# Review of Literature: Risk Factors for Breast Cancer in Younger Women & Health Promotion Campaigns

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# CHAPTER 1: INTRODUCTION

## *Purpose*

The purpose of this literature review is to highlight the most recent incidence and mortality data for breast cancer in young women, as well as to review the literature on risk factors, health promotion campaigns and self-detection. This is an update to the literature review that was conducted in 2007.

## *Breast cancer in younger women*

Young women present a substantially different picture of breast cancer compared to older women. Breast cancer in women under 35 is rare and tends to be more advanced when detected with aggressive tumours and often, a poorer prognosis [1]. Also, due to the age that these young women are stricken, the potential years of life lost is quite significant compared to other cancers. There are a range of risk factors for young women, including genetic factors/family history, lifestyle factors, and in utero exposures [2]. These risk factors differ from those of older women [3]. Because women under the age of 50 are not targeted by traditional breast screening programs, it is important that young women are made aware of their risk factors, particularly those that may interact with genetic factors to increase their risk, and how to examine their breasts for any changes. Comprehensive, effective health promotion campaigns are crucial for raising awareness about breast cancer in young women.

*Incidence*

The incidence (occurrence) of breast cancer tends to be much lower in young women compared to older women. Table 1 shows the incidence of breast cancer in Canadian women between the ages of 20 and 39 years over the past 15 years. As is expected, women 30-39 years old have significantly higher incidence rates than those 20-29 years of age. Over the past 15 years, it appears that the incidence of breast cancer has been rising in women aged 20-29 years, though the increase is slight. It is possible that the increased incidence is due to earlier diagnosis, as there has been a corresponding decrease in the incidence for women 30-39 years of age, but the small numbers of women affected also produces large variations in the reported rates so needs to be interpreted with these facts in mind.

**Table 1:** Incidence of breast cancer in Canadian women 20-39 years old, per 100,000, 1996-2010*

| Age group | 1996-2000 | 2001-2005 | 2006-2010 |
|---|---|---|---|
| 20-29 | 3.43 | 3.60 | 3.68 |
| 30-39 | 41.02 | 37.73 | 37.90 |

* Data sources: number of new cases for 1996-2007 are from the Public Health Agency of Canada's (PHAC) Cancer Surveillance online (http://dsol-smed.phac-aspc.gc.ca/dsol-smed/cancer/c_age-eng.php); while 2008-2010 are from Canadian Cancer Statistics reports for the corresponding years. Denominators are population counts for females in specific age groups, from Statistics Canada's Annual demographic statistics reports: 1998 (for years 1991-1995), 2003 (for years 1996-2000), 2004 (for years 2001-2002), 2010 (for years 2003-2010).

Every year in Canada, 1 or 2 adolescent females (15-19 years old) are diagnosed with breast cancer as are about 10-15 women who are 20-24 years old and about 65-70 women who are 25-29 years old. The numbers continue to increase as women enter their 30s, with about 230-240 women diagnosed between the ages of 30 and 34 years and 600-625 women who are 35-39 years old [4, 5].

*Mortality*

Corresponding to the incidence rates, mortality rates from breast cancer are higher in Canadian women aged 30-39 than those 20-29 years old. Over the past 15 years, mortality rates for 30-39 year old women have declined, likely as a result of improved screening, diagnostic, and treatment options. There is no clear trend in the mortality rate in the women 20-29 years old since the numbers are small and therefore not stable (they vary greatly with small actual changes in the number of women dying in a given year).

**Table 2:** Mortality rates attributed to breast cancer in Canadian women 20-39 years old, per 100,000, 1996-2010*

| Age group | 1996-2000 | 2001-2005 | 2006-2010 |
|---|---|---|---|
| 20-29 | 0.29 | 0.32 | 0.20 |
| 30-39 | 6.87 | 5.39 | 3.97 |

* Data sources: number of deaths for years 1996-2007 are from PHAC's Cancer Surveillance online (http://dsol-smed.phac-aspc.gc.ca/dsol-smed/cancer/d_age-eng.php); for years 2008-2010 are from Canadian Cancer Statistics.
Denominators are population counts for females in specific age groups, from Statistics Canada's Annual demographic statistics reports: 1998 (for years 1991-1995), 2003 (for years 1996-2000), 2004 (for years 2001-2002), 2010 (for years 2003-2010).

The number of very young women who die from breast cancer is not released due to the small numbers involved. In Canada, about 3-9 women who are only 25-29 years old die from breast cancer every year as do about 25-30 women 30-34 years old and 80-85 women who are only 35-39 years old at the time of their death [4, 5].

## *Outline of the report*

The purpose of this report is to update the 2007 literature review and focuses on three areas of interest. First, we investigate risk factors, particularly lifestyle and in utero factors, for breast cancer in young women. Second, we investigate recent health promotion campaigns targeting breast cancer in young women as well as campaigns on general awareness, social marketing and health promotion strategies that are successful at targeting this age group. Finally, we review changes in self-detection messaging and strategies as well as mechanisms for enhancing knowledge of self-examination for breast cancer in young women.

The literature review is made up of six key sections. The specific goals and objectives for this report are outlined in chapter two. Chapter three describes the methods used to conduct the literature searches. Results of these searches are described in chapter four with recommendations based on the literature reviews are outlined in chapter five.

# CHAPTER 2: GOALS AND OBJECTIVES

## *Goals*

The primary goal of this literature review was to gather information on risk factors for and self-detection of breast cancer in young women, as well as to update the 2007 review on health promotion campaigns. Young women, for the purposes of this report, are defined as age 39 years or younger.

## *Objectives*

There were three main objectives for completing the literature reviews. These findings will assist in educating about breast cancer in younger women. The objectives of this report include:

- Highlighting recognized risk factors for breast cancer in young women
- Identifying recent health promotion campaigns targeting young women with breast cancer awareness
- Determining any changes in self-detection practices for breast cancer in young women



# CHAPTER 3: METHODS

A literature review was conducted to obtain any articles relevant to breast cancer in young women. Databases, including Pubmed, Google Scholar, and EBSCO, were searched for relevant journal articles using the following key words:

- breast cancer
- young women
- women under 35
- women under 40

These key words were searched in combination with other terms related to the project:

- risk factor (and specifically broken down by key risk factor if needed, particularly stress, diet, smoking, alcohol and breastfeeding)
- awareness
- social marketing
- self-detection
- health promotion

Reference lists were also reviewed to identify additional relevant sources. Articles were selected based on the goals and objectives of the project, namely whether they addressed risk factors, health promotion or self-detection for breast cancer in women under the age of 40 years. Health promotion literature was searched through academic journals but also through the grey literature (via Google) to identify recent social media campaigns and marketing techniques targeting young women that may not be traditionally evaluated.

Articles were screened and considered based on the following inclusion criteria:

- Relevant to North American women
- Target women under 35. This was expanded to women under 40 and included articles with a wider age range provided they presented data specifically relevant to younger women. In rare cases, where no data existed for women under 40 years, articles were accepted if their age range covered women aged 20-44.
- Primary sources. Review articles were excluded
- For risk factor and self-detection data, articles published within the last 20 years
- Because the most recent literature review on health promotion was conducted in 2007, health promotion and awareness campaign searches focused on more recent publications



# CHAPTER 4: RESULTS

## *Risk factors*

This literature review examines lifestyle and in utero (before birth) factors to identify those that may be modifiable. Each of the following lifestyle factors are examined individually: oral contraceptive use, alcohol consumption, tobacco use (smoking), physical activity, body size (BMI), stress, diet and reproductive factors (parity and breastfeeding).

### Oral contraceptives

Mayberry [6] conducted a case-control study with African-American women under the age of 40 years. The researchers interviewed 177 women with breast cancer and 137 women without cancer. The authors found that the odds of a woman with breast cancer using oral contraceptives were higher than the odds of a woman with breast cancer never using oral contraceptives. This association was significant for women using oral contraceptives for > 10 years, but was positive at shorter duration as well. However, the results are limited to women of African American heritage. When the same women were combined with older women (up to 54 years old), the association was not significant. Also, no association was detected for Caucasian women 20-54 years of age [7].

McCredie et al. [8] conducted a case control study of 467 young Australian women (under 40 years old) with breast cancer and 408 women without. Data was collected through questionnaires and included family pedigrees. Their data indicates that there is an association with the duration of oral contraceptive use for women with breast cancer. Women with breast cancer had a significantly higher odds of having used oral contraceptives for 5 years or longer than women with cancer who had used never used them or had used them for less than 5 years before diagnosis (odds ratio=1.3). Similarly, the odds of a woman with breast cancer having started using oral contraceptives before the age of 19 were higher than for women with cancer having started their use at 19 years or older (odds ratio=1.4).

Ursin et al. [9] carried out a case-control study with 744 breast cancer patients under 40 years old and an equivalent number of women without cancer, matched on age, race, parity, and neighbourhood. Reproductive and oral contraceptive histories were obtained using in-person interviews. The authors determined that while the odds of a woman with breast cancer using oral contraceptives for 12 years or longer were higher than the odds of women with breast cancer never using them (odds ratio=1.4), the association was not statistically significant. Similarly, the odds of a woman with breast cancer using oral contraceptives for longer than 3 years and having started their use before the age of 20 were greater than the odds for women not using them (odds ratio=1.38). Again, the association was not significant. Although these authors found no significant association, the odds are positive, indicating a trend similar to other research in this area.



Tavani et al. [10] combined results from two Italian case-control studies of women under 40 years of age and included 579 women with breast cancer and 668 women without cancer. Data was obtained through questionnaires. The authors found that oral contraceptive use was not a significant risk factor for breast cancer. Women with breast cancer had similar odds of having ever used oral contraceptives (odds ratio=1.05). The association was not significant but is positive, which is consistent with other findings regarding oral contraceptive use and breast cancer in young women.

Narod et al. [11] completed a case-control study of 1311 pairs of women positive for BRCA1 and BRCA2 genes but with breast cancer (cases) and without breast cancer (controls). The women were from a variety of western/developed countries, including Canada. They report that the odds of having used oral contraceptives in younger (under 40 years) women with BRCA1-positive breast cancer was significantly higher than odds of never use (odds ratio=1.38). There was no association between oral contraceptive use and breast cancer in BRCA2 carriers.

Althius et al.[3] conducted a case-control study in the United States investigating different risk factors for breast cancer in 3302 women between 20 and 54 years old. In this study, the odds of women under 35 years old with breast cancer using oral contraceptives for at least six months were double (odds ratio=2.03) the odds of women with breast cancer having never used oral contraceptives. Women with breast cancer also had higher odds of having used oral contraceptives within the previous five years (odds ratio=2.26) and of having used oral contraceptives for 10 or more years prior to diagnosis (odds ratio=1.44). Each of these results was statistically significant.

Jernström et al. [12] report on a case-control of Swedish women under 40 years old at diagnosis. The odds of women starting oral contraceptive use before 20 years of age having breast cancer were double the odds of starting oral contraceptives at a later age. For women diagnosed before the age of 35 years, the odds were also significant (odds ratio=1.53).

Dolle et al. [13] conducted a population-based case-control study involving women younger than 45 years old who had breast cancer. Women with breast cancer (n=897) were age-matched to controls (n=961) using random digit dialling. In the group of women under 40 years, the odds of a woman with breast cancer having ever used oral contraceptives was higher than for women with cancer never using contraceptives (odds ratio=1.6). These authors also report that the odds of a woman with breast cancer beginning oral contraceptives before 18 years of age was higher than for women with cancer starting them when they were 22 years or older. Younger women with triple negative breast cancer (cancer that tests negative for estrogen receptors, progesterone receptors and HER2) had a higher odds ratio of having ever used oral contraceptives when compared with women with non-triple negative breast cancer indicating a possible link between oral contraceptive use and the type of breast cancer. This study included only Caucasian women but the results are consistent with other studies on oral contraceptives and breast cancer in young women.

The evidence suggests that there is an association between the use of oral contraceptives and a diagnosis of breast cancer in younger women. More recent publications indicate that oral contraceptive use is likely associated with specific types of breast cancer, specifically triple negative tumours and perhaps, to specific ingredients in the medication. The evidence suggests a possible link between starting oral contraceptives as a teen and the development of breast cancer.

## Alcohol consumption

Smith et al. [14] completed a case-control study including 755 women who were 35 years or younger at diagnosis and age-matched them with physician-associated controls. Although there was an indication of a trend in the amount of alcohol consumed and a diagnosis of breast cancer, the associations were not statistically significant for this large case-control study. Of note, the association between alcohol consumption and breast cancer was U-shaped, with cancer patients more likely to be moderate users of alcohol while women without breast cancer were more likely to be either non-users or heavy users of alcohol.

Swanson et al. [15] conducted a population-based case-control study of women under the age of 45 to determine the effect of alcohol consumption at different stages on breast cancer risk. Detailed lifetime histories of alcohol use were obtained in interviews and logistic regressions determined odds ratios for 1645 cases and 1497 controls. No association was found between breast cancer and drinking during the teenage years or early adulthood. The odds of women with breast cancer being drinkers were only slightly higher than for women without breast cancer (odds ratio=1.1). However, women with breast cancer had significantly higher odds of drinking 14 or more drinks per week within the 5 years before diagnosis than women without cancer (odds ratio=1.7).

McCredie et al. [8], described above, report that alcohol use was not associated with breast cancer in women under 40 years old in a case-control family study done in Australia. The odds of a woman with breast cancer consuming 10 or more drinks per week was similar to the odds of a woman without breast cancer consuming the same amount (odds ratio=0.99).

Tavani et al. [10], described above, report that the odds of a woman with breast cancer consuming 2 or more drinks per day was slightly (but not significantly, statistically) higher than the odds of a woman without breast cancer consuming a similar amount (odds ratio=1.3).

Althius et al. [3], described above, report that the odds of women under 35 years of age who had breast cancer consuming 14 or more drinks per week was higher than the odds of women who did not have breast cancer (odds ratio=1.7). However, this result was not statistically significant. However, when including all women in the study (20-54 years old), the results were statistically significant and had a similar odds ratio (2.06).

The research on alcohol consumption and breast cancer in younger women is not definitive but suggests a possible association. However, as with many risk factors for cancer in younger adults, there is limited data available, the studies all define alcohol consumption differently, and the duration of exposure is limited by the age of the participants. Literature from research involving older women with breast cancer conducted over the past two decades indicates a positive



association between breast cancer and alcohol consumption in both premenopausal and postmenopausal women [16].

## Cigarette smoking

Smith et al. [14], described above, did not find a significant association between smoking and breast cancer. The odds of a woman with breast cancer having smoked more than 200 cigarettes was higher, but not significantly, than for women who never smoked (odds ratio=1.1). Similarly, the odds of young women with breast cancer having been exposed to second-hand smoke (passive smoking) in both childhood and adulthood were slightly (but not significant, statistically) higher than for women without exposure (odds ratio=2.4).

McCredie et al. [8], described above, found no significant association between smoking and breast cancer in women under 40 (odds ratio=1.2), but again the association was positive suggesting a possible association.

Jernström et al. [12], described above, report the opposite of the previous two studies and that having *never* smoked was significantly associated with a diagnosis of breast cancer in their case-control study of women diagnosed by the age of 40 years (odds ratio=0.60).

Ginsburg et al. [17] investigated the link between cigarette smoking and breast cancer in a case-control study of 2538 pairs of women positive for BRCA1 and BRCA2 genes but with and without breast cancer. In the women under 40 years of age at diagnosis, no association was detected between tobacco smoking and breast cancer (odds ratio=1.00). Of concern in this study, an average of 7.7 years had elapsed between diagnosis and interview. Thus, women with aggressive disease and/or shorter durations of survival were under-represented.

There is limited and conflicting evidence for the association between breast cancer in young women and cigarette smoking. However, the evidence in older women with breast cancer points to a positive association. Early age of smoking commencement, higher pack years and longer duration of smoking have all been shown to increase the risk of breast cancer by 15% to 40% in older women.  Second hand smoke, or passive smoking, has also been associated with breast cancer, particularly in premenopausal women (Johnson, 2011). Although further research is needed to determine if the association exists in women diagnosed before 40 years of age, the short duration of exposure may affect the possibility of making the link.

## Physical activity

Bernstein et al. [18] completed a case-control study of 545 American women under 40 years of age who were newly diagnosed with breast cancer and 545 controls matched for age, race, parity and neighbourhood. Lifetime histories of exercise were obtained in interviews. The study found that the risk of breast cancer decreased with increasing average weekly hours of exercise between menarche and their reference date (estimated cancer onset). Particularly, the odds of women with breast cancer exercising an average of 3.8 hours or more per week was significantly lower than for women without cancer (odds ratio=0.42). This study was limited to Caucasian women who were born in Europe, Canada, or the USA.



Chen et al. [19] conducted a population-based case-control study of women 21-45 years old in the United States investigating the association between regular leisure-time physical activity and breast cancer. The study involved 747 women with breast cancer and 961 controls. Data was collected through personal interviews, with questions on frequency and duration of different types of exercise in the two years prior to diagnosis (or reference date), as well as for exercise history from 12 to 21 years of age. No significant association was found between breast cancer and the frequency of leisure-time physical activity (odds ratio=0.93), time spent exercising each week (odds ratio=0.92) or METS (metabolic equivalent energy expenditure units) (odds ratio=0.95).

McCredie et al. [8], described above, also failed to find and association between breast cancer in younger women and their level of physical activity (odds ratio=1.0).

Magnusson et al. [20] completed a case-control study of British women diagnosed with breast cancer before menopause. They interviewed 1560 women with breast cancer (750 <36 years old) and 1548 women without cancer (748 <36 years old). They found no significant association between participating in sports for >1 hour per week, on average, and breast cancer for women 35 year of age and younger (odds ratio=1.1).

The evidence for an association between breast cancer in younger women and their participation in regular physical activity is inconclusive, with one study showing a significant association and three studies showing nothing of statistical significance.

## Body size

Mayberry et al. [6], described above, found no relationship between breast cancer and body mass index (BMI) at 18 years of age. They report that women with breast cancer were more likely, but not significantly, to have a BMI of less than 24.9 $kg/m^2$ at the time of diagnosis than to have a higher BMI. However, the association applies only to African American women. In a separate report including both African American and Caucasian women from the same study, no association between body weight and breast cancer was detected [7]. However, this second study included women 20 to 54 years of age.

Chen et al. [19], described above, found that women with breast cancer were significantly less likely to be overweight (BMI≥25.6) than to have a healthy weight or underweight (odds ratio=0.74).

Tavani et al. [10], described above, report a significant inverse relationship with BMI. The odds of women with breast cancer being obese (BMI≥30) were lower than for being underweight (BMI≤20) (odds ratio= 0.51).

Althius et al. [3], described above, report that the odds for women with breast cancer having a low BMI (≤23 $kg/m^2$) were higher, but not significantly, than for women with higher BMI (odds ratio=1.51).



Magnusson et al. [20], described above, report that younger women with breast cancer were less likely (but not significantly) to rated themselves as 'thin' or 'average' than to rate themselves as 'plump' at the age of 10 years (odds ratio=0.82).

There are no studies that have shown a statistically significant association between body weight and breast cancer in younger women. Several of the studies cited show non-significant associations between being underweight and being diagnosed with breast cancer, but the studies use different BMI cut-off points and different ages for BMI calculation. The reviewer suggests a need to complete a systematic literature review and meta-analysis to look at several issues regarding breast cancer diagnosis and potential risk factors and also suggest that researchers consider the change in body weight between childhood and menarche or age at diagnosis.

## Stress

Peled et al. [21] conducted a case-control study of 622 women aged 25-45 to assess depression, happiness and optimism using Brief Symptom Inventory and Life Event Questionnaires. Women with breast cancer had higher scores of depression and lower happiness and optimism scores compared to controls. Severe life events, such as loss of a parent, divorce of parents before age 20, loss of a job, were investigated. It was found that the odds of women with breast cancer experiencing at least one severe life event was higher than for women with no events (odds ratio=1.62). Also, the odds of women with breast cancer having high happiness and optimism scores was lower than the odds of having low scores (odds ratio=0.75). While this was an interesting study with a large sample size, the response rate was very low (25%) and controls were not randomly selected, which may affect the validity of the study.

There is a very little literature published on the association between stressful life events and breast cancer specifically in young women. More research is needed to further examine this association; however, this study is consistent with findings in older women. For instance, Ollonen et al. [22] conducted a case control study in women aged 32-74 with breast cancer symptoms and concluded that breast cancer patients had significantly more severe stress in the previous ten years than women without breast cancer (p=0.02).

## Diet

Potischman et al. [23] completed a case-control study in the United States with 1647 women with breast cancer and 1501 controls under the age of 45 years. They interviewed them about the frequency of consumption and portion size for 29 food items at ages 12-13 years and found that diet is not strongly associated with decreased breast cancer risk. Mothers of a subset completed questionnaires as well. The odds of women with breast cancer consuming ≥6.5 portions of chicken at 12-13 years of age was higher than for women consuming fewer portions (odds ratio=1.28). Also, the odds of women with breast cancer consuming more portions of high-fat meat was higher than for women consuming less (odds ratio=1.22). There was no significant association between breast cancer risk and high consumption of fruits and vegetables, animal fat, high-fat foods, high-fat snacks, desserts or dairy during adolescence. One flaw of the study was the potential for recall bias, as many people would be unable to recall what their diet consisted of (and portion size) at 12-13 years of age. In addition, the authors state that response rates differ by race, which may affect results.

Potischman et al. [24] subsequently found modest protective effects of some food groups in a case-control study of women under 45 years old, with 568 cases of in situ and localized tumours and 1451 population controls. Although not statistically significant, the odds of women with breast cancer consuming a diet with a high cereal and grain content (odds ratio=0.84), vegetable content (odds ratio=0.86), bean intake (odds ratio=0.87) were lower than for diets low in these items.

Tavani et al. [10], described above, report that the odds of women with breast cancer consuming ≥8 servings of raw vegetables every week were lower than the odds of consuming fewer servings (odds ratio=0.57). The odds of women with breast cancer having a high daily caloric intake was higher than having a low caloric intake (odds ratio=1.38).

There is no clear evidence for a link between dietary intake and breast cancer in young women. Additional research is required.

## Reproductive factors: parity and breastfeeding

Tavani et al. [10], described above, show that for women under 40, the odds of women with breast cancer having had children was higher than the odds women having cancer if they had no children (odds ratio=1.58). Also, the odds were higher for women who had multiple children (odds ratio=1.53 for 1 child, odds ratio=1.70 for 2 children) and women who gave birth within the past three years (odds ratio=3.8).

Althius et al. [3], described above, found that the odds of women with breast cancer having their first child between the ages of 20 and 24 was higher than the odds of women with cancer having them at a later age (odds ratio=2.49). Note that this result may be confounded by the age at diagnosis, which would affect a woman's reproductive choices.

Largent et al. [1] carried out a population based case-control study of 298 women under 35 years old with breast cancer and found that women with higher number of children were at higher risk of breast cancer. The odds of women with breast cancer being young (<20 years) at their first birth were also higher than the odds of cancer for women who were older (odds ratio=3.0) at first birth. Finally, the odds of women with breast cancer having breastfed their child were lower than odds of a cancer diagnosis for women not breastfeeding their child (odds ratio=0.2).

The United Kingdom National Case-Control Study Group [25] conducted a case-control study with 755 pairs of women under 36 years old. They report that that the odds of women with breast cancer breastfeeding for at least 3 months was lower than the odds of cancer if women did not breastfeed or breastfed for a shorter duration (odds ratio=0.94). Increasing duration of breastfeeding beyond 3 months showed no added benefit in this study. This was a very large study with results directly relevant to our age classification of young women.

Largent et al. [1], described above, report that the odds of women with breast cancer having breastfed their child were lower than odds of a cancer diagnosis for women not breastfeeding their child (odds ratio=0.2).



Although it appears that having a child when you are young may be associated with breast cancer in younger women, these results must be interpreted with caution since the diagnosis of breast cancer may be affected by the medical attention allied with prenatal care. The studies cited also show an association between breastfeeding and the risk of breast cancer, with breastfeeding shown to be somewhat protective. Although the number of young women who have given birth and breastfed is limited, the findings are in keeping with those reported for older women.

## In utero and early life exposures

Sanderson et al. [26] used a population-based case control study of 746 women with breast cancer and 960 controls to investigate the relation between perinatal factors and breast cancer risk in women 21-45 years old (and 50-64 years old: results not reported here). In-person interviews were conducted to gather data. The study identified a U-shaped association between birth weight and breast cancer risk. The odds of women with breast cancer being less than 2500g (odds ratio=2.3, not statistically significant) or greater than 4000g (odds ratio=1.7, statistically significant) at birth were higher than the odds of cancer in women who were between 2500 and 4000 g at birth. The odds of a woman under 30 years of age at diagnosis being diagnosed with breast cancer were significantly higher for women exposed to perinatal maternal smoking than for women born to non-smokers (odds ratio=1.9).

Weiss et al. [27] conducted a population-based case-control study of Caucasian women in the United States with 534 women with breast cancer and 497 women without cancer. Subgroup analysis was performed on white women under the age of 45 years at diagnosis (at interview for controls). Questionnaires were completed by mothers of participants on early life experiences. No significant evidence of an association was found between maternal smoking (odds ratio=1.06) or diethylstilbestrol (DES) exposure (odds ratio=0.74) during pregnancy. The odds of women with breast cancer having been breastfed was lower (odds ratio=0.74) than the odds of cancer for women who were not breastfed.

Sanderson et al. [28] combined the data from two population-based case control studies of women diagnosed with breast cancer under the age of 45, yielding 510 cases and 426 controls. Data was collected through mailed questionnaires or telephone interviews. No association was reported between breast cancer and maternal pre-pregnancy BMI, thyroid disease, hypertension, pre-eclampsia, eclampsia, smoking, alcohol or coffee consumption. The odds of a woman with breast cancer's mother having gained 25-34 pounds during pregnancy was significantly higher than for women whose mothers gained less weight (odds ratio=1.5).Although the odds of a woman with breast cancer's mother having gained >35 pounds was higher than the odds of cancer in women whose mothers gained 15-24 pounds, it was not statistically significant (odds ratio=1.2). The odds of a women with breast cancer having a mother who experienced severe/nausea and vomiting during pregnancy were significantly higher than the odds of cancer in women whose mothers did not (odds ratio=1.5). The odds of a woman with breast cancer's mother taking antiemetic medications or DES was higher, but not significantly, than the odds of cancer in women whose mothers did not (odds ratio=2.9 and 2.3, respectively). The odds of a woman with breast cancer being <2500g or ≥4000g at birth were higher, but not significantly, than the odds for women with cancer being born weighing between 2500 and 4000g (odds

ratio=1.2 and 1.3, respectively). Similarly, the odds of a woman with breast cancer having been exposed to tobacco smoke in utero were higher, but not significantly, than the odds of a woman with cancer not being exposed (odds ratio=1.3). These authors report no association between breast cancer and having been breastfed as an infant.

Innes et al. [29] carried out a case-control study, involving 484 cases of women aged 14-37 years, to investigate the impact of early life factors on breast cancer risk. They found a U-shaped association between birth weight and breast cancer risk. The odds of a woman with breast cancer being <2500g or ≥4500g at birth was significantly higher than the odds of cancer in women born weighing 2500-4500g (odds ratio=3.10). Other factors associated with breast cancer included being first born (odds ratio=1.27) and a trend of increased risk with increasing maternal and paternal age at birth.

The literature supports an association between birth weight and the risk of breast cancer in younger women, with those born weighing <2500g or ≥4000g being at somewhat elevated risk. The research also indicates that being exposed to smoke in utero is also likely associated with breast cancer in younger women. Other possible factors reported herein are either inconsistently associated with breast cancer or reported in only one study and need further evidence before the reliability of the association can be confirmed.

### Bisphenol A

Prolonged exposure to oestrogen, through the use of oral contraceptives and/or hormone replacement therapy has been linked to higher rates of oestrogen-linked types of breast cancer [30, 31]. One possible environmental source of oestrogen (xenoestrogen) is bisphenol A, a compound used in plastics including can liners, baby bottles, and dental sealants. Whether exposure to environmental sources of oestrogen is cumulative or whether exposure during the perinatal period is more important is currently being researched. Mice and rats foetuses exposed to bisphenol A have higher rates of reproductive and mammary gland development problems [30]. However, it is incredibly difficult to reliably measure exposure to environmental exposures in humans; exposures that occur during the perinatal period are even more difficult to measure. At a later stage of development, experiments on human breast tissue show that exposure of the tissue to bisphenol A is linked to the development of more aggressive types of tumours [31]. On the other hand, the authors of a recent study found that the level of bisphenol A in the blood of women with breast cancer was the same as the level found in women without cancer [32].

## *Breast cancer awareness and health promotion campaigns*

Peacey et al. [33] conducted a cross-country study on awareness of breast cancer risk factors in women aged 17-30 years old and found that breast cancer awareness is rather low. The study asked women to identify related health problems and lifestyle factors. One-third of respondents were unable to identify any risk factors of breast cancer. Only 34% of respondents believed lifestyle factors had any relevance to breast cancer risk. The most commonly identified risk factors for breast cancer were smoking and stress; however, fewer than 8% were able to identify alcohol, exercise, dietary fat, dietary fibre or weight as risk factors. The authors recommend new messaging focused more on promoting healthy lifestyles rather than trying to increase awareness of individual risk factors.

Bottorff et al. [34] held focus groups with 46 young women (15-24 years old) to examine their responses to information about active and second hand (passive) smoke and their relationship to breast cancer in order to get advice on messaging. Women were interested in knowing risk factors, as they were previously unaware of them. The link between smoking and breast cancer was shocking to participants and they wanted detailed information on how the mechanisms worked. Suggestions on marketing included: make it about protecting others, give straight facts (science, statistics) and use personal stories to establish a connection and overcome desensitization. Younger women in the group favoured fear-based campaigns and hard-hitting messages, while older women suggested emphasis on empowering and positive messages. The women were mostly Caucasian and had some form of higher education, which may limit generalizability. The study was smoking-specific; however, many of the suggestions may be applicable to other forms of health promotion and awareness.

Haines et al. [35] report that breast cancer campaigns targeting young women need to be re-evaluated. This study analyzed 32 recent breast cancer campaigns targeting young women and used focus groups to obtain young women's (ages 15-24) responses to three campaigns. Most breast cancer messages targeting this age group are positive in their underlying tone; however, some are negative and purposefully shocking. General aims of breast cancer campaigns are to promote breast cancer education and awareness. The women in the focus groups were concerned with the sexualized, semi-nude images and found it alienating that all campaigns use model bodies. Recommendations included using different body types and to stop presenting breast cancer as an "ugly" disease that alters a woman's body, beauty and health.

In 2000, a network of substance abuse prevention professionals in central and southwestern Ontario evaluated a campaign to increase awareness about binge drinking in 19 to 24 year old adults [36]. Recommendations based on responses from 66 young adults who participated in post-campaign focus groups included using a "serious" tone in campaign messages, using messages that stand out from advertisements by using vivid graphics or a simple, quiet tone, making messages of direct personal relevance to the target audience, using real stories and local statistics, and making messages that focus on immediate and short-term risks. Although this evaluation was based on binge drinking, the age group is appropriate and it involved a health-related campaign making the recommendations applicable to messaging for breast cancer awareness in younger women.

In 2007, the *Team Shan* Community Project conducted a breast cancer awareness campaign targeting women 15-29 years of age, physicians and other healthcare providers, and the general public in a region of southwestern Ontario [37]. Activities included television, radio, print and interactive media (Team Shan website and Facebook group). Post-campaign questionnaires were completed by 301 young women from 3 secondary schools, 2 post-secondary educational institutions, and 1 community site in the target area. Over 80% of respondents were aware of the campaign with television/radio and print material being most often cited as the source of information. Of the 230 respondents who answered the question, 131 (57%) responded that the main message was that breast cancer can happen at any age. About two thirds of the young

women who participated claimed to have knowledge of the facts about breast cancer, including risk factors and symptoms.

Fairley [38] describes the "BodyTalk" smartphone application (particularly for iPhones and Android phones) developed by the Centre for Disease Control's Advisory Committee on Breast Cancer on Young Women. Because many young people have access to a smartphone, disseminating breast cancer campaign and education information to women under 40 years old through this medium would be an easy and effective means of increasing awareness. The proposed purpose of this application would be to educate young women on lifestyle factors (smoking, exercise, diet and drinking), family history and genetic factors, and on support networks in their area. It would also be able to utilize user profiles to develop person-specific plans for healthy living. Because this is a relatively new idea, presented at the Committee's January 2011 meeting, it is still in development and has yet to be evaluated.

Social media has become a part of breast cancer awareness. Recent "Facebook" campaigns had women posting various cryptic and provocative messages, such as the colours of the brassier they were wearing and "I like it on the ____", as part of their Facebook status during Breast Cancer Awareness month to increase awareness of breast cancer [39, 40]. Because this tends to be outside evaluated programs, it is unknown whether these campaigns were effective at promoting awareness and knowledge of breast cancer or if they actually encourage young women to look further for facts about the disease.

In general, awareness of breast cancer and its risk factors is low in young women and campaigns providing this information tend to be ineffective and in need of change. The Team Shan project showed that awareness campaigns can be effective in raising awareness in young women using a multi-media approach.

## Self-detection of breast cancer in young women

Wardle et al. [41] show that knowledge and practice of breast self-examination (BSE) is low in women 17-30 years old. A questionnaire was sent to 16,486 women across 20 European countries to determine attitudes towards breast self-examination. At that time, only 8% of respondents reported regular BSE, with about 1/3 of them performing it regularly. Over half over the respondents did not know how to examine their breasts or what to look for. Attitudes towards BSE and its importance significantly predicted whether it was performed. Those who regarded BSE as highly important were 15 times more likely to perform BSE than those who considered it of low importance. This was a large study but is out of date.

Merchant et al. [42] report that 45% of younger women (most were <35 years, white, and single) attending an emergency department in a northeastern USA state in 2002 performed breast self examination within the past year while 23% had never performed one. However, 82.5% correctly answered that they should perform BSE monthly.

Malak et al. [43] found that peer education, social support and self-esteem were found to influence BSE in a study of 65 students with a mean age of 20 years. A questionnaire was administered investigating BSE knowledge, self-esteem and social support. Findings indicate

that knowledge and practice ratios increase with peer support, with the proportion of women practice BSE increasing from 7.7% to 92.4%. It is important to interpret these results with caution as the sample size is small.

Jones et al. [44] also found that attitude towards the importance of breast cancer and early detection dictates BSE practices. The researchers received 200 responses to a questionnaire by undergraduates under 35 years old, living in the UK. They report that non-examiners saw fewer benefits of BSE and did not perceive themselves to be susceptible to breast cancer. This study had a relatively small sample size and may not be generalizable to populations with differing levels of knowledge of BSE and breast cancer.

Breast-self examination for the detection of breast cancer is no longer actively recommended by the Canadian or American cancer societies. However, the American Cancer Society offers BSE as an "option" for young women [45] and the Canadian Cancer Society suggests that women "know their breasts"[46]. Meanwhile, the Breast Cancer Society of Canada continues to promote BSE [47] while the Canadian Breast Cancer Foundation promotes being "breast aware" [48]. Thus, it is not surprising that the knowledge and practice of BSE is sporadic.



## Limitations of this review

As with any study, this literature review has limitations. The major limitations are:

- The amount of published research available regarding risk factors for breast cancer in young women is limited. As such, some articles include women up to 45 years old. As such, the results may not be as applicable, particularly to the youngest women.
- Although we attempted to review all of the relevant articles, we cannot be sure that all have been retrieved.
- There was little research on the interplay of different risk factors. Rather, risk factors were identified on an individual basis. Since no one factor acts alone, large trials that are able to control for confounding while investigating a number of risk factors would be instrumental in providing information on this interplay.



# CHAPTER 5: RECOMMENDATIONS

Based on the published research highlighted in this literature review, the authors suggest the following recommendations, to successfully educate young women about breast cancer.

1. *Inform the public about the potential risk to young women*. Although breast cancer is uncommon in women under 30 years of age, young women, parents, and medical practitioners need to know what symptoms may indicate the presence of breast cancer and that breast cancer is not a disease limited to older adults.

2. *Include statistics, science, causal mechanisms and personal stories in health promotion campaigns*. Health promotion campaigns may be more successful if they are personal and relatable to young women. However, they must still present the facts.

3. *Include risk factor information in health promotion campaigns*. Some risk factors, such as genetics, are not within an individual's control. However, maintaining a healthy lifestyle by following Canada's Food Guide, being physically active, and being smoke free is advisable for everyone, and may reduce the risk of breast cancer.

4. *Be empowering and positive*. Breast cancer health promotion campaigns should incorporate women of all different shapes, colours, sizes and ages so that all women can relate to them. Messages should emphasize strength and empowerment, rather than using scare tactics or show women as passive and helpless.

5. *Provide breast self-detection of breast cancer information to young women.* The confusion caused by the decision to discontinue promotion of BSE to Canadian women has created an informational gap for young women who may not receive regular clinical exams and most of whom should not receive screening mammograms.

6. *Explore new means of reaching young women*. Social media and smartphone technology are global phenomena capable of reaching young women of all education, socioeconomic and geographic levels.



# REFERENCE LIST


(1) **Largent J, Ziogas A, Anton-Culver H**. Effect of reproductive factors on stage, grade and hormone receptor status in early-onset breast cancer. *Breast Cancer Research* 2005; **7**: R541 - R554.

(2) **Bouchardy C**. Recent increase of breast cancer incidence among women under the age of forty. *British Journal of Cancer* 2007; **96**: 1743-1746.

(3) **Althuis MD, *et al.*** Breast cancers among very young premenopausal women (United States). *Cancer Causes and Control* 2003; **14**: 151-160.

(4) **Canadian Cancer Society**. Cancer in adolescents and young adults (15-29 years). *Canadian Cancer Statistics* 2009; **2009**: 68-88.

(5) Public Health Agency of Canada. Cancer Surveillance Online. In: Public Health Agency of Canada, 2011.

(6) **Mayberry RM**. Age-specific patterns of association between breast cancer and risk factors in black women, ages 20 to 39 and 40 to 54. *Annals of Epidemiology* 1994; **4**: 205-213.

(7) **Mayberry R**. Breast Cancer Risk Factors among Black Women and White Women: Similarities and Differences. *American Journal of Epidemiology* 1992; **136**: 1445-1456.

(8) **McCredie MRE, *et al.*** Breast cancer in Australian women under the age of 40. *Cancer Causes and Control* 1998; **9**: 189-198.

(9) **Ursin G, *et al.*** Use of oral contraceptives and risk of breast cancer in young women. *Breast Cancer Research and Treatment* 1998; **50**: 175-184.

(10) **Tavani A, *et al.*** Risk factors for breast cancer in women under 40 years. *European Journal of Cancer* 1999; **35**: 1361-1367.

(11) **Narod SA, *et al.*** Oral Contraceptives and the Risk of Breast Cancer in BRCA1 and BRCA2 Mutation Carriers. *Journal of the National Cancer Institute* 2002; **94**: 1773-1779.

(12) **Jernström H, *et al.*** Impact of teenage oral contraceptive use in a population-based series of early-onset breast cancer cases who have undergone BRCA mutation testing. *Eur J Cancer* 2005; **41**: 2312-2320.

(13) **Dolle JM, *et al.*** Risk Factors for Triple-Negative Breast Cancer in Women Under the Age of 45 Years. *Cancer Epidemiology Biomarkers & Prevention* 2009; **18**: 1157-1166.

(14) **Smith SJ, *et al.*** Alcohol, smoking, passive smoking and caffeine in relation to breast cancer risk in young women. *British Journal of Cancer* 1994; **70**: 112-119.

(15) **Swanson CA, *et al.*** Body Size and Breast Cancer Risk among Women under Age 45 Years. *American Journal of Epidemiology* 1996; **143**: 698-706.

(16) **Singletary KW, Gapstur SM**. Alcohol and Breast Cancer. *JAMA: The Journal of the American Medical Association* 2001; **286**: 2143-2151.

(17) **Ginsburg O, *et al.*** Smoking and the risk of breast cancer in BRCA1 and BRCA2 carriers: an update. *Breast Cancer Research and Treatment* 2009; **114**: 127-135.

(18) **Bernstein L, *et al.*** Physical Exercise and Reduced Risk of Breast Cancer in Young Women. *Journal of the National Cancer Institute* 1994; **86**: 1403-1408.

(19) **Chen C-L, *et al.*** Leisure-time physical activity in relation to breast cancer among young women (Washington, United States). *Cancer Causes and Control* 1997; **8**: 77-84.

(20) **Magnusson C, *et al.*** Body fatness and physical activity at young ages and the risk of breast cancer in premenopausal women. *British Journal of Cancer* 2005; **93**: 817–824.
(21) **Peled R, *et al.***, Breast cancer, psychological distress and life events among young women. 10.1186/1471-2407-8-245.
(22) **Ollonen P, Lehtonen J, Eskelinen M**. Stressful and Adverse Life Experiences in Patients with Breast Symptoms; a Prospective Case-control Study in Kuopio, Finland. *Anticancer Research* 2005; **25**: 531-536.
(23) **Potischman N, *et al.*** Diet During Adolescence and Risk of Breast Cancer Among Young Women. *Journal of the National Cancer Institute* 1998; **90**: 226-233.
(24) **Potischman NA**. Intake of food groups and associated micronutrients in relation to risk of early-stage breast cancer. *International Journal of Cancer* 1999; **82**: 315-321.
(25) **Group UKNC-CS**. Breast feeding and risk of breast cancer in young women. *British Medical Journal* 1993; **307**: 17-20.
(26) **Sanderson M, *et al.*** Perinatal Factors and Risk of Breast Cancer. *Epidemiology* 1996; **7**: 34-37.
(27) **Weiss HA, *et al.*** Prenatal and Perinatal Risk Factors for Breast Cancer in Young Women. *Epidemiology* 1997; **8**: 181-187.
(28) **Sanderson, *et al.*** Maternal factors and breast cancer risk among young women. *Paediatric and Perinatal Epidemiology* 1998; **12**: 397-407.
(29) **Innes K, Byers T, Schymura M**. Birth Characteristics and Subsequent Risk for Breast Cancer in Very Young Women. *American Journal of Epidemiology* 2000; **152**: 1121-1128.
(30) **Soto AM**. Does Breast Cancer Start in the Womb? *Nordic Pharmacological Society: Basic & Clinical Pharmacology & Toxicology* 2008; **102**: 125-133.
(31) **Dairkee SH, *et al.*** Bisphenol A Induces a Profile of Tumor Aggressiveness in High-Risk Cells from Breast Cancer Patients. *Cancer Research* 2008; **68**: 2076-2080.
(32) **Yang M, *et al.*** Effects of bisphenol A on breast cancer and its risk factors. *Archives of Toxicology* 2009; **83**: 281-285.
(33) **Peacey A, *et al.*** Low levels of breast cancer risk awareness in young women: An international survey. *European Journal of Cancer* 2006; **42**: 2585-2589.
(34) **Bottorff JL, *et al.*** Young women's responses to smoking and breast cancer risk information. *Health Education Research* 2010; **25**: 668-677.
(35) **Haines RJ, *et al.*** Breast Cancer Messaging for Younger Women: Gender, Femininity, and Risk. *Qualitative Health Research* 2010; **20**: 731-742.
(36) Middlesex-London Health Unit. Process evaluation of the central west/ southwest binge drinking campaign: implicatons for practice and lessons learned. London, ON: Middlesex-London Health Unit; 2001 2001.
(37) Larsen L, Forchuk C. Evaluation of awareness campaign targeting young women. Woodstock, ON; 2008.
(38) **Fairley TL**. Epidemiology and Applied Research Branch EARLY Act Projects: addressing the health needs of young women diagnosed with breast cancer, 2011;
(39) **Casserly M**. 'I like it on the…' Kinky Facebook Meme For Breast Cancer. Accessed 27-June-2011.
(40) **Parr B**. 'I like it' campaign on Facebook goes viral. (http://www.cnn.com/2010/TECH/social.media/10/07/mashable.facebook.like/index.html). Accessed 07-July-2011.

(41) **Wardle J, *et al.*** Breast self-examination: attitudes and practices among young women in Europe. *European Journal of Cancer Prevention* 1995; **4**: 61-68.
(42) **Merchant RC, *et al.***, Correlates of women's cancer screening and contraceptive knowledge among female emergency department patients. 22-May-2007. 10.1186/1472-6874-7-7.
(43) **Malak AT, *et al.*** Effects of Peer Education, Social Support and Self Esteem on Breast Self Examination Performance and Knowledge Level. *Asian Pacific J Cancer Prev* 2009; **10**.
(44) **Umeh K, Jones L**. Mutually dependent health beliefs associated with breast self-examination in British female university students. *Journal of American College Health* 2010; **59**: 126-131.
(45) **American Cancer Society**. Learn about cancer: Breast awareness and self-exam. (http://www.cancer.org/Cancer/BreastCancer/MoreInformation/BreastCancerEarlyDetection/breast-cancer-early-detection-acs-recs-bse). Accessed 07-July-2011.
(46) **Canadian Cancer Society**. Know your breasts. (http://www.cancer.ca/Canada-wide/Prevention/Knowing%20your%20body/Know%20your%20breasts.aspx?sc_lang=en). Accessed 07-July-2011.
(47) **Breast Cancer Society of Canada**. Prevention Methods. (http://www.bcsc.ca/p/43/l/123/t/Prevention-Methods). Accessed 07-July-2011.
(48) **Canadian Breast Cancer Foundation**. Be Breast Aware: Look and Feel. (http://www.cbcf.org/breastcancer/bc_aware_lo.asp). Accessed 14-July-2011.