diabetes) on mortality. The purpose of this study was to use the British Columbia Linked Health Database (1993-1997) to answer the research question, “Are there gender differences in mortality after AMI?” The use of secondary analysis constrained the specific questions that could be addressed. Despite these constraints, valuable information was obtained through secondary analysis to address the research questions. The secondary research questions included:

1) Is there an association between (a) gender and (b) CHF and mortality after AMI?

2) Is there an association between (a) gender and (b) hypertension and mortality after AMI?
3) Is there an association between (a) gender and (b) diabetes and mortality after AMI?
4) Is there an association between (a) gender, (b) SES, (c) CHF, (d) hypertension, and (e) diabetes and mortality after AMI?

Research Design

The 1994 AMI cohort was selected for this study because the cases all had an established diagnosis of AMI and the sample size obtainable would be large. The study was of exploratory, descriptive design using secondary analysis of data collected for the Hospital Admission Separation (HAS) of the British Columbia Linked Health Database, registration and premium billing (RPB) data for sex and age, and the Department of Vital Statistics for mortality data. The significance level was set a priori at .05. Research computer technicians cleaned the data. Rigour was strengthened by close and frequent checking of data by the investigator. Ethical clearance was obtained through submission and approval through the Centre for Health Services and Policy Research (see Data Access Form, Appendix A) and the Clinical Research Ethical Review Board (see Appendix B).

Cohort formation

The cohort consisted of the total population of clients that suffered AMI during the calendar year 1994 that were in a BC hospital. The cohort had a total of 1,365 cases of women and men that in 1994 suffered an AMI (ICD 9 Code 410) and were admitted to a BC hospital. The ICD code identifies the one diagnosis designated by the physician that describes the most significant condition of a patient that causes their stay in hospital (Fallon, 1994). In cases where people had multiple hospital admissions for AMI or subsequent problems, the first AMI admission that occurred in 1994 was used for analysis purposes. The AMI cohort had 196 cases (14.4%) with missing data and 1,169 (85.6%) that were complete. The cohort data set was formed by linking the large HAS dataset with RPB, Vital Statistics, and National Census Data. Researchers (Kazanjian, Savoie, & Moretin, 2001) have found that the HAS data are of good
quality and seem reliable. Kazanjian et al.’s method of aggregating by individuals rather than
diagnosis was replicated to prevent duplication of cases in the cohort, particularly because many
individuals had multiple admissions during a year. To improve rigour one programmer extracted
the data files and the researcher did all the data cleaning and coding for the study.
The dataset did not include: (a) people who had AMI, died outside of a hospital and were
pronounced dead other than in an emergency department; (b) people who had a mild AMI and
were not admitted to a hospital; and (c) those residents who suffered AMI while outside of BC.

Data files utilized

The data files utilized were the British Columbia Linked Health Data (1993-1997), the
Hospital Admission/Separations (HAS), registration and premium billing (RPB) data, and the
Department of Vital Statistics data. The British Columbia Linked Health Database obtains their
data from the Canadian Institute for Health Information (CIHI). The CIHI database is used by
researchers, health-care providers and planners to support risk management reports (and data) to
federal and provincial governments, epidemiological research and health services research. The
HAS data file included all BC hospital admissions from fiscal years 1994/1995 to 1996/1997
with AMI as the principal diagnosis (ICD 9 code 410). The hospital files had 17, 695 cases that
included admission date, separation date, exit code (discharged alive, signed out against medical
advice, or dead), diagnoses (comorbidity), and Study ID. Diagnoses analyzed were CHF (ICD 9
code 428), hypertension (ICD 9 code 401), and diabetes mellitus (ICD 9 code 250). The RPB
data file is used by the Ministry of Health to record persons eligible to receive BC health
services. Sex and age (date of birth) were obtained from RPB data. The Statistics Canada data
file combined with the hospital file postal code was used by the Canadian Health Services and
Policy Research at the University of British Columbia to derive SES Quintile. The SES Quintile
variable is an ecological variable from Census data that presents the average household incomes
at the enumeration level (postal code) divided into quintiles (lowest to highest, 1-5).
Sorting cases and linkages

The primary Hospital Admissions/Separations (HAS) file was formed by sorting cases by their study ID numbers. Study ID numbers were formed from scrambled personal health numbers that ensured anonymity of each case for ethical considerations. Linkages of cases in other data files (RPB, SES Quintile) were made using the study ID numbers to form the complete study cohort.

Operational definitions of variables

Mortality.

The variables that were identified in the research questions were operationalized as follows. The dependent variable of mortality in hospital was coded as "1, dead" or "2, alive" at discharge.

Sociodemographic Characteristics.

The sociodemographic characteristics at the time of admission to the hospital for AMI included the variables gender, age, and SES Quintile. These data were obtained from the Hospital Admission/Separations (HAS) data and the RPB data through the process of Access to Health Data for Research Uses (see Appendix A). Items included were gender, date of birth, and SES Quintile level. Gender was coded as “1, male” or 2, female.” Age was obtained from date of birth. The initial conceptualization of this study was to use the variable gender, measured by a composite variable of family composition and SES Quintile. However, the simpler conceptualization of sex was all that was feasible. Therefore, the SES Quintile variable was used as the unit of analysis in the logistic regression model to examine the main and interaction effects of SES on comorbidities and mortality after AMI. The SES Quintile takes into account the economies possible when people share a household (for example, two persons sharing the same household do not require twice the income as one person living alone to have the same standard
of living but rather about 40% more (1.36 times as much). The SES Quintiles, based on British Columbia averages for income represent the following:

Level 1: 0 - 20% income (lowest of the population),

Level 2: 20% - 40% income,

Level 3: 40% - 60% income,

Level 4: 60% - 80% income, and

Level 5: 80% - 100% income (highest of the population).

Comorbidities.

The presence of CHF, hypertension, or diabetes mellitus was obtained from the Hospital Admission Separation (HAS) Record. The severity of congestive heart failure or diabetes mellitus has a substantial effect on mortality. Although the prognostic model for weighting the influence of comorbidities developed and validated by Charlson, Pompei, Ales, and MacKenzie (1987) was considered for this study, the HAS does not include data on the severity of comorbidities and this is therefore a weakness of this method of data capture. It was decided to use a bivariate code for comorbidities, either “yes, present” or “no, not present.”

Data analysis

The choice of statistical analyses to be used for the study was given careful consideration. Frequencies characterize the study population. The research questions indicated examination of the effect of the independent variables (gender, comorbidites, SES Quintile) on mortality (dependent variable) after AMI. Chi square analyses were done to determine whether the observed frequencies (mortality and gender) differed significantly from the expected frequencies, or whether the observed differences were due to chance alone. Subjects were the unit of analysis and were either "1, dead," or "2, alive." The logistic regression model is useful for dichotomous variables such as this because it gives us a biologically meaningful interpretation (Hosmer & Lemeshow, 1989). The analysis allowed us to independently test the effects of the independent
variables on the dependent variable and the results provided odds ratio and confidence intervals for interpretation. The logistic regression model also allowed us to test the interaction effects of SES Quintile, the comorbidities, and gender on the dependent variable, mortality. As women typically present with CVD at an average age that is ten years greater than that of men (Greenland et al., 1990; Herman et al., 1997), age-standardized mortality rates were calculated to describe the difference between the genders.

*Limitations of measurement*

If subjects are admitted to the hospital in an emergency and the accompanying persons do not give information correctly for the HAS, the results of any analysis are called into question.

In summary, the phenomenon of gender differences in mortality after AMI is complex and has been under researched for a variety of reasons. Notwithstanding the issues, this study focuses on delineating the problem from a sociological perspective by examining socioeconomic status in addition to the more conventional factors of comorbidities.
CHAPTER FOUR: DATA ANALYSIS AND FINDINGS

The analysis of data and findings of the study are presented in the following chapter. First, the AMI cohort is characterized and summarized; sociodemographics and comorbidities (CHF, hypertension, diabetes) are compared between women and men. Sex was an explanatory variable in the study with men used as the reference category. Age, also an explanatory variable, was treated as a continuous variable. To independently assess the effects of the explanatory variables (i.e., sex and age), and to control for the effects of possible confounding by CHF, hypertension, diabetes, and SES on the distribution of the outcome variable, mortality, logistic regression analyses were conducted to obtain coefficients (B) and odds ratios with 95% confidence intervals. Statistical calculations were completed with SPSS (version 10.0) and significant results are highlighted. A more detailed, comprehensive synthesis of the study findings, in light of the existing literature and knowledge base, limitations, recommendations and conclusions follow in Chapter Five, the final chapter of the thesis.

Comparison of Women and Men by Sociodemographics and Comorbidities

The cohort sociodemographics and presence of comorbidities are presented in Table I. The AMI cohort had a total of 1,169 cases (342 women and 827 men). Women were significantly older ($p < .01$) than the men in the cohort, as expected. The average age of the women was 69.3 years (SD = 11.2, range 39 – 93 years), compared to the average age of men: 65.4 years (SD = 11.5, range 38 – 95 years). There were significant differences in SES Quintile between women and men. Women tended to be in the lower quintiles. Although more women than men had CHF and hypertension, the differences were not significant. However, significantly more of the women were diabetic compared to men (5.6% versus 3.0%).
Table I

Sociodemographics and Comorbidities

<table>
<thead>
<tr>
<th>Variables</th>
<th>Men (n=827)</th>
<th>Women (n=342)</th>
<th>t</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Mean ± SD)</td>
<td>65.4 (11.5)</td>
<td>69.3 (11.2)</td>
<td>-5.3**</td>
<td></td>
</tr>
<tr>
<td>SES Quintile (%)</td>
<td></td>
<td></td>
<td></td>
<td>9.5*</td>
</tr>
<tr>
<td>(1)</td>
<td>18.5</td>
<td>20.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2)</td>
<td>19.4</td>
<td>25.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3)</td>
<td>20.8</td>
<td>21.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4)</td>
<td>21.4</td>
<td>14.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5)</td>
<td>20.0</td>
<td>18.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHF (%)</td>
<td>9.1</td>
<td>11.1</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>Hypertension (%)</td>
<td>5.4</td>
<td>7.0</td>
<td>1.1</td>
<td></td>
</tr>
<tr>
<td>Diabetes (%)</td>
<td>3.0</td>
<td>5.6</td>
<td>4.3*</td>
<td></td>
</tr>
</tbody>
</table>

SES Quintile is a ecological proxy indicator for SES that presents the average household incomes by geographic region and divided into quintiles, lowest to highest, 1-5; (1) refers to lowest 20% average income (based on enumeration area); Quintile (2) refers to 20-40% average income; Quintile (3) refers to 40-60% average income; Quintile (4) refers to 60-80% average income; and Quintile (5) refers to 80-100% average income.

*\( p < .05 \), ** \( p < .01 \).

Mortality Rates

The mortality incidence after AMI was significantly higher \( (p < .01) \) in the women than men (19.9% of 342 women versus 10.5% of 827 men), indicating that women have a 10% increased risk of mortality compared to men. It is important to note that in BC hospital admissions, the HAS data file include DOA (dead on arrival) and emergency room mortalities whereas in other provinces, for example in Ontario DOA’s are not included as admissions.
Table II shows that there was a significant difference in the overall ages of women and men who died. Also, the women who died tended to be in the older age groups.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Men n (%)</th>
<th>Women n (%)</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 49</td>
<td>2 (2.1)</td>
<td>1 (4.0)</td>
<td>35.83**</td>
</tr>
<tr>
<td>50-59</td>
<td>11 (7.0)</td>
<td>2 (5.9)</td>
<td></td>
</tr>
<tr>
<td>60-69</td>
<td>14 (5.7)</td>
<td>15 (15.3)</td>
<td></td>
</tr>
<tr>
<td>≥ 70</td>
<td>60 (18.2)</td>
<td>50 (27.0)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>87 (10.5)</td>
<td>69 (19.9)</td>
<td>18.44**</td>
</tr>
</tbody>
</table>

** $p < .01$. 

Age, Gender, CHF, Hypertension, Diabetes, SES Quintile, and Mortality

Multiple Logistic regression model #1 (Table III) analyzed the association of age, gender, CHF, hypertension, diabetes, and SES with mortality. Multiple logistic regression model #2 depicts a model building exercise; this step included analysis of all theoretically plausible two-way interactions. The only significant interaction was between age and SES Quintile (2) as shown in Table IV. Hosmer and Lemeshow’s (1987) test for goodness of fit did not reveal problems with the statistical model #1. As seen in Table III, age, gender, and CHF had significant associations with mortality after AMI. Age and gender were highly significant ($p < .01$), the odds ratio of age was 1.07 (95% CI: 1.5 – 1.1), and the odds ratio of
gender was 1.81 (95% CI: 1.24 – 2.64); older people and women were at greater risk of mortality. CHF was also significantly ($p < .05$) associated with mortality, the odds ratio was 1.76 (95% CI: 1.05 – 2.93). There were no significant associations between hypertension, diabetes, and SES (quintile) and mortality.

Table III

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>Odds ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>.06</td>
<td>1.07**</td>
<td>1.04 – 1.08</td>
</tr>
<tr>
<td>Gender (Men are the referent)</td>
<td>.59</td>
<td>1.81**</td>
<td>1.23 – 2.64</td>
</tr>
<tr>
<td>CHF</td>
<td>.56</td>
<td>1.76*</td>
<td>1.05 – 2.93</td>
</tr>
<tr>
<td>Hypertension</td>
<td>-.56</td>
<td>.57</td>
<td>.21 – 1.50</td>
</tr>
<tr>
<td>Diabetes</td>
<td>-.55</td>
<td>.58</td>
<td>.17 – 1.93</td>
</tr>
<tr>
<td>SES Quintile</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1)</td>
<td>.26</td>
<td>1.30</td>
<td>.71 – 2.37</td>
</tr>
<tr>
<td>(2)</td>
<td>.07</td>
<td>1.07</td>
<td>.58 – 1.97</td>
</tr>
<tr>
<td>(3)</td>
<td>.33</td>
<td>1.40</td>
<td>.76 – 2.53</td>
</tr>
<tr>
<td>(4)</td>
<td>.17</td>
<td>1.19</td>
<td>.63 – 2.23</td>
</tr>
<tr>
<td>(5) referent</td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

SES Quintile is a ecological proxy indicator for SES that presents the average household income by geographic region divided into quintiles, lowest to highest, 1-5; (1) refers to lowest 20% average income (based on enumeration area); Quintile (2) refers to 20-40% average income; Quintile (3) refers to 40-60% average income; Quintile (4) refers to 60-80% average income; and Quintile (5) refers to 80-100% average income.

*p < .05, ** p < .01.
<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>Odds ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>.04</td>
<td>1.04</td>
<td>.99 - 1.08</td>
</tr>
<tr>
<td>Gender</td>
<td>.63</td>
<td>1.9**</td>
<td>1.28 - 2.76</td>
</tr>
<tr>
<td>CHF</td>
<td>.59</td>
<td>1.8*</td>
<td>1.07 - 3.04</td>
</tr>
<tr>
<td>Hypertension</td>
<td>-.61</td>
<td>.54</td>
<td>.20 - 1.43</td>
</tr>
<tr>
<td>Diabetes</td>
<td>-.56</td>
<td>.57</td>
<td>.17 - 1.95</td>
</tr>
<tr>
<td>SES Quintile</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1)</td>
<td>.28</td>
<td>1.32</td>
<td>.02 - 74.28</td>
</tr>
<tr>
<td>(2)</td>
<td>-7.4</td>
<td>.00**</td>
<td>.00 - .12</td>
</tr>
<tr>
<td>(3)</td>
<td>-1.8</td>
<td>.15</td>
<td>.00 - 10.72</td>
</tr>
<tr>
<td>(4)</td>
<td>-1.7</td>
<td>.18</td>
<td>.00 - 15.63</td>
</tr>
<tr>
<td>(5) referent</td>
<td></td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Age x SES Quintile</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1)</td>
<td>.00</td>
<td>1.00</td>
<td>.95 - 1.06</td>
</tr>
<tr>
<td>(2)</td>
<td>.10</td>
<td>1.10**</td>
<td>1.03 - 1.19</td>
</tr>
<tr>
<td>(3)</td>
<td>.03</td>
<td>1.03</td>
<td>.97 - 1.09</td>
</tr>
<tr>
<td>(4)</td>
<td>.03</td>
<td>1.03</td>
<td>.97 - 1.10</td>
</tr>
<tr>
<td>(5) referent</td>
<td></td>
<td>1.0</td>
<td></td>
</tr>
</tbody>
</table>

x = interaction.

SES Quintile is an ecological proxy indicator for SES that presents the average household incomes by geographic region and divided into quintiles, lowest to highest, 1-5; (1) refers to lowest 20% average income (based on enumeration area); Quintile (2) refers to 20-40% average income; Quintile (3) refers to 40-60% average income; Quintile (4) refers to 60-80% average income; and Quintile (5) refers to 80-100% average income.

*p < .05, ** p < .01.
CHAPTER FIVE: DISCUSSION AND RECOMMENDATIONS

This final chapter includes the following: 1) a summary of the study, 2) a discussion of some of the underlying assumptions, 3) research questions, 4) some study limitations, 5) recommendations and conclusions.

Summary of the Study

Women die after AMI at a rate approximately double that of men (Brister et al., 2000), as evidenced by an abundant number of epidemiological and clinical studies. Contentious debate on this alarming problem has been fueled by inadequate conceptualization of the problem of women and coronary disease, and misread evidence due to selection bias. Women's alarming mortality rates and the research debate gave rise to this study, to clarify the issues and to further our understanding of the subject area. The purpose of this study was to answer the research question: Are there gender differences in mortality after AMI? In addition, the secondary questions of the association between gender, sociodemographics and comorbidities (CHF, hypertension, diabetes) and mortality after AMI were addressed; surprisingly, there is no published study to date that has examined the association of sociodemographics and these factors and mortality after AMI in a Canadian context. The study was of an exploratory, descriptive design using secondary analysis of data collected for the Hospital Admission Separations of the BC Linked Health Database, with linkages to registration and premium billing data, and the Department of Vital Statistics data. The AMI cohort (n = 1, 365) was the total population of clients (342 women and 827 men) in 1994 that suffered AMI (ICD 9 Code 410) and were admitted to a BC hospital. Logistic regression models were developed to assess the independent effects of age, and gender, CHF, hypertension, diabetes, and SES on the outcome variable (mortality).

The results of the study are as follows. Cohort women were significantly older than the men (mean age 69.3 versus 65.4; \( p < .01 \)); significantly poorer - almost one half
were in SES Quintile 1 or 2 (lowest 40% average income); and more frequently had CHF (11.1% versus 9.1%). These prevalence rates suggest that women and men have different clinical profiles and disease progression in AMI. Significantly more women (19.9%; p < .001) died after AMI in hospital compared to men (10.5%; odds ratio 1.81, 95% confidence interval 1.24 – 2.64). CHF was a significant predictor of mortality (odds ratio 1.76, 95% confidence interval 1.05 – 2.93); hypertension, diabetes, and SES Quintile were not significant predictors. All possible interactions were tested in the study of age, gender, CHF, hypertension, diabetes and SES Quintile. Of note, of all possible interactions between gender and age, CHF, hypertension, diabetes, and SES Quintile, there was only a significant interaction between age and SES Quintile (2). In the following discussion of the study findings it is worthwhile at the outset to examine the underlying assumptions of the study and research problem.

Discussion

Assumptions

The majority of the previous biomedical science research on women and coronary disease has been flawed because of its underlying assumption that women and men are the same and should be treated as such in the health care of AMI and coronary disease. Progress in the coronary disease research arena has paved the way to a more enlightened and accurate approach. The caveat: in our haste to progress we should not make the assumption that women and men are totally different either because there may be some similarities between women and men that we have no knowledge of due to lack of research.

Comparison of women and men by sociodemographics and comorbidities

The comorbidity rates are lower in this study (11.1% of women and 9.1% of men had CHF; 7% of women and 5.4% men had hypertension; 5.6% of women and 3% of men had diabetes) than those found in the landmark study by Greenland et al. (1990) based on a diverse
Israeli AMI population wherein women were older, and more often had CHF (26.8% vs. 24.4%), hypertension (51.4% vs. 35.6%) and diabetes (19.9% vs. 11.7%) than men. These differences in rates may have occurred because BC women and men have a lower prevalence of these comorbidities. In Heart Health: A Report Of The BC Heart Health Survey (1990) of the general population conducted in 1989, wherein there were low prevalence rates of hypertension, and diabetes, 15% of women (aged 35 – 64 years) and 23% of men (aged 35 – 64) had hypertension, and 5% of women and men had diabetes. The prevalence of hypertension is much higher in the Heart Health survey. The survey’s definition of hypertension was different wherein it was a diastolic blood pressure of • 90 mmHg and/or on treatment (pharmacological or non-pharmacological: weight control and/or salt restriction). The high incidence of poverty in women is not surprising, and according to the Canadian Fact Book on Poverty (Ross et al., 2000), elderly unattached females are particularly marginalized. In 1997, 49.1% of unattached elderly females were living in poverty compared to 33.3% of elderly males.

Mortality rates

The mortality rates in this study add to our knowledge about BC women and their risk for mortality after AMI. The mortality rates are slightly higher than in an earlier BC study examining medication use in which 18% of the women and 12% of the men died (Tsuyuki et al. 1994), and are similar to the study by Greenland et al. (1990) where hospital mortality was 23.1% in 1,524 women and 15.7% in 4,315 men (odds ratio 1.72, 95% confidence interval 1.45-2.04). Why are BC women at almost double the risk of dying than men after AMI?

Research Questions

Research question one was: is there an association between age, sex, CHF and mortality after AMI? CHF had a significant association with mortality (the odds ratio was 1.75; 95% CI: 1.05 to 2.93) in the statistical model that included age, gender, hypertension, diabetes, and SES, thereby controlling for their effects. These results are consistent with the complexities of the
clinical profile of CHF in the AMI client that have long been recognized by clinicians. Typically, acute CHF becomes chronic and progressive, chronic hypertension makes CHF worse, and diabetics frequently have both. As longevity increases, CHF is a growing personal and health care problem. Gillum (1993) from The US National Center for Health Statistics reported that CHF is an important prognostic indicator for mortality and disability (ICD Code 428 was mentioned on over 250,000 US death certificates in 1988). Prevention of CHF is paramount, research is sadly lacking that would perhaps shed light on other factors, for example psychosocial and behavioural that may affect the outcome of mortality.

Research question two was, “Is there an association between age, gender, and hypertension and mortality after AMI?” Although more women had hypertension than men (7.0% vs. 5.4%), there was not a significant association between hypertension and AMI mortality. The higher incidence of hypertension in women in the study suggests that women may have a longer, more insidious onset and progression of coronary disease compared to men, who tend to have sudden onset of an acute event (AMI).

Research question three was: “Is there an association between age, gender, diabetes and mortality after AMI?” Although there were significantly more diabetic women than men in the study (5.6% of women vs. 3% of men), this factor was not significantly associated with mortality after AMI. In addition, the interactions of diabetes with age, gender, CHF, hypertension, and SES Quintile were not significant. This result differs from the study by Greenland et al. (1990) in which diabetes was significantly associated with increased mortality in women (29.1% women were diabetic versus 18% of men).

Research question four was: “Is there an association between age, gender, SES, CHF, hypertension, and diabetes and mortality after AMI? Although SES was not significant in this statistical model, there was a significant interaction between age and SES Quintile (2); the odds ratio was 1.11, 95% confidence interval: 1.03 - 1.20. The significant interaction indicates the
influence of living in a 20% - 40% average income neighbourhood, particularly for older people. Because SES quintile is a proxy measure for SES, this finding may indicate the burden that aging has on working class people and the subsequent effect this combination of factors has on risk for mortality after AMI. In future research, a more exact measurement of SES would provide more information about the effect of poverty after AMI. This knowledge is important to provide the best possible equitable care for our clients.

Screening/monitoring of women

There are three important discussion areas in relation to this study: screening/monitoring of women, follow-up of women, and population health. This study has provided evidence that women who suffer AMI are older, poorer, and have a higher incidence (risk profile) of CHF. This evidence suggests that women have a different risk profile than men prior to and leading up to AMI. Due to the lack of research on women and coronary disease, we have no knowledge of whether other risk factors contribute to their risk profile (for example, smoking, obesity, lack of exercise), or psychosocial factors (self-efficacy, self-care). Related to their risk profile is the matter of their risk perception. Anderson (1992), in her dissertation work at the University of Washington, found in her grounded theory study that women cognitively mitigated their perceived risk through various strategies and identified role overload and other issues unique to women as barriers to participate in risk reduction. These findings posit the question: are screening and monitoring programs for women adequate?

Follow-up on women

In this study, there is evidence that there is a significant association between gender, CHF, and mortality after AMI. Patients with CHF have increased odds of mortality of 1.76 times that of other patients in our study. This finding is consistent with an earlier study by Greenland et al. (1990). It is a limitation of the study method – secondary analysis of the HAS data - that data are not available on whether there were gender differences in CHF severity. I
often noticed in my clinical practice when doing follow-up of AMI female clients that some women recover easily from an AMI but others develop complications such as CHF for a variety of reasons related to decision making, psychological factors and self-care skills; these factors influence clients in their challenge to maintain the delicate balance of their health with this chronic disease. Women, like those in this study, often elderly, are used to caring for their spouses and families and often have trouble making good decisions to maintain this delicate balance as they find it a difficult transition to change from caregiver to devoting time for self-care. Dowding and Hindmoor (1997) argue that decision making is very complex and not always based on rational choice. Women base their decisions on many factors, and typically their concerns are first about their loved ones, not themselves. Ask any woman why women die more often after AMI and she will reply, “Women die more often because we’re too busy looking after everyone else—spouses, children, and elderly parents.” This anecdotal evidence emerged during the process of this study, in informal discussions with faculty, colleagues, family, friends, and women in the community. This conflict posits the question: Is a woman’s conflict between the caregiver role and her self-care needs increasing her mortality risk? The issue of role overload is particularly relevant for poor women who lack the ability to hire support services, for example housekeeping. Although SES was not significantly associated with mortality in the study, this may have occurred because of inadequate measurement of the SES construct. Because there was a significant interaction between SES quintile (2) and age, the finding warrants further exploration in future research endeavours.

Population health

Now that we have considered the findings in relation to women as individuals, we need to consider the ‘bigger picture’ of population health. The knowledge that BC women die more often after AMI is important and indicates that careful consideration should be given to research and preventive measures from a population health perspective, before the onset of an acute
event. This careful consideration is necessary because there is widespread agreement in the research literature that identifying factors that increase risk of mortality after AMI is a critical dimension of health care policy to provide the best possible equitable care for clients. The results of this study indicate a critical need to re-examine the way we do business in health care for women. This study provides evidence that Canadian women have a 80% higher risk or almost double (1.81 odds ratio) the odds of mortality after AMI, after adjusting for differences in age. Canadians take great pride in their socialized health care system and value highly its tenets of equal care, access for all citizens—regardless of gender, race, or creed. Although these results are alarming, it is not time to start blaming our hard-working colleagues, whether nurses, physicians, or other health care providers. Rhetoric and turf protection only serve to ‘divide and conquer.’ Instead of blaming ourselves and each other we should see this as an opportunity to work collaboratively and to re-examine our perspective (assumptions, values, resources and limitations), to critically analyze our programs (research, clinical) and policies in order to ensure equitable care and to make much needed knowledge advances.

Study limitations

The findings of this study should be viewed in light of the limitations associated with secondary analysis and proxy measurement, and that concern generalizability. Because the study took place within the Canadian context, the findings may not be generalizable to populations in other countries, particularly those with different systems of health care provision. The use of secondary analysis of government data files has the advantages of low cost and quick access to large populations, but has the disadvantage of being limited to the data available in the files. The secondary data used for the study did not provide information on comorbidity severity. These limitations may have influenced the association between comorbidities and mortality. The use of the Quintile variable as a proxy measure for SES has been an issue in the literature. The SES Quintile variable is only a ecological proxy measurement of SES based on
where a person lives (postal code), and as a proxy measure it does not shed light on true differences between women and men in the study. The ecological argument that environmental influences are equal to if not greater than sociological factors such as family composition or individual choices is beyond the focus of this discussion. Further research using an individual level indication of SES, for example a self-report measure would be useful to provide more information and may give more direction for recommendations.

Recommendations

Screening/monitoring of women

The results of the study give guidance for recommendations on education, nursing clinical practice, research and policy; especially in the areas of screening/monitoring of women, follow-up, and population health. Educational media campaigns that target women’s risk for coronary disease are in place from the local community level to national, international and global initiatives that include the World Wide Web, TV, and radio. For nurses, knowledge that BC women die more often after AMI has important implications for prevention as well as follow-up and rehabilitation programs to help prevent subsequent events. Nurses play a critical role in assessing the risk of AMI clients throughout all phases of the process of coronary disease, from prevention programs (targetting risk factors) to emergency departments, coronary care units, cardiology wards, home care and rehabilitation programs.

Women of all ages need to be screened judiciously for risk and those at risk should be targetted for health promotion programs to modify risks such as CHF, hypertension, and diabetes at the community level, and also on an individual basis in primary care programs, for example at multidisciplinary clinics. As nurses we should encourage a multidisciplinary approach to facilitate informed decision making by the client and to ensure programs that are sensitive to the needs of women.
Follow-up

Women, particularly the elderly with CHF should be monitored more frequently, and poor, elderly women with coronary disease should be monitored closely and assessed for potential barriers to care (for example, access and resources) and informed decision making. Edwards, Elwyn, and Mulley (2002) succinctly summarized the current literature on risk communication into four points: a) clients often want more education than is provided, b) risk communication should be a two-way process between clients and professionals in which both exchange information and opinions, c) health care professionals need to convert raw data into information that is meaningful to facilitate discussion, and d) professionals should not manipulate data by using risk data on survival after AMI, for example without presenting factors that increase risk. Nursing education programs should incorporate into their curriculum women’s health issues in coronary disease so that nurses will recognize that the female model in coronary disease is different than the male model and that there is much that is not known.

Population health

Although in nursing we must consider each client as an individual we must also consider the broader implications and considerations of population health in order to have judicious and balanced health care programs and policies to provide the best care for our clients. Another aspect to consider is whether today’s health care services and resources support women’s diverse and unique health needs and reflect equal access and female preferences. What is known is that a lack of research on women’s cardiovascular health has precluded an informed and proactive approach by both nurses and other health care professionals in identifying what factors place Canadian women at higher risk for mortality after AMI. Multidisciplinary research teams using rigorous methods will help bring advances to this critical area of research.
Future research

Any discussion of differences between women and men in mortality after AMI should be prefaced with mention that there is a frontier of discovery in this subject area. Women tend to develop coronary disease and AMI later in life and more often have CHF, a prognostic indicator in the study. In this study the researcher only examined one outcome, albeit the important one of mortality. Examination of other outcomes, for example morbidity, would also provide us with valuable information. Re-admission for CHF not only increases costs in the health care system but decreases quality of life and leads to increased mortality. Qualitative methods are also useful in nursing research to help us understand the lived experience and facilitates conceptualization that reflects diversity and complexity of individuals, families, communities and populations. These factors affect outcomes such as mortality and vary depending on women’s age, transportation, social supports, self-efficacy, and self-management strategies. This study used a socioenvironmental approach to health as the theoretical framework, operationalizing physiological risk factors (comorbidities) and risk conditions (gender, poverty). In future research, inclusion of additional factors such as psychosocial and behavioural that relate to self-care theory would more accurately reflect the complexities involved. Furthermore, a clear view of this complex picture is obscured because of the lack of research on women and the historical assumption that women and men should be treated the same because their response to treatments, situations, and the onset of coronary disease is the same. But are women and men totally different in coronary disease? Until we have results of more rigorous research using adequate sample sizes it would be dangerous for researchers to make the assumption that women and men are totally different because women and men may have some similarities.

In conclusion, this study has provided evidence that Canadian women die more often than men after AMI during hospitalization for the event. Women with CHF warrant special
attention and deserve aggressive preventive, in-hospital, and follow-up care. Research is critically needed on gender differences in coronary disease to gain a further understanding of women and the factors that influence their risk.
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