

# Main causes of death among Swedish women born 1914 and 1918: 32-year follow-up of the Population Study of Women in Gothenburg

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**Background:** Coronary heart disease has been reported to be the major cause of death of post-menopausal women in industrialized countries. The risk for women of dying from myocardial infarction is significantly greater than the risk of dying from cancer. The aim of this study was to compare previous observations regarding causes of death with the results from the Population Study of Women in Gothenburg. We also examined how causes of deaths vary among different age cohorts.

**Methods:** This follow-up report based on the prospective observational Population Study of Women in Gothenburg, Sweden was confined to mortality in two age cohorts: 180 women born in 1914 and 398 women born in 1918. These women were representative of the female population in Gothenburg in these age groups. Women were followed for 32 years, from 1968–1969 to 2000–2001. During the follow-up period, data on mortality were obtained from the population registry and the Cause of Death Register. Women's death certificates were also examined.

**Results:** In women aged between 60 and 80 years, cancer accounted for 30% of deaths, myocardial infarction for 19%, and stroke for 14%. In women who died after the age of 80 years, myocardial infarction was a more common cause of death than cancer.

**Conclusions:** Cancer accounts for most years lost from a woman's normal life span. Myocardial infarction was a more common cause of death than cancer only in women above the age of 80 years. Although myocardial infarction is a common cause of death among women, cancer is a more common cause of death at younger ages. This should be emphasized when planning care, prevention, and research involving women's health.

**Keywords:** causes of death, mortality, population study, women

## Introduction

The press and television occasionally report that women with acute coronary syndromes, such as myocardial infarction, receive more latent treatment than do men with the same diagnosis.<sup>1</sup> This may be because women experience more unrecognized myocardial infarctions compared to men.<sup>2</sup> It has been reported that coronary heart disease is the primary cause of death of postmenopausal women in industrialized countries,<sup>3</sup> and that the risk of women dying from myocardial infarction is significantly greater than the risk of dying from cancer.<sup>4–7</sup>

Causes of death and mortality have been studied in many countries. The life expectancy both in men and women in the US increased until 1983. However, between 1983 and 1999, female mortality increased in the US, primarily due to chronic diseases related to smoking, obesity, and blood pressure.<sup>8</sup>

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Recently, the life expectancy of women has increased, and 2006 was the first year in which women worldwide were reported to have a longer life expectancy than men.<sup>9</sup> In 2004, the World Health Organization presented estimates of different causes of death on global, regional, and country levels and provided an overview of global and regional patterns. In 111 countries, ischemic heart disease and cerebrovascular disease were the leading causes of death.<sup>10</sup>

Previous studies have shown that the leading causes of death in 1990 were ischemic heart disease (6.3 million deaths) and cerebrovascular diseases (4.4 million deaths), whereas lung cancer caused 0.9 million deaths.<sup>11</sup>

The aim of this study was to compare previous observations regarding mortality and causes of death in women with the results of the Population Study of Women in Gothenburg. The Population Study of Women in Gothenburg recorded data regarding both mortality and morbidity for more than 40 years.

## Participants and methods

The Prospective Population Study of Women in Gothenburg was initiated in 1968–1969.<sup>12</sup> Women participated in a comprehensive health assessment, and selection was based on date of birth to ensure that the women were representative of all women in Gothenburg in the age groups studied. The high participation rate, which was approximately 90%, further supported the hypothesis that this population was representative of the general population.

This follow-up report was conducted to examine mortality in two age cohorts. A total of 398 women born in 1918 who were 50 years old at baseline were followed from 32 years to 82 years of age, with the study period ending in 2000. Additionally, 180 women born in 1914, who were 54 years old at baseline and 86 years old in 2000, were also followed. The number of participants, participant rates in 1968–1969, and the number of deaths are shown in Table 1.

## Definition of myocardial infarction, other cardiovascular diseases, and stroke

A woman was defined as having myocardial infarction, heart failure, other cardiovascular diseases, or stroke if a diagnosis had been made by a doctor and classified according to the International Classification of Diseases,<sup>13</sup> Ninth and Tenth Revision (ICD 9 and 10), diagnosis codes ICD 391-448B or I01.0–I79.2, respectively (myocardial infarction, heart failure, other cardiovascular diseases, and stroke). Data from

**Table 1** Year of birth, number of participants, and participant rate for the two different age groups examined in the Population Study of Women in Gothenburg 1968–1969 and the number of deaths over the 32-year study period (2000–2001)

Year of birth	Age in 1968–1969	Participants		Mortality in 32 years	
		n	%	n	%
1918	50	398	91.0	166	41.7
1914	54	180	88.6	115	63.9

**Abbreviation:** n, number of participants.

between 1980 and 2001 were obtained from the Swedish Hospital Register.

## Verification of cancer diagnosis

Data from the Swedish Cancer Registry and from regional cancer registries were used. Additionally, each participant was asked if she had any history of neoplastic disease and, if so, she was asked to provide details regarding the type, localization, and treatment of the disease. Information from the 32-year period from 1968–1969 to 2000–2001 was obtained. A previous comparison between the 1988 Cancer Registry and observations made in the Prospective Population Study of Women showed 99% agreement.<sup>14</sup>

During the follow-up period, data on mortality were obtained from the population registry and the Cause of Death Register. Women's death certificates were analyzed; if the cause of death was not clear, additional data were gathered from hospital and medical records.

## Results

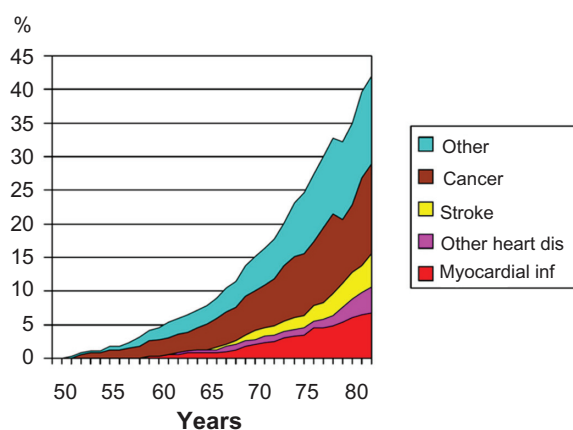
### Causes of death in women

The most commonly observed causes of death during the 32-year follow-up period are shown in Table 2 and in Figures 1 and 2. In the younger age group (born in 1918), which was followed until the age of 82 years, death from

**Table 2** Causes of death for women followed from 50 to 82 years of age, and from 54 to 86 years of age, respectively

	From 50 to 82 years of age		From 54 to 86 years of age	
	n	%	n	%
Myocardial infarction	27	16	29	25
Other cardiovascular diseases	15	9	15	13
Stroke	20	12	16	14
Cancer	52	31	28	24
Other reason	52	31	27	23
Total	166		115	

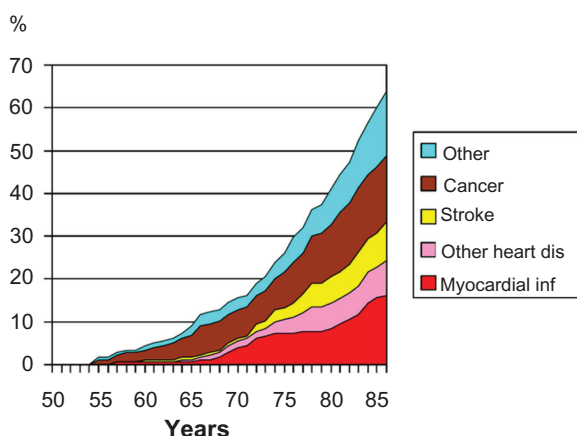
**Abbreviation:** n, number of participants.



**Figure 1** Causes of death in women born in 1918, followed from 50 to 82 years of age (total of 32 years).

cancer was twice as common as death from myocardial infarction, while in the older age group (born in 1914), which was followed until the age of 86 years, death from myocardial infarction was as common as death from cancer. Figures 1 and 2 show the cumulative frequency of causes of death in both age groups. Stroke was a common cause of death at younger ages and accounted for nearly 15% of deaths.

In an examination of causes of death between ages 60–80 years (Figures 1 and 2), the results were approximately the same in both age cohorts; the percentage of deaths from cancer was 30% of deaths, from myocardial infarction 19%, and from stroke 14%. Of women who died between 80–85 years of age, 34% had been diagnosed with fatal myocardial infarction, 15% suffered from cancer, and 12% suffered from stroke. After 80 years of age, myocardial infarction appeared to be a more frequent cause of death than cancer.



**Figure 2** Causes of death in women born in 1914, followed from 54 to 86 years of age (total of 32 years).

## Discussion

Our study presents mortality and causes of death in two representative birth cohorts examined in the Population Study of Women in Gothenburg, Sweden, which were followed for 32 years. Cancer was a more common cause of death than both myocardial infarction and stroke in women aged between 60–80 years. Similar observations were made in Iceland.<sup>15</sup> In women aged between 55–85 years, cancer and ischemic heart disease caused 40% and 11% of deaths in Iceland in 2007, respectively. Data regarding myocardial infarctions in Gothenburg in the late 1960s and early 1970s for men and women aged 67 years and younger<sup>16</sup> revealed that myocardial infarction was six to eight times more common in men than in women of the same ages.<sup>17</sup> Although this difference has decreased, men continue to experience significantly higher morbidity and mortality from myocardial infarction than do women.<sup>18</sup> The incidence of myocardial infarction increases with increasing age; some studies have shown that patient age was more important than patient sex in the rate of myocardial infarction.<sup>19</sup> Although myocardial infarction is less frequent in women than in men of younger ages, short-term outcomes are worse for women than for men.<sup>3</sup> Thus, rapid diagnosis and clear support objective methods must be in place.

Stroke was found to be a common cause of death in women in our study. These findings agree with those of earlier reports.<sup>20,21</sup> Stroke is one of the leading causes of death worldwide.<sup>22</sup>

Our study shows that it is important not only to focus on myocardial infarction and stroke, but to emphasize the risk of suffering from cancer in women younger than 80 years of age.<sup>20,21</sup> These observations are important for planning of preventive care such as cancer screening. It is important to identify and to motivate women who do not participate in screening programs against breast cancer and cervical cancer. Patients and health care providers should be aware of the importance of smoking cessation, sufficient physical activity, and maintaining a healthy weight in reducing the cancer burden.<sup>23</sup>

It is not meaningful to discuss which cause of women's causes of death is the most important. Cardiovascular disease is likely the most common overall cause of death in women,<sup>5–7,24</sup> while cancer results in the highest number of lost years of life. Our results agree well with those presented by the Swedish National Board of Health and Welfare, which show that twice the number of life years were lost due to cancer compared to cardiovascular disease in women younger than 75 years old.<sup>25</sup> Our results are in agreement with cross-sectional national statistics data from Nordic countries, which

show that cancer is the most common cause of premature death in those younger than 75 years old.<sup>26</sup>

Among the advantages of this study are the longitudinal design and the long follow-up period ranging from 1968–1969 to 2000–2001. Statistics regarding causes of death can be based on a national level, but in a limited, well-defined population, higher quality data can be obtained. Using record briefings, interviews, and surveys, more reliable diagnosis can be reported than use of a review of publicly collected data. The main limitation of the study is the limited number of women who were followed-up. However, the quality of the data exceeds the limitation of the small sample size.

## Key points

It is important not only to focus on myocardial infarction as the main cause of death in women, but also to emphasize that the causes of death vary in relation to the ages of women. The risk of suffering from stroke in women examined in this study is significant, and the presence of cancer before 80 years of age is more common than both myocardial infarction and stroke. These observations are important for planning of care, prevention, and research in women's health.

## Ethical approval and participants consent

The Ethics Committee of University of Gothenburg approved this study. All subjects gave informed consent, in accordance with the provisions of the Helsinki Declaration.

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## Disclosure

The authors declare no conflict of interest.

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