

# Trends in mammography utilization, 1981 to 1994

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## Abstract

From 1981 to 1994, the annual number of mammograms performed in Canada increased from less than 200,000 to more than 1.4 million. By 1994, about three in five women aged 40 and over reported having had a mammogram at some time in their lives. Most of the increase that occurred between 1985 and 1991 was because of greater use of mammography for breast screening. In the early 1990s, the annual numbers and rates stabilized as the number of mammograms performed on a fee-for-service basis declined slightly, while those conducted by provincial/territorial breast screening programs rose.

Mammography is increasingly targeted to women aged 50-69 for whom screening is considered to be most effective. About 30% of Canadian women aged 50-69 have had a mammogram within the past year, although just one-fifth of these mammograms were obtained through provincial/territorial breast screening programs.

Most mammography in Canada is provided through the fee-for-service system, although about 80% of fee-for-service mammograms are done for screening purposes, and the remaining 20% for diagnostic assessment.

This article is based on administrative data provided by provincial/territorial departments of health and by breast screening programs, as well as on data from the National Population Health Survey. Some implications of mammography utilization for breast cancer incidence and mortality rates are assessed, but because of the long lead time between detection and death, it may be too early to reach definitive conclusions.

**Key words:** mammography, breast neoplasms, administrative data, breast screening

Among Canadian women, breast cancer is the form of cancer most frequently diagnosed, and it ranks second after lung cancer as the leading cause of cancer death.<sup>1,2</sup> Many of the risk factors associated with breast cancer—for example, early menarche, late menopause, and a family history of the disease—do not lend themselves to prevention strategies.<sup>3,4</sup> However, early detection through mammography, used alone or in combination with a thorough physical examination of the breast, can find smaller tumours that allow for wider treatment options. Advances in the treatment of early breast cancer afford some hope of reducing mortality rates.<sup>3,5</sup> Thus, screening offers perhaps the best chance of improving the control of breast cancer at this time.<sup>5,6</sup>

Although mammography was originally developed in the early part of this century, a standard technique for general application did not evolve until the 1950s and 1960s.<sup>7</sup> At first, mammography was used primarily as a *diagnostic* tool to evaluate women with symptoms or signs of breast disease. As the ability of mammograms to detect early breast cancers became apparent, *screening* of asymptomatic women was developed.<sup>3,5,8</sup> The effectiveness of large-scale screening mammography was first determined by the Health Insurance Plan (or HIP) study in New York in the 1960s, and later, by a number of studies in the 1970s and 1980s.<sup>3,5,8</sup> Canada has contributed significantly to assessing the role of mammographic screening in reducing breast cancer mortality through the Canadian National Breast Screening Study, the National Workshop on the Early Detection of Breast Cancer, and the National Forum on Breast Cancer<sup>9-12</sup> (see *Breast screening initiatives*).

Between 1988 and 1991, breast screening programs offering mammography through dedicated centres were established in five Canadian provinces and one territory. A network of dedicated breast cancer screening centres allowing universal access with high quality facilities and specially trained staff are key components for a reduction in breast cancer mortality.<sup>13</sup> Further, high-volume centres have the potential to achieve relatively low-cost mammography while maintaining high quality.<sup>3</sup>

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## Methods

### Data sources

Data on the annual number of mammograms, by five-year age group where possible, were collected from administrative sources. Breast screening program data were provided by provincial and territorial breast screening programs. Fee-for-service data were provided by the departments of health.

Data on mammography are also available from the household component (which excludes long-term health care facilities) of Statistics Canada's 1994-95 National Population Health Survey (NPHS).<sup>14,15</sup> The NPHS is a longitudinal survey that measures the health status of the Canadian population. The target population is household residents in all provinces, except persons living on Indian reserves, on Canadian Forces bases, or in some remote areas.

The NPHS collects most information from one household member who is selected randomly. The final 1994-95 sample size was 27,263 households. The final response rate (the proportion of selected households agreeing to participate, including households later rejected for sampling reasons) was 89%. (NPHS data from the Northwest Territories and the Yukon were not available.)

As part of the NPHS interview, women aged 35 and over were asked, "Have you ever had a mammogram, that is, a breast x-ray?" Those who replied affirmatively were asked, "When was the last time?" Women who had had a mammogram were also asked, "Why did you have your last mammogram?" Of three possible responses—"breast problem," "check-up, no particular problem," or "other"—only one was recorded. Response rates to these questions ranged from 98% to 100%. Proxy responses were not allowed. The data analyzed in this article are based on the 5,030 women aged 40 and over who answered the NPHS questions on mammography.

### Limitations

Data about fee-for-service mammograms were not available before 1986 for Manitoba and Saskatchewan, before 1987 for New Brunswick, before 1988 for Prince Edward Island, and before 1992 for the Yukon. Ontario reported estimates of fee-for-service mammograms before 1988. No fee-for-service data were available from Nova Scotia or the Northwest Territories. Fee-for-service data for New Brunswick, Prince Edward Island, Manitoba, Saskatchewan, Alberta, British Columbia, and Ontario (1980-1982) were usually reported by fiscal, not calendar, years. As well, fee-for-service data include mammograms (less than 1% of the total) performed on a small number of men. Age breakdowns were available for only five provinces: Quebec, Ontario, Saskatchewan, Alberta, and British Columbia. However, between 1985 and 1994, 87% of Canadian women aged 40 and over lived in these provinces.

Provinces and territories generally used similar methods to compile breast screening program data, although Nova Scotia reported for fiscal years, while all other programs reported for calendar years.

For several reasons, total mammography rates calculated from administrative sources for women aged 40 and over may be overestimated. Fee-for-service figures include mammographic

examinations of women younger than age 40. Data for those provinces and years for which age breakdowns are available indicate that mammograms performed on women younger than age 40 accounted for around 20% of the annual total in the mid-1980s, but had dropped to about 10% in the 1990s.

Also, in any given year, some women have more than one mammogram. For example, some would require two or more diagnostic examinations through the fee-for-service system. As well, the approximately 6% of women with abnormal results from breast screening programs would usually be referred to the fee-for-service system for further diagnostic assessment. An Ontario study found that 14% of fee-for-service mammograms provided in that province over an 18-month period were repeat mammograms.<sup>16</sup> The percentage would likely be somewhat lower (around 10%) within the 12-month reference period used here.

On the other hand, underestimation may occur because some women receive mammograms through services not included in this analysis, such as those conducted from 1980 to 1985 as part of the National Breast Screening Study. Further, some provinces provide block funding to certain hospitals for mammographic services, and counts of these mammograms are not reported to the provincial departments of health. Such examinations are thought to represent fewer than 10% of the total.

On balance, the reasons for overestimation tend to outweigh those leading to underestimation, such that mammography rates based on administrative data could be overestimated by about 10%.

### Comparison of administrative and survey data

In several respects, mammography rates based on administrative data are comparable to rates calculated using the 1994-95 NPHS. Both sources show rising east-to-west gradients and agree closely on the rank order of provinces. Patterns by age are also similar. However, the NPHS yielded rates five to ten percentage points above annual rates derived from administrative data. These results do not support the high validity cited for self-reported mammography.<sup>17</sup>

Several factors may contribute to the difference between rates for survey and administrative data. NPHS respondents might not have remembered the exact date of their last mammogram and misreported it as having taken place within the previous 11 months, an occurrence that has also been noted in the United States.<sup>18</sup> In addition, women who are included in and agree to respond to a survey such as the NPHS may also be more likely than non-respondents or those out-of-scope (for example, those in institutions) to have engaged in health-promoting behaviours such as having a screening mammogram. Some respondents, wishing to provide a socially desirable answer, may have said they had a mammogram, when in fact, they had not. Further, respondents might have replied affirmatively, assuming that the chest x-ray or other breast examination that they had was actually a mammogram or breast x-ray. And some women may have obtained mammograms from sources other than the fee-for service system or a breast screening program, for example, from hospitals that received block funding for this service.

Mortality reductions of approximately 40% among women aged 50 and over have been found five to seven years after screening was started, in research studies where participation rates ranged from 65% to 90%.<sup>8,11,19,20</sup> Population-based screening programs in Canada were set up on the assumption that screening could reduce mortality by 30% in women aged 50-69, providing that 70% of women in this age range received a screening mammogram every two years.<sup>12</sup>

This article analyzes data from several sources to document trends in mammography utilization in Canada, in the context of recommendations and initiatives related to breast cancer screening (see *Methods* and *Definitions*).

### Numbers and rates rise

The annual number of mammograms performed in Canada increased slowly from 162,000 to 250,000 between 1981 and 1985, then climbed to 1.3 million by 1991. The increase levelled off, and by 1994, the total was 1.4 million (Chart 1; Appendix, Table A).

Trends in annual mammography rates paralleled the sharp rise and levelling off of the numbers. As a percentage of women aged 40 and over, the rate rose from 5% in 1985 to 23% in 1991, and has since been relatively stable. The sharp upturn between 1985 and 1991 largely reflects increases in mammography performed for screening, whether provided through breast screening programs or the fee-for-service system.

### Majority fee-for-service

Most mammography is conducted on a fee-for-service basis. The number of fee-for-service mammograms peaked in 1991 at just over 1.2 million, and then declined slightly. By contrast, between 1988 and 1994, as breast screening programs were established in several provinces, the number of mammograms these programs provided surged from 4,500 to 231,000. In 1994, mammography conducted through breast screening programs accounted for 16% of the national total. The stabilization of the total mammography rate after 1991 occurred partly because of shifts from the fee-for-service system to breast screening programs, and partly because, in accordance with guidelines in most provinces, women may be having a mammogram every two years rather than annually.

### Highest rates in provinces with well-established screening programs

In all provinces, total mammography rates mirrored the national trend, increasing rapidly in the late 1980s, and levelling off in the early 1990s. By 1994, as a percentage

of women aged 40 and over, total mammography rates ranged from 17% in Newfoundland to 32% in British Columbia. Provinces with well-established breast screening programs tended to have high total mammography rates, and among the lowest rates of fee-for-service mammography.

The highest breast screening program mammography rates were 16% in British Columbia and 12% in Saskatchewan, where about half of all mammography was conducted by such programs. Provincial fee-for-

#### Definitions

A *mammogram* is a safe, low-dose x-ray of the breast that uses a special technique to find tumours at an early stage. Several views of the breast may be taken at any one *mammographic examination*. The mammograms taken at each examination are reviewed by a radiologist who specializes in the diagnosis of breast disease. In this article, the terms "mammogram" and "mammographic examination" are used interchangeably.

*Breast screening program mammography* is offered through government-sponsored programs at dedicated screening centres, and at no cost to women in the target age group. Referral from a physician is not necessary for women in the target age range. Most programs do not accept women of other ages unless they have been referred by a physician or have been previously screened by the program. Breast screening programs provide a mammographic examination, supplemented in some provinces with a physical examination of the breast. *Screening mammography* such as this is done on a mass basis, through standard protocols aiming to separate abnormal from normal mammograms. Any abnormalities detected are followed up through more intensive diagnostic processes.<sup>21</sup>

*Fee-for-service mammography* refers to mammographic examinations conducted by a radiologist for diagnostic assessment. Women must be referred by a physician, and the costs are paid to the radiologist on a fee-for-service basis by the provincial health care system. To the extent that this service may be used for breast check-ups rather than for diagnosis of a suspected problem, a portion of fee-for-service mammograms are done for screening. Fee-for-service data, however, cannot be disaggregated by the reason for the examination.

The *mammography rate* is calculated as the annual number of mammograms per 100 women aged 40 and over to provide a general indication of mammography utilization by province and over time. *Total mammography rates* include both breast screening program and fee-for-service examinations.

An *age-specific mammography rate* is the number of mammograms per 100 women in a given age group. These rates are of most value in assessing the coverage of breast screening programs. However, annual, not biennial, rates are calculated to minimize the impact of duplicates. Because of the lack of age-specific information for a number of provinces and over time, national age-standardized mammography rates have not been calculated.

## Breast screening initiatives

### The National Breast Screening Study

The National Breast Screening Study (NBSS), the first large-scale study of mammography in Canada, was designed to evaluate the effect of mammographic screening, alone or in combination with physical examination, on breast cancer incidence and mortality rates among women aged 40-59.<sup>9,10</sup> When the NBSS was designed in 1979, there was no evidence that screening was effective in reducing breast cancer mortality among women aged 40-49. By contrast, for women aged 50 and over, mammographic screening, alone or combined with physical breast examination, had been found to be effective in reducing breast cancer mortality. However, the contribution of mammography beyond any benefit from physical examination alone was unclear.

The aim of the NBSS for women aged 40-49 was to evaluate the efficacy of the combination of annual mammographic screening, physical breast examination, and the teaching of breast self-examination in reducing the breast cancer mortality rate. For women aged 50-59, the aim was to evaluate the efficacy of annual mammograms over and above annual physical examination of the breasts and the teaching of breast self-examination. From January 1980 through March 1985, 50,430 women aged 40-49 and 39,405 women aged 50-59 were enrolled in the study.

The first NBSS results were published in 1992.<sup>9,10</sup> For women aged 40-49, annual mammographic screening and physical examination of the breasts detected considerably more small, node-negative tumours (that is, tumours localized to the breast) than usual care, but had no impact on the rate of breast cancer death among the participants up to seven years' follow-up from entry in the study. Similarly, for women aged 50-59, annual mammographic screening detected considerably more small, node-negative tumours than physical examination alone. But again, during seven years' follow-up, mammographic screening had no effect on mortality compared with having only a thorough physical examination. An 11-year follow-up on incidence and a 13-year follow-up on mortality are now in progress.

### Workshop on the Early Detection of Breast Cancer

After completion of the data collection phase of the NBSS in 1985, pressure had emerged to make mammographic screening widely available. The National Workshop on the Early Detection of Breast Cancer was convened in 1988.<sup>11</sup> The Workshop Report, developed by representatives of government, volunteer and professional groups from across Canada, recommended that women aged 50-69 be offered and encouraged to participate in an early breast cancer detection program, a component of which would be biennial mammography. The Workshop proposed the establishment of dedicated screening centres to ensure the highest standards in image quality, personnel, interpretation, follow-up, and pathology review, as well as the lowest unit costs.

### Provincial/territorial screening programs

British Columbia set up the first breast screening program in 1988, followed by Saskatchewan, Ontario and Alberta in 1990, and Nova Scotia and the Yukon in 1991. In 1995, Manitoba and New Brunswick, and in 1996, Newfoundland, instituted programs. The Northwest Territories has prepared and distributed guidelines that are undergoing regional review. Prince Edward Island is establishing a program, while Quebec does not yet have a screening program.

British Columbia initially targeted women aged 40 and over for annual screening, but since 1995, has concentrated on those aged 50-70. The other jurisdictions target women aged 50-69 for biennial screening. The goal of the provincial programs is to screen 70% of their target populations, and to achieve a 30% reduction in mortality after five to seven years.

### The National Forum on Breast Cancer

The National Forum on Breast Cancer was held in Montreal in November 1993 under the sponsorship of the Canadian Cancer Society, the National Cancer Institute of Canada, the Medical Research Council, the Canadian Breast Cancer Foundation, and Health Canada.<sup>12</sup> The purpose was to develop consensus on breast cancer research, prevention, and care. The Forum recommended that funding be increased to allow provincial programs to reach at least 70% of women aged 50-69 every two years.

### Breast screening programs, Canada, 1994

	British Columbia	Saskatchewan	Ontario <sup>†</sup>	Alberta	Nova Scotia	Yukon
Start date	July 1988	April 1990	June 1990	October 1990	June 1991	Mid-1991
Target age group	40+ <sup>†</sup>	50-69 <sup>‡</sup>	50-69 <sup>‡</sup>	50-69 <sup>‡</sup>	50-69 <sup>§</sup>	50-69 <sup>‡</sup>
Screening frequency	annual	biennial	biennial	biennial	biennial	biennial
Includes physical breast exam	no	no	yes (nurse examiner)	no	yes (technologist)	yes (general practitioner)

**Source:** Provincial and territorial screening programs and departments of health

**Note:** Start dates for other programs: 1995 - Manitoba, New Brunswick; 1996 - Newfoundland; None - Prince Edward Island, Quebec, Northwest Territories

<sup>†</sup> Since 1995, program has concentrated on women aged 50-70.

<sup>‡</sup> Program accepts women over age 69 on request.

<sup>§</sup> Program accepts women aged 40-49 and 70-72 on request.

service mammography rates were 16% for British Columbia and 13% in Saskatchewan. In other provinces, fee-for-service rates ranged from 17% in Alberta to 27% in New Brunswick.

### Mammography increasingly targeted to ages 50-69

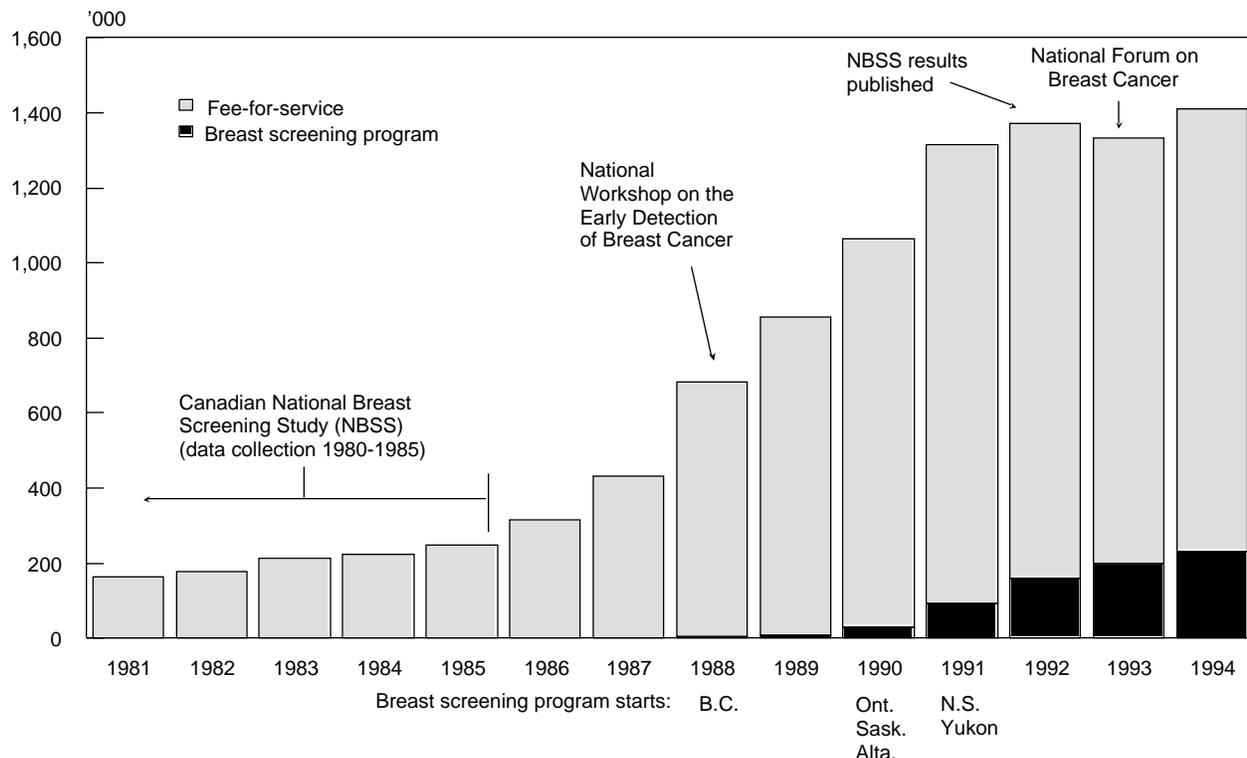
Age breakdowns of mammography data are available for Quebec, Ontario, Saskatchewan, Alberta, and British Columbia. In each of these provinces, age-specific mammography rates rose dramatically from the mid- to late-1980s to the early 1990s, and then levelled off or even declined slightly. Rates for each ten-year age group were highest in British Columbia and Saskatchewan, the two provinces with the greatest proportions of mammography conducted by breast screening programs (Appendix, Table B).

At 32% in 1993, the mammography rate was highest for women aged 50-59. The rate for this age group had tended to stabilize around 1992. The mammography rate for women aged 60-69 also stabilized in 1992, and by 1993, was about 26%. Saskatchewan and British Columbia were the only provinces with a marked decline in fee-for-service mammography rates for both age

groups. However, between 20% and 26% of women in their fifties and sixties had a mammogram through the provinces' breast screening programs in 1994. As a result, that year, Saskatchewan, along with British Columbia, had the highest total mammography rates (at least 37%) for women aged 50-69, the age group targeted for screening mammography. In these two provinces, over half of all mammograms performed on women in this age range were conducted through breast screening programs (Table 1). Elsewhere, most, if not all, mammography was provided to women in the targeted age groups by the fee-for-service system.

Stabilization of the overall mammography rate in the early 1990s may partially reflect rates close to a saturation level for women aged 50-69. By 1994, rates for women in their fifties and sixties in the five provinces were approaching 30% or more. This may indicate that the desired goal—70% of women screened every two years—was close to being achieved. The levelling off also results from less mammography among women in their forties, possibly because of greater awareness that no conclusive evidence has shown this age group to benefit from mass screening.<sup>3,5,8</sup>

**Chart 1**  
**Number of mammograms, Canada, 1981-1994**



**Source:** Provincial and territorial departments of health and breast screening programs

**Note:** Data coverage of the population increases from 85% in 1981 to 97% by 1988.

In fact, among women in their forties, the mammography rate was 18% in 1993, a drop from 22% in 1991. This was entirely attributable to a downturn in fee-for-service rates, since except for British Columbia, almost no mammograms were provided to women aged 40-49 through breast screening programs. Declines in fee-for-service mammography for women in their forties were particularly marked in the provinces with breast screening programs (Appendix, Table B).

At around 16% in 1993, the total mammography rates for women in their seventies were also low. That year, about 3% of women aged 70-79 had mammograms from breast screening programs, with the highest rates reported for British Columbia (12%) and Saskatchewan (8%).

**Table 1**  
**Mammograms conducted by breast screening programs, by age group, four provinces, 1994**

	Age group		
	40-49	50-59	60-69
	Breast screening program mammograms as % of total mammograms		
<b>Ontario</b>			
1990	—	—	—
1991	—	5	5
1992	—	11	12
1993	—	13	15
1994	..	..	..
<b>Saskatchewan</b>			
1990	...	22	32
1991	...	39	46
1992	...	38	46
1993	...	60	66
1994	...	64	70
<b>Alberta</b>			
1990	—	1	2
1991	1	10	11
1992	2	21	28
1993	2	26	25
1994	1	20	29
<b>British Columbia</b>			
1988	5	5	4
1989	8	8	8
1990	15	15	14
1991	27	27	29
1992	38	39	41
1993	46	45	47
1994	50	51	53

**Source:** Provincial departments of health and breast screening programs

## Majority have had mammogram

As the increase in the annual number of mammograms indicates, a growing number of Canadian women have had the procedure. According to the National Population Health Survey (NPHS), by 1994-95, 64% of women aged 40 and over had had at least one mammogram (Table 2). The highest lifetime rate was among women in their fifties (74%), one of the age groups targeted by screening programs. Moreover, this was up from 58% in 1990, as reported by the Health Promotion Survey.<sup>22</sup> In 1994-95, 71% of women in their sixties reported having had a mammogram, a substantial increase from 51% in 1990. At 54% in 1994-95, the lifetime rate among women aged 70 and over was much lower, but this was a considerable jump from 32% in 1990.

There was a rising east-to-west gradient in the percentage of women reporting ever having had a mammogram, from 43% in Newfoundland to 69% in British Columbia. A major exception to this pattern was Quebec, where the figure was 67%.

## Most mammograms performed for screening

NPHS respondents' reasons for their last mammogram reflect the increased use of mammography for screening, as opposed to diagnostic purposes. Of women aged 40-79 who had ever had a mammogram, 80% reported that a "check-up" was the reason for the last one, while "breast problem" was mentioned by just 17%. (Similar percentages were found when the analysis was restricted to women who had a mammogram in the previous year.) At 84%, the percentage of mammograms conducted for a check-up was highest for women aged 50-69, the age group targeted for screening (Chart 2). The highest percentage of respondents reporting that their last mammogram was to "investigate a breast problem" was among women in their forties (25%). This is not surprising, because in most provinces women in their forties are not targeted for screening.

These data suggest that a large majority of fee-for-service mammograms are performed for screening rather than diagnostic purposes. The 17% of mammograms reported by the NPHS to be conducted for "breast problems" can be considered equivalent to diagnostic mammography, and is similar to figures derived from other sources. Assuming that most fee-for-service mammograms performed in Canada before 1986 (around 250,000 annually) were diagnostic (Appendix, Table A), and that screening accounts for most of the rise since then, in 1994, just 20% of fee-for-service mammograms

would have been performed for diagnostic assessments. Therefore, in Canada in 1994, about 80% of fee-for-service mammography appears to have been for screening, although the proportion would be lower in provinces with well-established screening programs.

These results are consistent with an Ontario survey which indicated that, depending on the definition of breast disease used, between 72% and 89% of fee-for-service mammograms were for screening.<sup>23</sup> Similarly, data from an Alberta survey showed that in 1992, only about 25% of fee-for-service mammograms were for diagnostic purposes.<sup>24</sup>

### Implications for control of breast cancer

Since the mid-1980s, the use of mammography has increased substantially in Canada. As the procedure became more well known, growing demand by the public and by physicians for access to mammography led to the implementation of organized screening programs, as well as to increased use of diagnostic assessments through the fee-for-service system.

Since mammography detects breast cancers earlier than they otherwise would have been diagnosed, an increase in mammograms can be expected to produce an initial upturn in incidence, not because there is more cancer, but because tumours are being detected at an earlier stage. This artifactual increase in the incidence rate because of the earlier date of detection will eventually disappear as the rate falls back to its natural level, a trend that has been noted in the United States.<sup>25,26</sup>

In Canada, among women in their fifties, moderate increases in breast cancer incidence occurred from 1988 to 1992, which coincides with the upsurge in mammography.<sup>2</sup> Breast cancer incidence rates among women in their sixties rose sharply between 1986 and 1988, and then more slowly, again coinciding with rising mammography rates. Among women in their seventies, breast cancer incidence rates increased sharply between 1987 and 1989, but these rates had been rising steadily since 1981, suggesting that earlier detection through mammography was not the only factor associated with the increase. And despite rapidly rising mammography rates, there is no evidence of any change in breast cancer incidence rates among women in their forties.

While mammography may be an important factor in the increased diagnosis of breast cancer, the crucial question is whether earlier detection will affect breast cancer mortality rates. Because of the relatively long survival time for breast cancer patients, and because

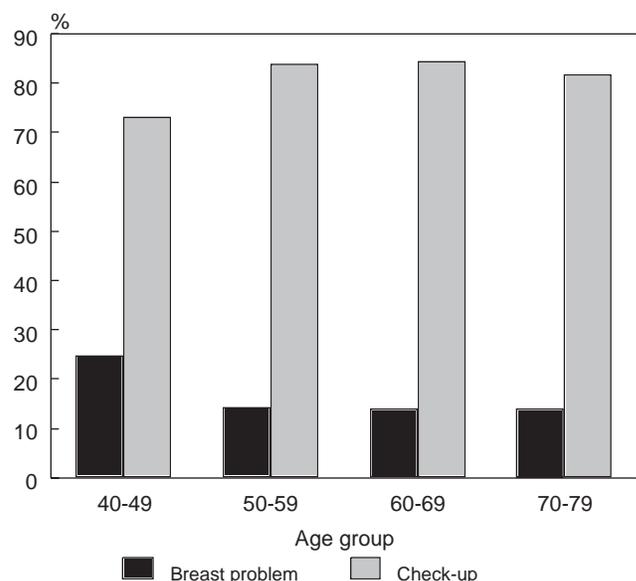
earlier detection will improve the prognosis for only some of them, a reduction in mortality may not be evident for many years after implementation of breast screening programs.<sup>27</sup> Moreover, by pushing back the date of diagnosis, earlier detection might appear to lengthen survival, even if the woman dies at the same time that she would have had the tumour been discovered later.

**Table 2**  
**Percent of women who have ever had a mammogram, by age group, Canada and provinces, 1994-95**

	Age group					
	Total 40+	40-49	50-59	60-69	70-79	80+
	%					
<b>Canada</b>	<b>64</b>	<b>59</b>	<b>74</b>	<b>71</b>	<b>59</b>	<b>40</b>
Newfoundland	43	48	52	--	--	--
Prince Edward Island	58	50	76	71	--	--
Nova Scotia	49	47	54	57	--	--
New Brunswick	57	57	75	50	38	--
Quebec	67	66	81	67	57	--
Ontario	63	56	71	77	61	40
Manitoba	58	52	67	64	66	--
Saskatchewan	65	52	83	81	57	--
Alberta	65	55	71	83	67	--
British Columbia	69	66	82	70	64	--

Source: National Population Health Survey, 1994-95

**Chart 2**  
**Reason for last mammogram, by age group, Canada, 1994-95**



Source: National Population Health Survey, 1994-95

And if the tumours detected through screening have limited malignant potential, no differences in mortality will be observed.<sup>27</sup>

It is not yet possible to conclude definitively that the rapid increase in mammography in the late 1980s has had an impact on breast cancer mortality in Canada. However, declines in the breast cancer mortality rate in the United States since 1990 have been attributed to early detection through mammography combined with treatment advances, particularly for disease that had spread to the regional lymph nodes.<sup>28</sup> Trends are similar in Canada, and in 1993, the Canadian breast cancer mortality rate was at its lowest point since 1950.<sup>2</sup> The mortality rate declined between 1990 and 1994, as a result of a significant downturn in mortality rates at ages 60-69 and continuing declines in women under age 60.<sup>2</sup> Rates at older ages have remained stable since the late 1980s, but this followed an earlier tendency to increase. Further, the lowest breast cancer mortality rates have occurred in the two provinces with the most extensive breast screening programs and among the highest levels of mammography.<sup>2</sup>

Continued research and monitoring of mortality trends is needed to confirm whether mammography alone, or in combination with other factors, is responsible for these age-specific trends and geographic patterns. The value of screening can only be determined by whether breast cancer mortality rates continue to decline in the future, particularly among women in their fifties and sixties.

### Acknowledgment

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## Appendix

## Table A

## Annual mammograms and mammography rates, by provider, Canada, provinces and Yukon, 1981-1994

	Canada	Nfld.	P.E.I.	N.S.	N.B.	Que. <sup>†</sup>	Ont. <sup>‡</sup>	Man.	Sask.	Alta.	B.C.	Yukon
<b>Number of mammograms</b>												
<b>Fee-for-service<sup>§</sup></b>												
1981	161,907	213	..	..	..	96,699	45,000	..	..	4,811	15,184	..
1982	177,792	426	..	..	..	103,649	50,400	..	..	5,835	17,482	..
1983	212,639	161	..	..	..	120,396	62,000	..	..	7,271	22,811	..
1984	224,808	735	..	..	..	109,734	74,000	..	..	10,952	29,387	..
1985	249,601	989	..	..	..	93,717	98,000	..	..	18,745	38,150	..
1986	314,499	1,072	..	..	..	101,707	123,000	11,349	1,193	25,680	50,498	..
1987	433,664	1,729	..	..	11,047	129,705	155,699	14,867	6,326	38,878	75,413	..
1988	679,693	4,672	3,579	..	14,546	195,965	261,412	18,729	14,407	56,738	109,645	..
1989	847,002	5,946	4,752	..	23,803	234,055	334,545	24,590	23,519	69,172	126,620	..
1990	1,032,246	7,330	5,255	..	27,950	282,854	412,465	23,178	34,739	84,523	153,952	..
1991	1,219,140	11,835	5,559	..	33,872	337,052	497,518	29,317	39,842	99,751	164,394	..
1992	1,210,300	10,085	6,283	..	38,476	341,639	500,004	30,753	44,524	96,292	142,012	232
1993	1,133,378	18,175	6,776	..	38,588	322,790	458,854	32,178	31,860	85,518	138,451	188
1994	1,179,655	19,174	6,529	..	42,470	343,292	481,330	44,633	28,099	85,614	128,319	195
<b>Breast screening program</b>												
1988	4,475	..	..	..	..	..	..	..	..	..	4,475	..
1989	9,371	..	..	..	..	..	..	..	..	..	9,371	..
1990	30,536	..	..	..	..	..	590	..	6,336	626	22,984	..
1991	94,407	..	..	2,872	..	..	15,391	..	14,313	5,948	55,883	..
1992	160,706	..	..	4,132	..	..	40,307	..	15,746	15,837	83,963	721
1993	198,473	..	..	5,723	..	..	45,456	..	26,063	16,148	104,378	705
1994	231,053	..	..	9,991	..	..	55,566	..	25,546	15,371	123,879	700
<b>Total</b>												
1988	684,168	4,672	3,579	..	14,546	195,965	261,412	18,729	14,407	56,738	114,120	..
1989	856,373	5,946	4,752	..	23,803	234,055	334,545	24,590	23,519	69,172	135,991	..
1990	1,062,782	7,330	5,255	..	27,950	282,854	413,055	23,178	41,075	85,149	176,936	..
1991	1,313,547	11,835	5,559	2,872	33,872	337,052	512,909	29,317	54,155	105,699	220,277	..
1992	1,371,006	10,085	6,283	4,132	38,476	341,639	540,311	30,753	60,270	112,129	225,975	953
1993	1,331,851	18,175	6,776	5,723	38,588	322,790	504,310	32,178	57,923	101,666	242,829	893
1994	1,410,708	19,174	6,529	9,991	42,470	343,292	536,896	44,633	53,645	100,985	252,198	895
<b>Mammograms as % of women aged 40+</b>												
<b>Fee-for-service<sup>§</sup></b>												
1981	4	..	..	..	..	8	3	..	..	1	3	..
1982	4	1	..	..	..	9	3	..	..	2	3	..
1983	5	..	..	..	..	10	4	..	..	2	4	..
1984	5	1	..	..	..	9	4	..	..	3	5	..
1985	5	1	..	..	..	7	5	..	..	5	7	..
1986	6	1	..	..	..	8	7	5	1	7	9	..
1987	9	2	..	..	..	8	10	8	7	3	10	..
1988	13	5	14	..	11	14	13	9	7	14	17	..
1989	16	6	19	..	17	17	17	11	12	17	19	..
1990	19	7	20	..	19	19	20	10	18	20	23	..
1991	22	12	21	..	23	23	23	13	20	23	23	..
1992	21	10	23	..	25	22	23	13	22	21	19	6
1993	19	17	25	..	25	21	20	14	16	18	18	4
1994	19	17	23	..	27	21	21	19	13	17	16	4
<b>Breast screening program</b>												
1988	..	..	..	..	..	..	..	..	..	..	1	..
1989	..	..	..	..	..	..	..	..	..	..	1	..
1990	1	..	..	..	..	..	..	..	3	..	3	..
1991	2	..	..	2	..	..	1	..	7	1	8	..
1992	3	..	..	2	..	..	2	..	8	3	12	18
1993	3	..	..	3	..	..	2	..	13	3	14	16
1994	4	..	..	5	..	..	2	..	12	3	16	16
<b>Total</b>												
1988	13	5	14	..	11	14	13	9	7	14	18	..
1989	16	6	19	..	17	17	17	11	12	17	21	..
1990	19	7	20	..	19	19	20	10	21	20	26	..
1991	23	12	21	2	23	23	24	13	27	24	31	..
1992	24	10	23	2	25	22	25	13	30	25	31	23
1993	22	17	25	3	25	21	22	14	28	21	32	21
1994	23	17	23	5	27	21	23	19	26	20	32	20

Source: Provincial and territorial departments of health and breast screening programs

Note: Rates based on estimated population on July 1 in each year.

Coverage of the population ranges from 85% in 1981 to 97% by 1988.

<sup>†</sup> Quebec data from 1981 to 1985 may include up to 10% duplicate reports.

<sup>‡</sup> Ontario fee-for-service data estimated for 1981 to 1986.

<sup>§</sup> Includes small number of men (less than 1% of all mammograms).

Table B

## Annual age-specific mammography rates, by provider, Canada and selected provinces, 1985-1994

Age group and year	Total†						Fee-for-service						Breast screening program					
	Total†	Que.	Ont.	Sask.	Alta.	B.C.	Total†	Que.	Ont.	Sask.	Alta.	B.C.	Total	Que.	Ont.	Sask.	Alta.	B.C.
%																		
<b>40-49</b>																		
1985	..	7	..	..	5	..	..	7	..	..	5	..	...	...	...	...	...	...
1986	..	7	..	..	7	..	..	7	..	..	7	..	...	...	...	...	...	...
1987	..	9	8	4	10	..	..	9	8	4	10	..	...	...	...	...	...	...
1988	14	13	13	9	14	18	13	13	13	9	14	17	-	...	...	...	...	1
1989	16	15	16	14	16	21	16	15	16	14	16	19	-	...	...	...	...	2
1990	19	18	19	19	18	26	19	18	19	19	18	22	1	...	-	...	-	4
1991	22	21	21	23	20	30	21	21	21	23	20	22	1	...	-	...	-	8
1992	21	20	20	24	18	29	19	20	19	24	18	18	2	...	-	...	-	11
1993	18	17	17	17	14	29	17	17	17	17	14	16	2	...	-	...	-	13
1994	..	17	..	15	14	27	16	17	16	15	13	14	..	...	..	...	-	14
<b>50-59</b>																		
1985	..	6	..	..	4	..	..	6	..	..	4	..	...	...	...	...	...	...
1986	..	7	..	..	6	..	..	7	..	..	6	..	...	...	...	...	...	...
1987	..	10	8	4	9	..	..	10	8	4	9	..	...	...	...	...	...	...
1988	15	15	15	8	14	20	15	15	15	8	14	19	-	...	...	...	...	1
1989	19	19	19	15	18	24	19	19	19	15	18	22	-	...	...	...	...	2
1990	24	23	24	28	22	30	24	23	24	22	22	26	1	...	-	6	-	5
1991	30	27	30	39	29	37	28	27	29	24	26	27	3	...	2	15	3	10
1992	32	28	33	41	32	37	28	28	29	26	25	23	5	...	4	16	7	15
1993	32	28	31	44	32	40	26	28	27	17	24	22	6	...	4	27	8	18
1994	..	30	..	39	29	41	27	30	28	14	23	20	..	...	..	25	6	21
<b>60-69</b>																		
1985	..	4	..	..	3	..	..	4	..	..	3	..	...	...	...	...	...	...
1986	..	5	..	..	4	..	..	5	..	..	4	..	...	...	...	...	...	...
1987	..	7	7	2	7	..	..	7	7	2	7	..	...	...	...	...	...	...
1988	12	11	11	6	11	17	12	11	11	6	11	16	-	...	...	...	...	1
1989	15	13	15	10	13	19	14	13	15	10	13	18	-	...	...	...	...	1
1990	19	16	18	24	18	25	18	16	18	16	17	22	1	...	-	8	-	4
1991	24	20	24	32	24	32	21	20	23	17	21	22	3	...	1	15	3	9
1992	27	21	27	37	29	33	22	21	24	20	21	19	5	...	3	17	8	13
1993	26	21	26	41	26	35	21	21	22	14	20	19	6	...	4	27	6	16
1994	..	23	..	37	27	37	22	23	23	11	19	17	..	...	..	26	8	20
<b>70-79</b>																		
1985	..	3	..	..	1	..	..	3	..	..	1	..	...	...	...	...	...	...
1986	..	3	..	..	2	..	..	3	..	..	2	..	...	...	...	...	...	...
1987	..	5	5	2	4	..	..	5	5	2	4	..	...	...	...	...	...	...
1988	8	8	8	3	6	10	8	8	8	3	6	10	-	...	...	...	...	-
1989	9	8	8	6	7	13	9	8	8	6	7	12	-	...	...	...	...	1
1990	11	10	11	11	10	17	11	10	11	10	10	15	-	...	-	1	-	2
1991	15	12	14	16	13	23	14	12	14	13	12	17	1	...	1	3	-	6
1992	17	13	16	20	14	24	14	13	15	16	13	15	3	...	2	4	1	9
1993	16	13	16	20	13	27	13	13	14	12	12	15	3	...	2	8	1	12
1994	..	13	..	21	13	28	14	13	15	12	12	13	..	...	..	9	2	14

Source: Provincial departments of health and breast screening programs

Note: Rates based on estimated population on July 1 in each year.

Saskatchewan and Quebec fee-for-service data for ages 70-79 contain ages 80+.

Ontario fee-for-service data for ages 70-79 contain ages 80+ in 1987 and 1988.

Ontario breast screening program data for ages 40-49 contain ages <40.

Ontario breast screening program data for ages 70-79 contain ages 80+.

† Data cover 87% of Canadian population.