

Original Article

# Myocardial Infarction Within 30 Days of Discharge From an Emergency Department: A Descriptive Study of Albertan Women

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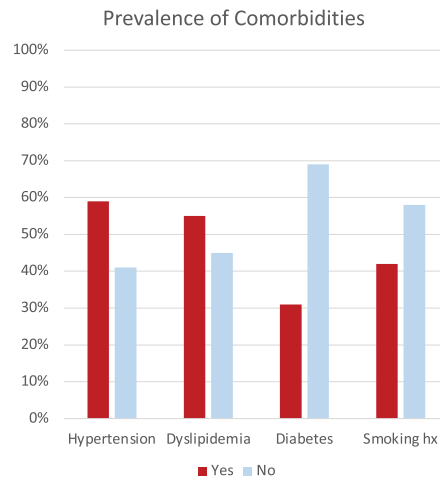
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## Myocardial Infarction within 30 Days of Discharge from an Emergency Department: A Descriptive Study of Albertan Women

Need for sex-specific life-stage based assessment, increased primary prevention of CVDs & improved recognition of MI symptoms in women



- 18.3% of women had no traditional CVD risk factors
- Findings highlight a complex issue. High prevalence of CVD risk factors in all women, and numerous confounding factors may lead to ED use.
- NP-led women's heart health clinics may help meet the need for increased primary prevention efforts.

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**ABSTRACT**

**Background:** Cardiovascular diseases (CVDs) are the leading cause of premature death for Canadian women, which may be due partly to a

**RÉSUMÉ**

**Contexte :** Les maladies cardiovasculaires représentent la principale cause de décès prématuré chez les Canadiennes, ce qui peut être en

lack of awareness of the presentation of acute coronary events in emergency departments (EDs). To address an identified gap in women's cardiovascular care, we sought to describe the clinical and comorbid factors of women who, following discharge from an ED, suffered a myocardial infarction (MI).

**Methods:** Descriptive analyses were completed on a cohort of women who presented to an ED in Alberta, Canada, between January 1, 2010 and December 31, 2020, were discharged, and within 30 days of their index ED visit, were admitted to the hospital with an MI. The cohort was explored for clinical and comorbid data, ED visits pre-MI, type of MI, and presenting complaint/ primary diagnosis for the index ED visit.

**Results:** 1380 women were included in this analysis with a mean age of 67 (standard deviation  $\pm 13$ ) years. The frequencies of hypertension, diabetes, and dyslipidemia among the youngest women, aged 18-45 years, were 47.5%, 31.3%, and 48.8%, respectively. Women across all ages demonstrated a high prevalence of traditional CVD risk factors, and 22% of women presented to an ED 2 or more times within the 30 days pre-MI.

**Conclusions:** Regardless of their age, the women in this cohort had notable CVD risk factors. Future research is required to better understand the phenomenon of women presenting multiple times to an ED pre-MI. Research is needed on life-stage-specific factors of women presenting to EDs pre-MI, to help reduce MI incidence.

partie attribuable à un manque de connaissance des manifestations des événements coronariens aigus dans les services d'urgence. Pour combler une lacune observée dans les soins cardiovasculaires chez les femmes, nous avons tenté de décrire les facteurs cliniques et les facteurs de comorbidité chez les femmes qui, après avoir reçu leur congé du service d'urgence, ont subi un infarctus du myocarde (IM).

**Méthodologie :** Des analyses descriptives ont été menées sur une cohorte de femmes qui se sont présentées dans un service d'urgence en Alberta, au Canada, entre le 1<sup>er</sup> janvier 2010 et le 31 décembre 2020, qui ont reçu leur congé et qui, dans les 30 jours suivant leur visite de référence aux urgences, ont été admises à l'hôpital pour un IM. L'analyse de la cohorte portait sur les données cliniques et les données de comorbidité, les consultations au service d'urgence avant l'IM, le type d'IM et la raison/le diagnostic primaire lors de la consultation de référence.

**Résultats :** Cette analyse a porté sur 1380 femmes dont l'âge moyen était de 67 (écart-type  $\pm 13$ ) ans. Les fréquences d'hypertension, de diabète et de dyslipidémie chez les femmes les plus jeunes, âgées de 18 à 45 ans, étaient respectivement de 47,5 %, de 31,3 % et de 48,8 %. Les femmes de tous les âges présentaient une prévalence élevée de facteurs de risque classiques de maladies cardiovasculaires, et 22 % des femmes s'étaient présentées à un service d'urgence au moins 2 fois au cours des 30 jours ayant précédé l'IM.

**Conclusions :** Indépendamment de l'âge, les femmes de cette cohorte présentaient des facteurs de risque de maladies cardiovasculaires notables. D'autres recherches s'imposent afin de mieux comprendre le phénomène des femmes qui se présentent plusieurs fois dans un service d'urgence dans la période précédant un IM. Une recherche doit être menée sur les facteurs spécifiques aux stades de la vie des femmes qui se présentent aux urgences avant un IM afin d'aider à réduire l'incidence des infarctus du myocarde.

## Lay Summary

*In Alberta, over the course of 10 years, 1380 women went to an emergency department 1-15 times within a 30-day period, but were discharged home. Within 30 days of the first emergency room visit, all these women experienced a heart attack. Women across all ages presented with several risk factors for heart disease, such as high blood pressure, diabetes, and high cholesterol. Future research is needed to better understand why, despite evidence of risk factors, these women were discharged home.*

Cardiovascular diseases (CVDs) are the leading cause of premature death for Canadian women,<sup>1</sup> claiming the lives of approximately 25,000 women yearly.<sup>2</sup> Women affected by CVDs, particularly ischemic heart disease<sup>3,4</sup> continue to be treated inadequately, experience poorer outcomes, and are underrepresented in clinical research. Although most women experiencing a myocardial infarction (MI) present with chest pain,<sup>5,6</sup> they may be more likely to present with

3 or more additional symptoms, such as unusual fatigue, sudden diaphoresis, shortness of breath, and pain in the jaw, neck, or back.<sup>1,6,7</sup>

Considerable overlap in symptomology exists for men and women presenting with MI, yet notable variability is present in symptom phenotypes, with additional symptoms being primary symptoms (in addition to chest pain) reported by women.<sup>6</sup> Hence, identifying these symptoms as being cardiovascular (CV)-related can be challenging for women and their clinicians.<sup>8,9</sup> Factors such as the variability in presenting symptomology<sup>10,11</sup> and implicit gender bias<sup>12-14</sup> may be contributing to missed CVD diagnoses in women and to the finding that younger women are less likely than men to receive treatment for an acute MI. Most Canadian women demonstrate at least one CVD risk factor,<sup>15</sup> and evidence indicates that traditional CVD risks, namely hypertension, smoking, diabetes, obesity, physical inactivity, anxiety, and depression, have a greater impact on women's CV health than they do on men's.<sup>16,17</sup>

The purpose of this descriptive retrospective cohort study was to describe the clinical, comorbid, and risk factors of a cohort of women who presented to an emergency department (ED), were discharged home, and within 30 days of their index ED visit suffered an MI. We aim to increase awareness of risk factors and comorbid conditions that may be contributing to inequities in CV care for women in Alberta, Canada.

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See page 360 for disclosure information.

## Methods

### Study design and setting

This retrospective cohort study included women who presented to EDs in Alberta, Canada, between January 1, 2010 and December 31, 2020. Of note, Alberta has 100 EDs, and a recent survey identified only one site in Canada that has integrated a female-specific CV protocol component into routine use in their ED.<sup>18</sup> Ethical review and approval for this study were provided by the Research Ethics Board at the University of Alberta.

### Study participants

This study explored a cohort of women aged 18 years and older who experienced an MI. All women presented to an ED in Alberta, Canada between 1 and 15 times in the 30 days preceding their MI, and were discharged from the visit(s). Within 30 days of the index ED visit, all the women were admitted to the hospital, underwent a cardiac catheterization, and were diagnosed with an MI. The date of the cardiac catheterization was used as the date of MI, and visits to an ED in Alberta in the 30 days prior to the MI date were identified for each participant.

### Data sources

The women in this cohort were identified using administrative data from the Alberta Discharge Abstract Database (DAD) and the National Ambulatory Care Reporting System (NACRS) database. Data were merged with clinical and comorbid data from the Alberta Provincial Project for Outcome Assessment in Coronary Heart Disease (APPROACH) registry.

The APPROACH database has been described previously.<sup>19</sup> In brief, APPROACH is a prospective clinical data collection initiative capturing data on all patients who have undergone cardiac catheterization and revascularization in the province of Alberta, Canada since 1995. The registry contains detailed clinical information, including the following data for each patient: age, sex, ejection fraction, presence or absence of previous MI, extent of coronary artery disease (CAD; determined using standardized coronary anatomy diagrams), congestive heart failure, CVDs, peripheral vascular disease, chronic obstructive pulmonary disease, present/previous smoking, renal function, renal dialysis, hyperlipidemia, hypertension (HTN), diabetes mellitus, liver disease, gastrointestinal disease, and malignancy, as well as indication for revascularization. Vital status data from the Alberta Vital Statistics Office are merged quarterly with the APPROACH registry.

Through administrative data, 2062 women were identified who were discharged with an International Classification of Diseases, 10th revision—Canada (ICD-10-CA) code of I20-I25 (Ischemic heart diseases)<sup>20</sup> and had presented to an ED within 30 days prior to the MI. Administrative data on all ED visits within this 30-day time window were collected. The established cohort data were then merged with the APPROACH registry; 1578 women had cardiac catheterization data from their hospital admission. Clinical and comorbid data were required to complete the descriptive analysis conducted in this study. Of the cohort identified, 1380

women had complete cardiac catheterization, clinical, and comorbid data available in the APPROACH registry.

### Data analysis

Descriptive analyses were completed on 1380 Albertan women. The cohort was stratified by life stage,<sup>21</sup> using the women's ages at admission to the hospital, and was explored for comorbidities (eg HTN, diabetes), smoking status (current/past/never), Canadian Cardiovascular Society (CCS) angina grade recorded at catheterization, body mass index (BMI), family history of heart disease, number of traditional CVD risk factors risks (HTN, diabetes, dyslipidemia, obesity, and current or former smoker),<sup>22</sup> number of visits to an ED in the 30 days prior to being diagnosed with an MI, the extent of CAD, left ventricular ejection fraction (LVEF) estimate, NACRS presenting complaints for the index ED visit, and primary diagnosis for the index ED visit.

The hospital admission in which the cardiac catheterization occurred was used as the MI date, and administrative data regarding all presentations to an ED within 30 days prior to hospital admission were then collected. Time to death post-MI was calculated as the date of the cardiac catheterization subtracted from the date of death. Vital status for the cohort was determined as of December 31, 2021. Descriptive statistics were run using the  $\chi^2$  test for categorical data, and Student's *t*-tests for continuous data. For variables that had less than 5 occurrences in any given cell, the presented *P*-value is Fisher's exact test. Analyses were completed on SPSS Statistics version 28 (IBM, Armonk, NY).

## Results

### Participant characteristics

A total of 1380 women with a mean age of  $67.1 \pm 13.1$  years who were admitted to a hospital in Alberta and discharged with a diagnosis of an MI (see [Supplemental Fig. S1](#)) were included in this study. All women presented to an ED at least once in the 30 days preceding their MI diagnosis. The cohort was categorized to reflect female-specific life stages, including child-bearing age—18-45 years (5.8%), perimenopausal/menopausal age—46-55 years (13.2%), postmenopausal age—56-69 years (34.6%), senior—age 70-79 years (26.4%), and octogenarian—age  $\geq 80$  years (20%).

### Clinical characteristics

Pertinent clinical characteristics are summarized in [Table 1](#).

### Traditional CV risk factors

More than half the women had HTN (58.5%) or dyslipidemia (55.1%), and approximately one third had diabetes mellitus (31.2%). Of note, among women aged 18-45 years, nearly half had HTN (47.5%) or dyslipidemia (48.8%), with one third having diabetes mellitus (31.3%). Of all women, nearly one third were overweight (26.1%), and more than one third were obese (35.7%). Half the youngest women, aged 18-45 years, were obese (50%). The BMI range was 15.2-74.7, with a mean of  $29.6 (\pm 6.9)$ . Nearly half of the women reported being current or former smokers (42.3%).

**Table 1. Comorbidities stratified by life stage**

|                                   | Age group, y (n) |             |             |             |            | P                 |
|-----------------------------------|------------------|-------------|-------------|-------------|------------|-------------------|
|                                   | 18–45 (80)       | 46–55 (182) | 56–69 (477) | 70–79 (365) | ≥ 80 (276) |                   |
| Hypertension                      | 47.5 (38)        | 42.9 (78)   | 53 (253)    | 67.7 (247)  | 69.2 (191) | <b>&lt; 0.001</b> |
| Diabetes                          | 31.3 (25)        | 33 (60)     | 34.8 (166)  | 34.8 (127)  | 19.2 (53)  | <b>&lt; 0.001</b> |
| Dyslipidemia                      | 48.8 (39)        | 49.5 (90)   | 52 (248)    | 60.8 (222)  | 58.7 (162) | <b>0.019</b>      |
| Heart failure                     | 1.3 (1)          | 0.5 (1)     | 7.3 (35)    | 9.6 (35)    | 11.6 (32)  | <b>&lt; 0.001</b> |
| COPD                              | 7.5 (6)          | 8.8 (16)    | 12.4 (59)   | 15.1 (55)   | 9.4 (26)   | 0.077             |
| Cerebrovascular disease           | 1.3 (1)          | 2.7 (5)     | 4 (19)      | 8.5 (31)    | 5.8 (16)   | <b>0.006</b>      |
| Chronic kidney disease            | 2.5 (2)          | 0           | 2.3 (11)    | 3.8 (14)    | 2.9 (8)    | 0.113             |
| Acute kidney injury               | 0                | 1.1 (2)     | 0           | 0.3 (1)     | 0          | 0.078             |
| Dialysis                          | 1.3 (1)          | 1.6 (3)     | 2.5 (12)    | 1.9 (7)     | 0.7 (2)    | 0.500             |
| Peripheral arterial disease       | 0                | 2.7 (5)     | 4 (19)      | 6.3 (23)    | 2.2 (6)    | <b>0.018</b>      |
| Liver disease                     | 0                | 0.5 (1)     | 1.3 (6)     | 0.3 (1)     | 0.7 (2)    | 0.466             |
| Malignancy                        | 0                | 1.1 (2)     | 1.9 (9)     | 4.1 (15)    | 1.1 (3)    | <b>0.024</b>      |
| Family Hx heart disease           | 37.5 (30)        | 31.3 (57)   | 25.2 (120)  | 23.3 (85)   | 13.8 (38)  | <b>&lt; 0.001</b> |
| CCS grade IV                      | 81.3 (65)        | 76.4 (139)  | 75.1 (358)  | 73.7 (269)  | 71.7 (198) | 0.468             |
| BMI (kg/m <sup>2</sup> ), 25–29.9 | 17.5 (14)        | 24.2 (44)   | 25.8 (123)  | 24.9 (91)   | 31.9 (88)  | 0.075             |
| BMI (kg/m <sup>2</sup> ), > 30    | 50 (40)          | 45.1 (82)   | 40.9 (195)  | 32.3 (118)  | 21 (58)    | <b>&lt; 0.001</b> |
| Current smoker                    | 59.5 (47)        | 38.5 (70)   | 32.1 (153)  | 15.1 (55)   | 7.2 (20)   | <b>&lt; 0.001</b> |
| Former smoker                     | 1.3 (1)          | 13.2 (24)   | 17.8 (85)   | 22.2 (81)   | 17.4 (48)  | <b>&lt; 0.001</b> |
| Never a smoker                    | 40 (32)          | 48.4 (88)   | 50.1 (239)  | 62.7 (229)  | 75.4 (208) | <b>&lt; 0.001</b> |

Values are % (n), unless otherwise indicated. Boldface indicates significance. CCS grade IV = inability to carry on any physical activity without discomfort, anginal symptoms may be present at rest. For BMI, 209 missing; minimum-maximum, 15.2-74.7; mean (standard deviation), 29.6 (6.9).

BMI, body mass index; CCS, Canadian Cardiovascular Society; COPD, chronic obstructive pulmonary disease; Hx, history.

The youngest women, aged 18–45 years, were the most likely to be current smokers (58.8%), and the women aged ≥80 years were the most likely to report never having smoked (72.7%). The 5-year average current (daily or occasional) smoking rates in Alberta from 2015–2019 among females are as follows: age 18–34 years: 16.3%; age 35–49 years: 14.2%; age 50–64 years: 17.2%; and age ≥ 65 years: 9.9%.<sup>23</sup>

The number of traditional CVD risks<sup>22</sup> (HTN, diabetes, dyslipidemia, obesity, and current or former smoker) and the number of visits to an ED in the 30 days pre-MI can be seen in [Table 2](#). Of note, 18.2% of all women did not have any traditional CVD risk factors. The youngest women (aged 18–45 years) were the most likely to have 4 traditional CVD risk factors (22.5%) or 5 risk factors (11.3%) and presented multiple times to an ED for 2 visits (20%) or 3 or more visits (11.3%) in the 30 days before their MI. The range of the number of ED visits in the 30 days pre-MI was 1 to 15. Analyses were conducted to explore possible relationships between age and the number of visits to an ED pre-MI. However, no significant relationships were found between these variables. A total of three quarters of the women reported a CCS angina grade of IV (inability to perform any activity without angina or angina at rest—ie, severe limitation<sup>24</sup>; 74.6%), with the highest prevalence seen among women aged 18–45 years (81.3%). Less than one third of women had a family history of CVD (23.9%).

### Extent of CAD and LVEF

Across all ages, relatively few women (10.5%) had a normal angiogram/disease less than 50% (see [Supplemental Table S1](#)). More than half of all women (51.2%) had 2- or 3-vessel disease, which included 2- or 3-vessel disease, and 2- or 3-vessel proximal left anterior descending coronary artery. Women aged 18–45 years were most likely to have 1-vessel disease (46.3%). Women aged ≥80 years were most likely to have left main disease (18.8%). LVEF data were limited

(reported for 32% of the cohort); across all ages, the most prominent reported LVEF was > 50% (18.6%).

### Vital status and death rate per person-years

As of December 31, 2021, 427 women in the cohort (30.9%) were deceased (see [Table 3](#) and [Fig. 1](#)). The highest death rate per person-years was seen in women aged 70–79 years (9.3%) and women aged >80 years (12.4%). Of note, of the women aged 18–45 years who died post-MI, 88% (6) died within 4 years of their MI. The Kaplan-Meier log-rank comparison for death rate per person-year identified a significant difference ( $P < 0.001$ ) based on age categories, indicating that age was related to survival time.

### ED visits preceding diagnosis of MI

Of importance, NACRS presenting complaints are an optional reporting field<sup>25</sup>; given this, data were reported for the index ED visit for 308 of 1380 women. The primary presenting complaint was categorized as being CV (9.9%), which includes complaints such as chest pain (cardiac and noncardiac features), general weakness, and syncope. The next most common category was orthopedic (2.7%), including complaints such as back pain and upper-extremity pain, followed by respiratory (2.3%), including complaints such as shortness of breath and cough. Complete data can be found in [Supplemental Table S2](#). A full list of presenting complaints contained within each category can be found in the Canadian Emergency Department Information System (CEDIS) Presenting Complaint List for Use with NACRS (version 5.1).<sup>26</sup> The predominant diagnoses (NACRS International Classification of Diseases, 10th revision, Canada codes<sup>27</sup>) for the index ED visit in the 30 days pre-MI were symptoms, signs, and abnormal findings (35%), circulatory (11.5%), and respiratory (8.1%). Under the symptoms, signs and abnormal findings, the most diagnosed symptom was chest pain (14.3%; see [Supplemental Table S3](#) for all diagnosis data).



**Table 2.** Number of traditional cardiovascular disease (CVD) risks and number of visits to an emergency department (ED) pre–myocardial infarction, (MI), stratified by life stage

|  | Age group, y (n) |             |             |             |            | P                 |
|--|------------------|-------------|-------------|-------------|------------|-------------------|
|  | 18–45 (80)       | 46–55 (182) | 56–69 (477) | 70–79 (365) | ≥ 80 (276) |                   |
| Number of traditional CVD risk factors |                  |             |             |             |            |                   |
| 0                                      | 15 (12)          | 18.1 (33)   | 18.7 (89)   | 18.4 (67)   | 18.5 (51)  | 0.960             |
| 1                                      | 26.3 (21)        | 19.2 (35)   | 14 (67)     | 11.8 (43)   | 17 (47)    | <b>0.007</b>      |
| 2                                      | 10 (8)           | 19.8 (36)   | 19.5 (93)   | 18.6 (68)   | 28.3 (78)  | <b>0.002</b>      |
| 3                                      | 15 (12)          | 18.1 (33)   | 22.6 (108)  | 26.6 (97)   | 27.2 (75)  | <b>0.035</b>      |
| 4                                      | 22.5 (18)        | 14.8 (27)   | 16.1 (77)   | 19.2 (70)   | 7.6 (21)   | <b>&lt; 0.001</b> |
| 5                                      | 11.3 (9)         | 9.9 (18)    | 9 (43)      | 5.5 (20)    | 1.4 (4)    | <b>&lt; 0.001</b> |
| Number of ED visits pre-MI             |                  |             |             |             |            |                   |
| 1                                      | 68.8 (55)        | 79.1 (144)  | 80.5 (384)  | 77.3 (282)  | 79 (218)   | 0.196             |
| 2                                      | 20 (16)          | 14.8 (27)   | 14.3 (68)   | 17.3 (63)   | 16.7 (46)  | 0.602             |
| ≥ 3                                    | 11.3 (9)         | 6 (11)      | 5.2 (25)    | 5.5 (20)    | 4.3 (12)   | 0.210             |

Values are % (n), unless otherwise indicated. Traditional CVD risks included hypertension, diabetes, dyslipidemia, obese body mass index, and current or former smoker status. Boldface indicates significance.

### Discussion

Our results demonstrate that women in this cohort across all life stages demonstrated a high prevalence of comorbidities, including HTN (58.5%), dyslipidemia (55.1%), and diabetes (31.2%), with nearly half reporting being a current or past smoker (42.3%). The combination of these comorbidities puts them at a higher risk for developing CVDs. The death rates in our cohort were notably higher than those in the general population. In Alberta, 2021 all-cause mortality in women was 0.05% (aged 15–44 years), 0.04% (aged 45–54 years), 0.1% (aged 55–69 years), 0.2% (aged 70–79 years), 0.4% (aged ≥80 years).<sup>28,29</sup> Of note, 18.3% (252) of the women in the cohort did not demonstrate *any* traditional risk factors for CVD (HTN, diabetes, dyslipidemia, current or past smoker, obesity<sup>22</sup>). The findings from this study highlight a complex issue. Although the women in this cohort had appreciably high comorbid burdens, not all visits to an ED were for cardiac concerns. The presenting complaint data were very limited, although 136 of 306 concerns were CV-related. Further, the ED discharge diagnoses reflect a wide array of health concerns.

Significant differences were noted in CVD risk factors when stratifying results by female-specific life stages. Evidence suggests that assessing CVD risk for women should include sex-specific conditions/history that have been shown to increase CVD risk in women, such as early or late menarche, pregnancy complications (hypertension, gestational diabetes, preeclampsia), polycystic ovary syndrome, premature menopause (spontaneous or surgical), autoimmune disorders, chronic kidney disease, breast cancer, and depression.<sup>17,22</sup> Risk assessment should occur in primary care, and a nurse practitioner-led clinic could help meet this need. The recognition and intervention for traditional and nontraditional CVD risk factors during primary care appointments may help reduce the incidence of CVD and MI in women. Lastly, evidence suggests the

value of increasing awareness among women and clinicians on sex differences in CVD and MI.<sup>3,6,30</sup> An improved recognition of non–chest pain anginal equivalents may help improve the recognition of symptomatic CAD in EDs.

### Limitations

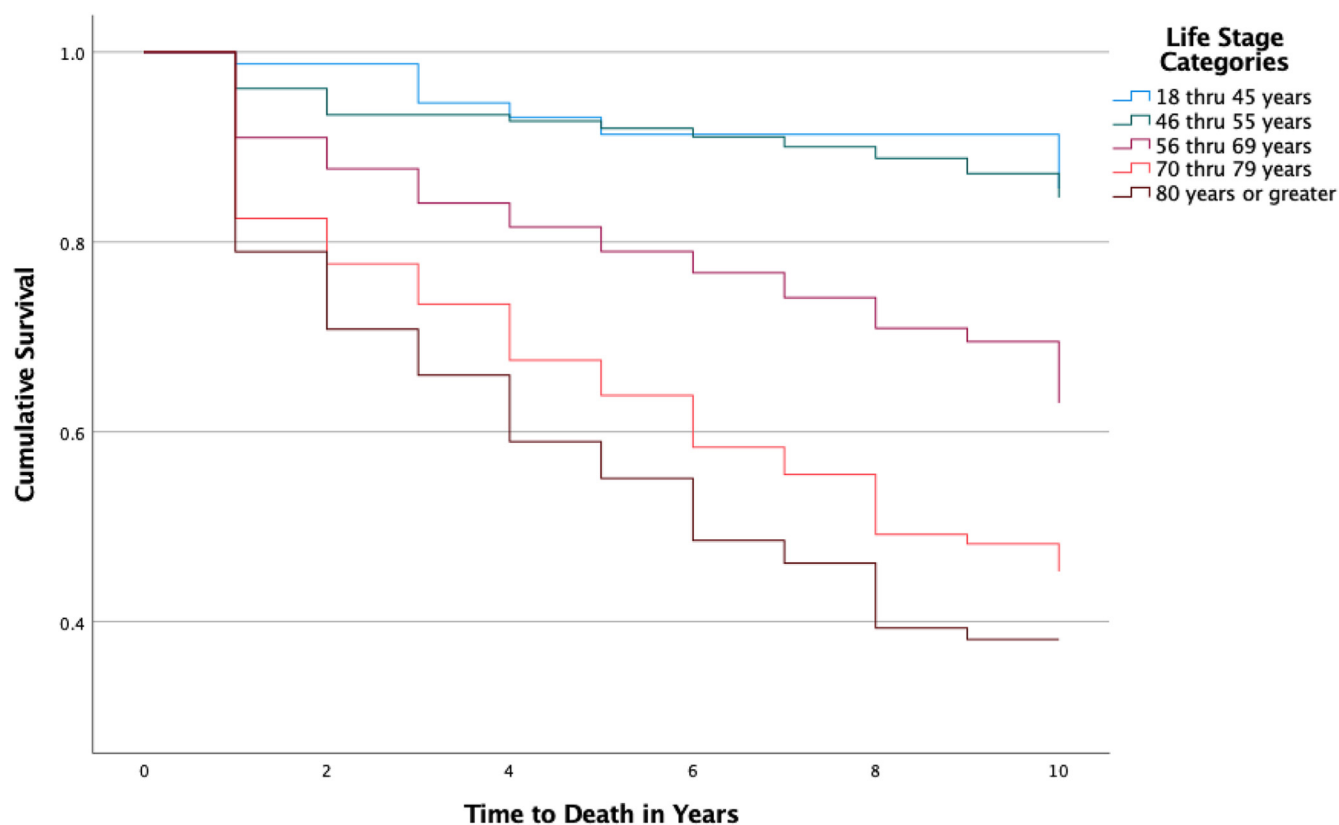
This retrospective cohort was derived from administrative data; therefore, this cohort does not include women who did not seek medical care, those who died before presenting to an ED, or those who presented to an ED and died. Data on presenting complaints for the index ED visit in the 30 days pre-MI were available for only 22.3% of the cohort. From the limited data we do have, we know that some of these visits were not for cardiac concerns. Further, we were unable to describe or determine whether the interventions done during these ED visits and the decisions for discharge were appropriate. We were unable to determine why women were discharged from the ED visits. For women who presented with cardiac concerns, potential explanations for the ED discharge may include the language the women used to describe symptoms (for example, women may report chest “discomfort” as opposed to “chest pain”), implicit bias, or sex differences in the presentation of acute coronary syndrome. This study was not designed to identify the probability of missed CAD diagnoses in EDs. Therefore, from the data in this study, we cannot identify an absolute miss rate or a difference in miss rate between males and females, as a comparison group was not used.

### Conclusion

Of the women in this cohort, 81.7% demonstrated between 1 and 5 traditional CVD risk factors. Although not all presentations were for cardiac concerns, all women in the

**Table 3.** Date rate per person-year stratified by life stage

|                               | Age group, y (n) |             |             |             |            |
|-------------------------------|------------------|-------------|-------------|-------------|------------|
|                               | 18–45 (80)       | 46–55 (182) | 56–69 (477) | 70–79 (365) | ≥ 80 (276) |
| Date rate per person-years, % | 1.4              | 1.7         | 4.7         | 9.3         | 12.4       |
| Crude deaths, % (n)           | 8.8 (7)          | 10.4 (19)   | 24.3 (116)  | 41.1 (150)  | 48.9 (135) |



**Figure 1.** Time from myocardial infarction to all-cause mortality, in years, stratified by life stage.

cohort presented to an ED a minimum of 1 time and a maximum of 15 times in the 30 days before admission for an MI. The findings from this study reveal potential opportunities for improving the primary prevention of CVD, possible improvements to the recognition of MI symptoms in women in the ED, and overall, a need to empirically evaluate the existing strategies to improve the prevention and recognition of CVD and MI among women. Future research includes collecting sex-specific factors, including menstrual, pregnancy, perimenopausal/menopausal history, as well as gendered factors recognized to be associated with CVDs,<sup>31,32</sup> from the women in this cohort. To develop a more comprehensive understanding of female-specific CVD risk factors, longitudinal prospective data are needed. Lastly, future research could provide valuable insights into the phenomenon of women presenting to EDs pre-MI, by better characterizing the causes of MI and seeking to identify those women in whom the MIs may have been preventable.

### Ethics Statement

Ethical review and approval for this study were provided by the Research Ethics Board at the University of Alberta.

### Patient Consent

The authors confirm that patient consent is not applicable to this article. This is a retrospective cohort study using de-identified data; therefore, the IRB did not require consent from the patient.

### Funding Sources

The authors have no funding sources to declare.

### Disclosures

The authors have no conflicts of interest to disclose.

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### Supplementary Material

To access the supplementary material accompanying this article, visit *CJC Open* at <https://www.cjopen.ca/> and at <https://doi.org/10.1016/j.cjco.2023.09.003>.