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DEVELOPMENT AND APPLICATION OF A FOOD FREQUENCY QUESTIONNAIRE FOR USE IN BREAST CANCER RESEARCH IN PRINCE EDWARD ISLAND

A Thesis

Submitted to the Graduate Faculty

in Partial Fulfilment of the Requirements

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Master of Science

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ABSTRACT

The primary purpose of this research was to develop and pilot test a population specific, semi-quantitative food frequency questionnaire (FFQ) for use in breast cancer research in Prince Edward Island (PEI). It was hypothesized that Island women recently diagnosed with breast cancer would have significantly lower intakes of n-3 fatty acids, monounsaturated fats, total dietary fibre and carotenoids than would women never diagnosed with breast cancer. The research was conducted in two phases. Phase I involved the development of the FFQ. In Phase II a pilot test of the FFQ was conducted in women with newly diagnosed breast cancer and women never diagnosed with breast cancer to: *(a)* verify the performance of the questionnaire in regards to the food list length, contents and format; *(b)* assess dietary intakes of nutrients hypothesized to play a role in breast cancer incidence in cases and controls; *(c)* assess dietary adequacy; and *(d)* to investigate to the extent possible the association of dietary risk factors with breast cancer in recently diagnosed cases and controls in PEI. A second questionnaire to assess exposures to non-dietary risk factors was also developed and administered at the same time by trained interviewers who conducted in-home interviews from April through July, 1998. Cases included women diagnosed within the past year with primary, invasive, ductal and/or lobular carcinoma (n=50); controls (n=50) were healthy women category matched (± 3 years) to the cases. Response rates among cases and controls were 92 per cent and 98 per cent, respectively. Mean age of the sample was 58.6 years (median 59 years; range 34-80 years).

While the FFQ food list length and format were judged to be acceptable, pilot test results indicated that 13 food items were rarely, if ever, consumed. Analysis of dietary intakes by the entire sample found that dietary intakes of iron (for ages 34-49 years), calcium, vitamin E and folate were less than recommended. Further examination found statistically significant differences in dietary intakes of carotenoids between cases and controls aged 50+ years: controls (n=37) had higher median intakes of carotenoids then did cases (n=34)(p=0.03). Analysis of non-dietary risk factors found that controls (n=50) engaged in significantly more hours per week of vigorous physical exercise than did cases (n=50) (p=0.03). These results confirm findings from other studies. Multivariate analysis indicated that intakes of carotenoids and hours of vigorous exercise were the best predictors of breast cancer status in women aged 50 years and older in this sample: daily dietary intakes of carotenoids in excess of 950 RE and 25 minutes of vigorous exercise per day were associated with a lower risk of breast cancer. Thus, study findings support the hypothesized relationship between carotenoid intake and breast cancer risk. The remaining nutrients (n-3 fatty acids, monounsaturated fats, total dietary fibre) were not found to be associated with cancer risk. A larger sample size would be required before ruling out the role of these and other dietary factors for breast cancer in Island women.

An important component of this research is the methodology successfully utilized in the development of the FFQ. However, future research should include testing for validity and reliability. Current study findings add to the growing body of evidence suggesting that pre- and postmenopausal breast cancer etiology differs. Furthermore, they support existing recommendations for regular vigorous exercise and the consumption of a balanced, moderate diet that includes dark green and orange vegetables and orange fruit more often.

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TABLE OF CONTENTS

TABLE OF ABBREVIATIONS

Term	Abbreviation
gram	g
milligram	mg
microgram	μg
kilogram	kg
metre	m
centimetre	cm
number	#
per cent	%
number of observations	n
standard deviation	std dev
probability	p
t-test	"Student's" t-test
Akaike Information Criterion	AIC
Schwartz Criterion	SC
degrees of freedom	df
chi-squared	χ^2
confidence interval	CI
odds ratio	OR
relative risk	RR
Statistical Analysis System®	SAS®
drug information number	DIN
Prince Edward Island	PEI
Northwest Territories	NWT
United States of America	US

American Institute of Cancer Research	AICR
Estrogen Replacement Therapy	ERT
Hormone Replacement Therapy	HRT
Oral Contraceptive	OC
docosahexaenoic acid	DHA
eicosapentaenoic acid	EPA
estrogen receptor	ER
sex hormone-binding globulin	SHBG
ataxia-telangiectasia	AT
National Health and Nutrition Examination Survey	NHANES
body mass index	BMI
food frequency questionnaire	FFQ
kilocalorie	kcal
Retinol Equivalents	RE
Niacin Equivalents	NE
Polyunsaturated Fatty Acid	PUFA
Recommended Nutrient Intakes	RNI
Dietary Recommended Intakes	DRI
Estimated Average Requirement	EAR
Recommended Dietary Allowance	RDA
Adequate Intake	AI
Canadian Nutrient File	CNF

1. INTRODUCTION

1.1 The significance of breast cancer

Breast cancer incidence rates vary widely throughout the world. According to the International Agency for Research on Cancer[1], American females had the highest incidence rate in the world at approximately 85 cases per 100,000 in 1997. The rate among Canadian women in this same time period ranked second at 76.9 cases per 100,000[1]. Based on data collected from 1988 to 1990, the next highest rate was reported in England and Wales with 68.8 cases per 100,000[1]. The incidence rate in Japan was substantially lower at 24.3 cases per 100,000[1]. Breast cancer is the most commonly reported cancer among women of these countries[1].

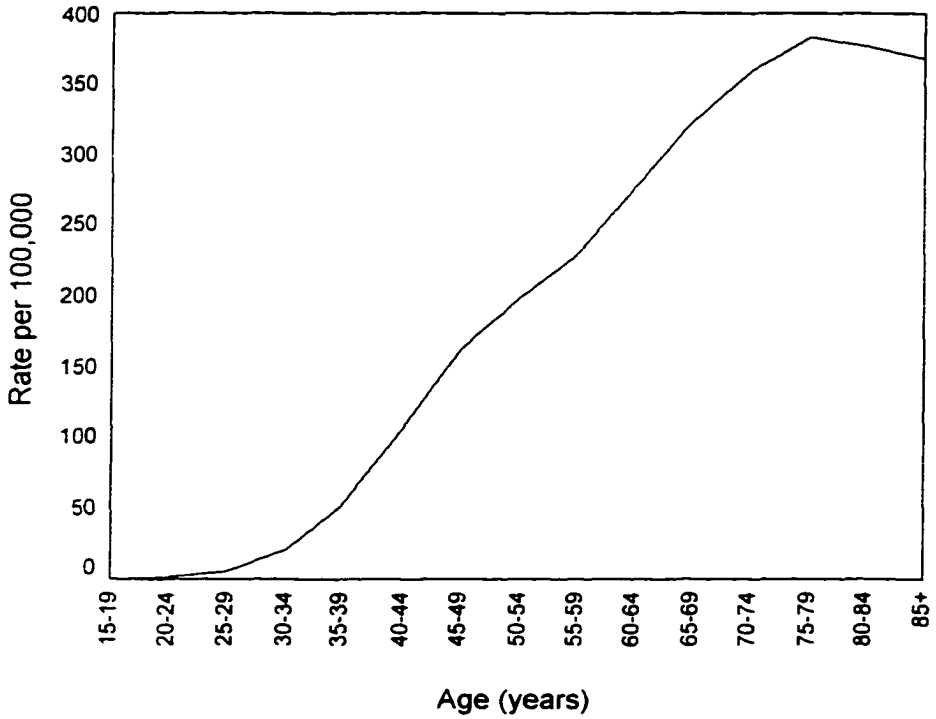
Breast cancer accounted for about 30% of all newly reported cancers in Canadian women in 1996 (excluding non-melanoma skin cancer)[2]. Breast cancer incidence rates in Newfoundland and Quebec during that time period were lower, while those in Ontario, Manitoba, Saskatchewan and British Columbia were significantly higher than the national average[3]. Rates in the Northwest Territories (NWT) and Prince Edward Island (PEI) should be considered within the context of trends over time rather than as annual rates since the small populations and small number of cases make calculated rates highly variable from year to year, resulting in wide fluctuations in annual rates. Incidence rates in the NWT were lower than the national rate, while those for PEI during this time period were comparable to the national rate[3].

Breast cancer risk increases with age[4,5]. Age-specific rates for the period 1986 to1994 clearly show an age effect associated with breast cancer incidence[6]. For example, during this period, the average incidence rate among women aged 50 to 54 years was more than four times higher than the rate among women aged 30 to 34 years (198.1 cases per 100,000 versus 21.4 cases per 100,000, respectively). Rates among women aged 70 to 74 were even higher at 359.5 cases per 100,000[6] (Figure I).

Secular trends covering the period 1984 to1994 also demonstrate a slow increase in the risk of breast cancer in older Canadian women. While age-specific incidence rates remained relatively stable for women aged 20 to 49 years at approximately 51.5 cases per 100,000, the rate for women aged 50 to 74 years increased from 242.67 to 276.51 cases per 100,000[7] (Figure II). Some of this increase may reflect increased detection through technological advances in screening procedures[8], but the evidence suggests that as the number of aged Canadians increases[9], the Canadian health care burden will increase as well due to the concordant increase in the number of breast cancer cases which will require health care services.

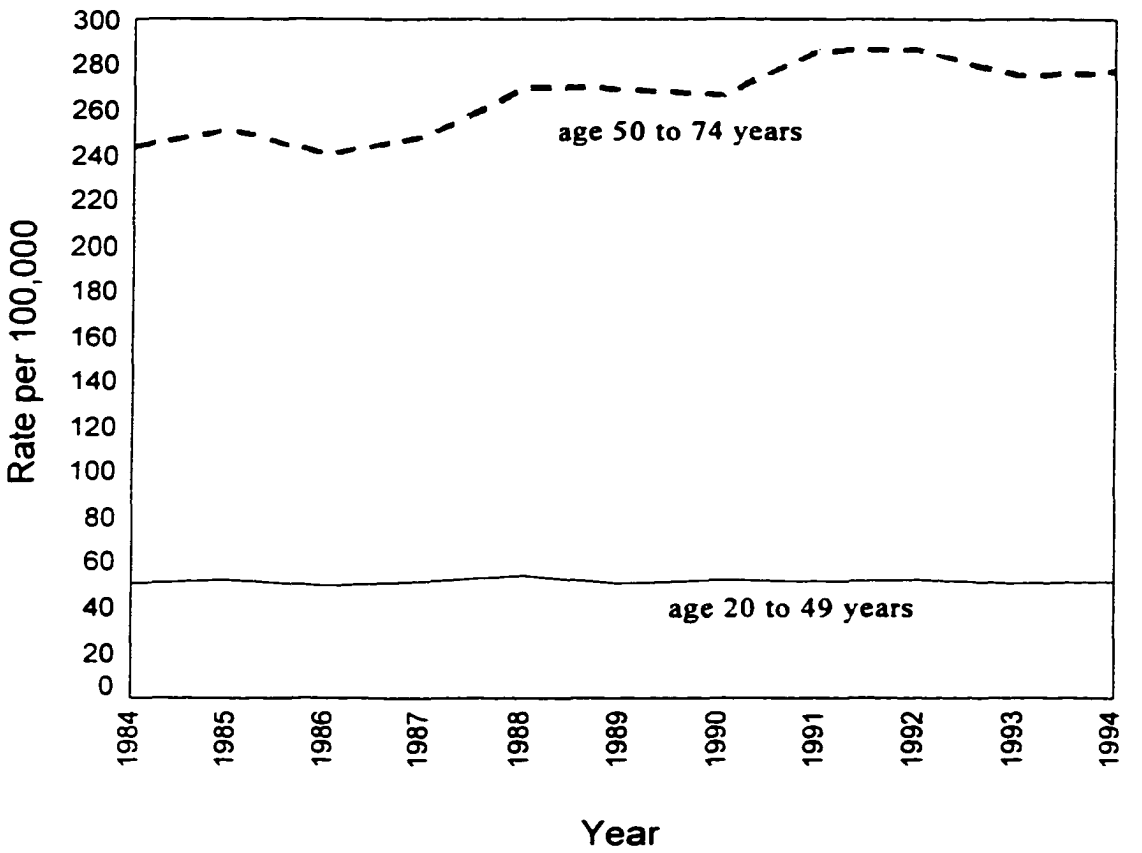
Currently recognized risk factors explain just over half of breast cancer occurrence[10]. When migrants and their offspring move from low- to high-incidence countries, their incidence rates soon climb to those of the new country[11,12]. This suggests that large differences in rates between countries such as Japan and the United States (US) are not due to racial or genetic differences, but rather are due to environmental factors such as

Figure I.
Breast cancer incidence (1986-1994) among Canadian women, by age group[a]. Age-specific rate per 100,000.



[a] Health Canada. (1999). *Cancer Incidence by Age Group*. Ottawa, Canada: Author. Retrieved January 20, 2000 from the World Wide Web: http://www.cythera.ic.gc.ca/spansweb/cancer/index_e.html

Figure II.
Breast cancer incidence among Canadian women aged 20 to 49 years and 50 to 74 years from 1984 to 1994[b]. Age-standardized rate per 100,000 (Canada 1991).



[b]Health Canada. (1999). *Cancer Incidence over Time*. Ottawa, Canada: Health Canada. Data retrieved January 20, 2000 from the World Wide Web: http://www.cythera.ic.gc.ca/spansweb/cancer/index_e.html

diet and lifestyle. For example, risk of breast cancer among Chinese, Japanese and Filipino women who migrated to the US rose as years lived in the US increased[12]. Dietary intake patterns within high incidence, westernized countries are generally characterized by higher intakes of total energy, total and saturated fat and refined carbohydrates[13], and people in these countries typically attain a greater body weight and height when compared to those from non-westernized countries with lower incidence rates of breast cancer[14]. These differences suggest the need for continued investigation into the role of dietary risk factors in the etiology of breast cancer.

1.2 Objectives of Chapter 1

This chapter begins with a review of dietary and nondietary risk factors associated with breast cancer. It next describes various dietary assessment methodologies used in nutritional assessments, and the interpretation of dietary data. The final section of the chapter outlines the objectives of this study.

1.3 The role of diet in the etiology of breast cancer

1.3.1 Overview

Diet may provide an avenue for women to modify their risk of developing breast cancer, but its role continues to provoke controversy due to diverse and sometimes conflicting findings. Studies to date have investigated the role of various nutrients including total fat and fat types (total saturated fat, monounsaturated fat, n-3 polyunsaturated fat and *trans*-fatty acids), total dietary fibre, alcohol, vitamins C, E and A, and carotenoids (see review

following). A complicating factor in assessing the role of individual nutrients is that the majority of foods are mixtures of nutrient and non-nutrient constituents. One nutrient may compete with, antagonize, or alter the bioavailability of any other nutrient contained within the same food[15]. Some nutrients are highly correlated with each other within a primary food source, therefore making it difficult to separate the specific effect(s) associated with each nutrient[16]. For example, it is difficult to isolate the individual effect of carotenoids because the amount of carotenoids is highly correlated with one of its primary sources, fruits and vegetables, as well as with vitamin C and total dietary fibre found in the same sources.

The diversity of results may also be attributed to limitations associated with the methodologies used to assess this complex environmental exposure[17]. The modest risk association exhibited by some nutrients may reflect error in the dietary assessment methodology utilized[18]. By definition, nondifferential errors in exposure assessment affect cases and controls equally, and may mask associations between exposure and breast cancer in observational studies. For example, perceptions of the social acceptability of drinking may cause cases and controls to under-report their consumption[19]. Sources of dietary error and their implications are discussed in detail in *Section 1.5.2 Sources of error and their impact.*

Study design may also influence findings. In general, case-control studies are more susceptible to selection and information biases than are cohort studies[20]. The results of

some cohort studies should be interpreted with caution since even weak associations will be statistically significant when utilizing extremely large sample sizes[21]. For example, results from a meta-analysis of cohort studies[22] including more than 3000 cases among 250,000 women found a weakly negative association (RR=0.95) between intakes of saturated fat and risk of breast cancer while in contrast, another large meta-analysis of cohort studies[23] (4980 cases among a cohort of approximately 338,000 women) found an opposing effect: a weak positive association (RR=1.11) between intakes of saturated fats and risk of breast cancer was observed.

The review which follows describes proposed mechanisms, details of pertinent study results and conclusions regarding the impact of each dietary factor on the risk of breast cancer. Nutrients which are hypothesized to increase risk are listed first. They include total energy (kcal), total fat, saturated fat, *trans*-fatty acids and alcohol. Nutrients which may provide a protective effect, including vitamins C and E, monounsaturated fat, n-3 polyunsaturated fat, dietary fibre, vitamin A and carotenoids, follow. Table I, following, lists the nutrients and summarizes hypothesized mechanisms as well as the evidence supporting the hypothesized effect. Terms describing strength of evidence are as follows:

'**Strong**': Epidemiological studies show consistent associations. Mechanistic and laboratory evidence is supportive.

'**Weak**': Epidemiological associations are limited in consistency. Mechanistic and laboratory evidence may or may not be supportive.

'**Probable evidence of no effect**': Current research findings consistently indicate that

intakes of this nutrient have no effect on risk of breast cancer.

'**Insufficient evidence to make a judgement**': Data may suggest a possible relationship, but are too limited to draw conclusions.

Due to the vast amount of literature available describing associations of dietary components with breast cancer, landmark and more recent articles are emphasized in the following review. Comprehensive review articles are referenced when available.

1.3.2 Total energy (kcal)

Consumption of fats, protein and carbohydrates provide all of the energy supplied to the body through food sources[24]. Kilocalories (kcal) or kilojoules (kJ) are most commonly used as a measure of the energy available from foods.

Energy balance is dependent on energy input (the energy value of food consumed) and output (energy expenditure), and influences energy stores[15]. Positive energy balance (weight gain) results when energy consumed is greater than energy expended. Investigations of total energy intake from food and energy balance have been conducted to ascertain their involvement in the etiology of breast cancer because of the roles they play in adult weight and weight gain, and in growth rates prior to puberty[15]. For example, adult obesity has been associated with decreased risk of breast cancer in premenopausal women and increased risk in postmenopausal women. Further, a negative energy balance (undernutrition) during childhood does not allow children to achieve their full genetic

Table I.
Dietary risk factors and their impact on the etiology of breast cancer

Nutrients hypothesized to increase risk	Proposed influence(s)	Strength of evidence supporting hypothesized effect
total energy (kcal)	- influence on energy balance and age at first menstrual cycle	- weak
total fat (g)	- increased estrogen production	- strong
saturated fat (g)	- introduction of carcinogen (HCA)	- weak
trans-fatty acids (g)	- cellular damage	- insufficient evidence to make judgement
alcohol (g)	- increased estrogen production - increased mammary cell proliferation	- strong
Nutrients hypothesized to decrease risk		
vitamin C (mg)	- antioxidant	- weak
vitamin E (mg)	- antioxidant	- probable evidence of no effect
monounsaturated fat (g)	- antioxidant - enhanced immune response	- weak
n-3 fatty acid (g)	- enhanced immune response - inhibition of breast cancer cell growth	- insufficient evidence to make judgement
dietary fibre (g)	- inhibit intestinal reabsorption of estrogen	- weak
vitamin A (RE)	- inhibition of breast cancer cell growth	- strong
carotenoids (RE)	- antioxidant	- weak

potential in terms of height and weight[15] and is associated with a delay in the age at which the first menstrual cycle begins[25], which decreases risk of breast cancer. (See *Sections 1.4.4.2 Adult weight and weight gain* and *1.4.6.1 Age at first menstrual cycle* for a full discussion of these risk factors.)

Animal studies involving rats and mice have demonstrated the inhibition of spontaneous and induced mammary carcinogenesis when energy intake is restricted[26]. In a meta-analysis of diet and mammary cancer in mice, Albanes[27] observed a strong positive association between total energy intake and mammary cancer. Freedman et al.[28] conducted a meta-analysis of experiments with both rats and mice, and found that both higher total energy and dietary fat independently increased mammary tumor incidence. In cross-over rat studies, Kritchevsky et al.[29] demonstrated that high fat and high calorie diets were co-carcinogenic, promoting mammary tumorigenesis.

In contrast to experimental studies in animals, the evidence from human observational studies supporting total energy intake as a risk factor for breast cancer is mixed. A case-control study conducted in Shanghai[30] found that high energy intakes were significantly associated with increased risk of breast cancer. However, examination of data obtained from the first National Health and Nutrition Examination Survey (NHANES-I) in the United States and subsequent follow-up surveys[31,32] found a negative association between both energy intake and fat intake and risk of breast cancer. The authors attributed these findings to under-reporting of caloric intakes, particularly by obese people. Conflicting

findings may arise from the difficulty in human studies in separating the role of total energy intakes from that of fat intake, due to the high correlation between the two variables[33]. For example, after controlling for the effect of total caloric intake in a meta-analysis of 12 case-control studies, Howe et al.[34] found that the observed association between high energy intake and increased risk of breast cancer was attributable to the association of calorie intake with total fat consumption; total energy intake by itself was not associated with increased risk of breast cancer.

Current epidemiological study results indicate that total energy intake and energy balance do not directly affect risk of breast cancer. However, differences in energy intake and expenditures (for example, through physical activity) may translate into important gains or losses of weight over a period of years which could then impact on risk. The high correlation between total energy intake and dietary fat intake makes it important to control for energy intake in nutritional epidemiology studies. This is accomplished through the use of a statistical model such as the multivariate energy density model[35] which includes individual nutrients as a proportion of energy, as well as including energy as a separate variable.

1.3.3 Total fat

Total fat includes all visible and invisible fats consumed in the diet[36]. Visible fat includes food items such as butter, the oils in salad dressings and the fat trimmed from meats. Invisible fats are found in a variety of foods including nuts, cheese, fried foods and baked

goods[36].

Breast cancer is known to be hormonally mediated[37]. The presence and quantity of estrogen directly influences breast cancer risk[38]. Total dietary fat consumed in excess of requirement contributes to obesity, and fat cells in obese persons serve as sources of estrogen[39]. This is particularly true for obese postmenopausal women for whom the primary source of endogenous estrogen is metabolic conversion from adipose tissue[40]. It is therefore hypothesized that excessive intakes of total fat could alter hormonal balance, resulting in increased risk of breast cancer[41]. Total dietary fat intakes were first implicated as a risk factor for breast cancer by ecological studies. It was noted that breast cancer mortality rates were higher in those countries with higher per capita fat consumption compared to breast cancer mortality rates in countries with lower per capita fat consumption[42]. However, conclusions are limited since these studies were based on food disappearance data. This type of data describes national tabulations for food produced and imported minus the food that is exported, fed to animals, or is otherwise not available for human consumption[43]. Other risk factors including low parity, late age at first birth, low physical activity and obesity, all of which are more prevalent in developed countries where dietary fat content is also highest, would be expected to confound the association between total dietary fat intake and risk of breast cancer[44]. Results of animal studies have demonstrated that dietary fat acts as a promoter, rather than as an initiator of mammary carcinogenesis[45].

One of the largest case-control studies conducted to date[46] found that total dietary fat intake was unrelated to risk. A meta-analysis[34] that summarized results from 12 studies found little evidence of an association between total fat intakes and risk in premenopausal women, but found that postmenopausal women had a significantly increased risk (RR=1.48) when comparing the highest to the lowest intakes of dietary fats. After adjustment for energy intakes and other risk factors in another meta-analysis of 16 case-control studies, Boyd et al.[22] found that total dietary fat intake was associated with increased risk of breast cancer among women of all ages (RR=1.42). Cohort studies, on the other hand, have found little to no association between consumption of total fat and risk of breast cancer. Hunter et al.[23] found no association after conducting a pooled analysis of six prospective studies. Likewise, a meta-analysis of seven cohort studies[22] found only a negligible increase in risk (RR=1.03) after adjusting for total energy intake and other risk factors. Overall, study results remain inconsistent; diets high in total fat may increase risk, especially among postmenopausal women.

1.3.4 Saturated fat

The primary source of saturated fats is animal products, but they are also found in palm and coconut oils[36].

A number of heterocyclic amines (HCAs) are produced during the broiling and frying of meats and fish[47], and many have been shown to induce cancer of the breast, colon, pancreas and prostate in rats[48]. The formation of these mutagenic compounds is due to

the pyrolysis of amino acids in foods with high protein content[49,50]. Carcinogenicity studies utilizing HCAs to induce cancers in rats demonstrated that higher levels of dietary fats increased the number of resulting mammary tumors[51]. This has led to the hypothesis that the consumption of cooked meats with their associated saturated fatty acid component increases risk of breast cancer.

The effect of saturated fat on breast cancer risk is similar to that of total fat: while case-control studies suggest a positive association, cohort studies have tended to be null or only weakly supportive of this association. Howe et al.[34] combined the analysis of 11 case-control studies and analyzed the dietary habits of pre- and postmenopausal women separately. The authors found a consistent, statistically significant positive association between saturated fat intake and breast cancer in postmenopausal women. Boyd et al.[22] also found a positive association (RR=1.31) after adjustment for energy and other risk factors in a meta-analysis of seven case-control studies. However, in their meta-analysis of cohort studies, Boyd et al.[22] found a weakly negative association (RR=0.95) while a pooled analysis of eight cohort studies[23] found a weakly positive association (RR=1.11) when comparing the top to bottom decile of intakes. Given the inconsistent study results to date, it is difficult to make a final judgement on the effects of saturated fats on risk of breast cancer.

1.3.5 *Trans*-fatty acids

A small amount of *trans*-fatty acids are present naturally in milk and fat from cows and

other ruminants[52], but in Western diets the majority are produced as a byproduct of the hydrogenation of vegetable oils used in processed foods[53]. This process is used to harden liquid oils, to decrease oxidation and to stabilize the flavor of liquid oils. Thus, *trans*-fatty acids are found primarily in hard or stick vegetable oil margarines, frying and cooking fats and a large variety of commercially prepared snack foods including crackers and cookies[54].

Diets high in *trans*-fatty acids have been associated with chromosome breakage and spindle dysfunction[55]. They may also impair essential fatty acid metabolism[52]. These effects have led researchers to hypothesize that intakes of *trans*-fatty acids are associated with increased risk of breast cancer.

A multi-centre, case-control study[56] conducted in Europe found a positive association between *trans*-fatty acid content found in adipose tissue (used as a biomarker of dietary intakes of *trans*-fatty acids) and breast cancer in postmenopausal women. A North American study conducted by London et al.[57] found that the per cent of *trans*-fatty acid in adipose tissue was associated with a significantly increased risk of breast cancer among breast cancer cases of all ages, but only at the level of the second quintile when compared to the first quintile. In contrast, a study conducted by Petrek et al.[58] in New York found slightly lower, but not statistically significant, levels of *trans*-fatty acids in breast and abdominal tissue among women with breast cancer when compared to similar tissue samples in controls.

Few human observational studies have been conducted to investigate the effects of dietary intakes of *trans*-fatty acids on breast cancer incidence, primarily because of the lack of data describing the *trans*-fatty acid content of most foods[54]. While experimental evidence suggests that *trans*-fatty acids are associated with increased risk of breast cancer, more evidence is needed before drawing final conclusions.

1.3.6 Alcohol

Alcohol consumption has been associated with increased risk of breast cancer. The underlying mechanism remains unclear, but effects may be hormonally mediated[59]. Little is known of the effects of moderate alcohol consumption on estrogen metabolism, but investigators[60] found increased total estrogen and the amount of bioavailable estrogen in postmenopausal women who consumed large amounts of alcohol. However, the generalizability of the study is somewhat questionable since the alcohol was consumed in a fasting state and the effect was noted only in those women on Estrogen Replacement Therapy (ERT); no effect was noted among those women who were not on ERT. Results of animal studies indicate that alcohol does not induce cancer, but rather alters the rate of proliferation of mammary gland cells[61,62].

An examination by Roth et al.[63] of 38 case-control studies found no support for a dose-response relationship between alcohol consumption and breast cancer. Some of the studies included hospital-based controls while others utilized community- or population-based controls. At low levels of alcohol consumption (<4 drinks per week), six of the

hospital-based studies were associated with significantly elevated risks of breast cancer while only one of the community-based studies found a similar effect. However, at high levels of alcohol consumption (≥28 alcoholic drinks per week), a significantly elevated risk of breast cancer was observed in three of the community-based studies. A meta-analysis of 28 case-control and 10 cohort studies[64] found a modest association between risk and alcoholic intakes of one and two drinks per day, and a strong trend of increasing risk with increasing numbers of drinks per day. Similarly, a study conducted by Swanson et al.[65] of women less than 45 years of age (1645 cases, 1497 controls) found increased risk only among those who consumed 14 or more alcoholic drinks per week (RR=1.7). Furthermore, the effect was most pronounced among women diagnosed with advanced disease which lends support to the hypothesis that alcohol acts to enhance tumour growth. Finally, a cohort study by Framingham et al.[66] observing two generations of women found that neither light to moderate levels of alcohol consumption, nor the consumption of any particular type of alcoholic beverage was associated with increased risk of breast cancer when compared to nondrinkers. The authors were unable to assess the risk associated with heavy alcohol consumption because of the small number of women enrolled in the study who drank heavily.

Study results examining the relationship between alcohol consumption at low to moderate levels and risk of breast cancer are generally null to weakly positive, while intakes at higher levels of consumption are frequently associated with a significantly increased risk. Evidence of a dose-response relationship has been demonstrated, but not consistently.

However, it is difficult to disentangle the effect of excessive alcohol consumption on risk of breast cancer from the effects of other nutritional and lifestyle risk factors that may also be associated with high alcohol consumption[63]. The American Institute of Cancer Research (AICR)[67] concludes that there is probable evidence to suggest that high alcohol consumption increases risk of breast cancer.

1.3.7 Vitamin C

Vitamin C is a water soluble vitamin found primarily in fruits and vegetables[68]. It is an antioxidant and free radical scavenger[69] and has been shown to inhibit the formation of carcinogenic nitrosamines from nitrates[70]. It is therefore considered to possess some potential as a cancer-inhibiting agent. In an assessment of 46 epidemiological studies of various cancers and vitamin C[71], 33 studies reported a statistically significant protective association, although the association was most consistent for non-hormonal cancers such as lung and stomach cancers than it was for other hormonally mediated cancers such as breast cancer.

In an early study, Graham et al.[46] found no association between intakes of vitamin C and risk of breast cancer. In a subsequent study[72] of postmenopausal women only (439 cases and 494 controls), a protective effect was found when comparing the highest to the lowest intake levels (RR=0.6). However, the authors noted that this study had a low response rate among cases and controls (56% and 46% respectively) and so results may not be generalizable. A meta-analysis conducted by Howe et al.[34] of nine case-control studies

demonstrated a protective association (RR=0.69). On the other hand, cohort studies conducted by Rohan et al.[73] and Hunter et al.[74] found no statistically significant association between intakes of vitamin C and risk of breast cancer.

Study results to date are inconclusive: case-control studies have generally found a null to minimally protective effect while cohort studies have found no association.

1.3.8 Vitamin E

Vitamin E is a fat soluble vitamin that is widely available in a variety of foods including fats and oils, fruits and vegetables, fortified cereals and grain products, meat, poultry, fish, eggs, seeds and grains[36]. The richest common source is plant oils[36]. This vitamin is a major lipid soluble antioxidant in plant and animal tissues, protecting cell membranes from free radical damage[69] by preventing lipid peroxidation of polyunsaturated fatty acids.

Mixed results were noted in a review[75] of 10 experimental studies examining the effect of vitamin E on chemically induced mammary carcinogenesis in rats or mice: six studies demonstrated a protective effect while four showed no effect. Three case-control studies[72,76,77] have reported a weak, non-significant protective association while two others[78,79] have reported non-significant odds ratios of 1 and 1.3. A cohort study conducted by Hunter et al.[74] of 89,494 American women found a weak inverse relationship between intakes of vitamin E and risk of breast cancer, but multivariate

analysis suggested that the protective association with vitamin E was due to its correlation with vitamin A. A cohort study of 56,837 women conducted in Canada in the same year by Rohan et al.[73] found no association between vitamin E intakes and risk of breast cancer.

Intakes of vitamin E, however, are difficult to quantify because of the wide availability of vitamin E in vegetable oils found in commonly consumed foods. This results in a narrow range of intakes, making it very difficult to demonstrate an effect of exposure[67]. Results to date seem to indicate that intakes of vitamin E have no effect on the incidence of breast cancer, although relatively few epidemiological studies have been undertaken to assess the role of vitamin E in breast cancer etiology.

1.3.9 Monounsaturated fat

While canola oil is a good source, olive oil is the best known and most concentrated source of monounsaturated fat[36]. Olive oil also contains a generous amount of antioxidants and relatively low levels of saturated fats and n-6 polyunsaturated fatty acids[80].

Ecological evidence suggests a protective effect of monounsaturated fats on breast cancer. For example, incidence of breast cancer in the Mediterranean countries, where olive oil usage predominates in the diet[81], is relatively low compared with rates in North American and Northern Europe[82] where alternate vegetable oils are commonly used.

Case-control studies examining the association between intakes of monounsaturated fats and risk of breast cancer have produced conflicting results. High intakes of olive oil may decrease the risk of breast cancer. A reduced risk of breast cancer was observed among women in three Mediterranean studies[83-85] who consumed more olive oil. A combined analysis of eight case-control studies[34] from a variety of countries which analyzed the dietary habits of pre- and postmenopausal women separately found that dietary intakes of monounsaturated fats may possibly decrease risk. However, a meta-analysis by Boyd et al.[22] found an increased risk (RR=1.42). Cohort studies have suggested a weak protective effect. Hunter et al.[23] found a minimal decrease in risk (RR=0.96) when comparing the top to bottom decile of intake in their pooled analysis of eight studies, while Boyd et al.[22] found a similar result (RR=0.95) in his meta-analysis.

Results overall are inconsistent. Inconsistencies may be due to the limited range of intakes of monounsaturated fats consumed by most individuals, or to the influence of the various study designs utilized.

1.3.10 n-3 polyunsaturated fatty acids

The n-3 polyunsaturated fatty acids (PUFAs) are one of two families of PUFAs which cannot be synthesized by humans and must therefore be obtained from the diet[15]. These essential fatty acids are found in fish oils and fatty fish including salmon, herring, smelt, eels, lake trout, mackerel, swordfish and in the dark meat of tuna, and in vegetable oils including canola and flaxseed oils[15,16]. The principal n-3 PUFAs found in fish oils are

docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA). A dose-response relationship has been demonstrated between EPA and DHA and inhibition of breast cancer cell growth[86]. Exact mechanisms relating intakes of n-3 PUFAs to breast cancer are not well understood[87]. However, animal studies indicate that tumorigenesis is associated with enhanced eicosanoid biosynthesis[88]. Eicosanoid biosynthesis is increased with intakes of n-6 PUFAs, and decreased with intakes of n-3 PUFAs[89]. Thus the ratio of dietary intakes of n-3 to n-6 PUFAs may influence the process of carcinogenesis.

Animal studies have demonstrated that diets rich in n-3 PUFAs suppress growth of mammary tumor cells[86,89,90]. While there have been no epidemiological analytical studies in humans examining intakes of n-3 PUFAs per se, results of international ecological studies[42,91,92] examining fish consumption as a proxy for n-3 PUFAs suggest that these essential fatty acids have an inhibitory effect on breast cancer. While initial work generally supports a protective role of n-3 PUFAs in the incidence of breast cancer, the paucity of information makes it difficult to draw conclusions.

1.3.11 Dietary fibre

Total dietary fibre, available from vegetables, fruits and cereals, is comprised of both soluble and insoluble fibre[73]. Soluble fibre is found primarily in fruits and vegetables while whole grains are a good source of insoluble fibre[73]. The protective effect of dietary fibre on risk of breast cancer is believed to be due to the inhibiting action of fibre on the

intestinal reabsorption of estrogens excreted in the bile[93]. Some fibre components such as lignins (or phytoestrogens) can also reduce the bioavailability of estrogen either by acting as anti-estrogens, occupying estrogen-binding sites, or by stimulating the production of sex hormone-binding globulin[94].

Results of a meta-analysis of 10 case-control studies[34] from a variety of countries identified a statistically significant protective effect (RR=0.85) when comparing the highest to lowest quintile of dietary fibre intake. Although not significant, van't Veer[95] also found a protective association (OR = 0.55) when comparing the highest to lowest quartile of intakes. Cohort studies produced conflicting results: analysis of results of eight years follow-up of 89,494 women in the Nurses' Health Study[96] demonstrated no relationship between fibre intakes and risk of breast cancer (intake range: ≤11 g/day to ≥22 g/day; RR=1.02) while results of a Canadian study[73] of 519 cases and 1182 controls indicated that relatively high intakes of dietary fibre (≥25 g/day) were associated with a reduced risk of breast cancer (RR=0.68).

Study results suggest that fibre may provide a weak protective effect at high levels of intake.

1.3.12 Vitamin A

A fat soluble vitamin, vitamin A consists of two different 'families' of dietary factors: preformed vitamin A and provitamin A[73]. Preformed vitamin A includes retinol, retinal,

retinyl esters and related compounds, and is found in foods of animal origin[97]. β-carotene and other carotenoids are components of provitamin A[73], and are found in fruits and vegetables[98]. The role of vitamin A (preformed and provitamin A) was examined in respect to carcinogenesis because of the opposing actions of vitamin A and carcinogenesis on cell growth and differentiation: vitamin A regulates normal cell growth and differentiation while carcinogenesis is associated with the disruption of normal cell function[68,69]. Hypothesized mechanisms associated with the anticarcinogenic effects of vitamin A include hormone like control of the expression of genetic information controlling cell differentiation[68]. Studies have demonstrated the inhibition of the growth of human breast carcinoma cells *in vitro* by retinol[99] while in some rodent models, retinyl acetate has been shown to reduce breast cancer incidence[100].

Vitamin A (preformed and provitamin A together) was associated with a protective effect against breast cancer (RR=0.87) in a meta-analysis of nine case-control studies[34]. Similarly, a case-control study[46] of 2024 cases and 1463 controls found decreased risk of breast cancer with increasing intakes of vitamin A among women aged 55 years and older. Cohort studies also support a protective role for vitamin A. A marginally significant protective association (OR=0.83) was observed in a Canadian cohort study conducted by Rohan et al.[73]. Hunter et al.[74] also found a significant, moderately protective effect associated with vitamin A (RR=0.81). Further, supplemental intakes of vitamin A were associated with significantly reduced risk among those women in the lowest quintile level for vitamin A intakes from foods.

Animal studies and epidemiological evidence consistently suggest a modest, protective association between vitamin A intakes and breast cancer.

1.3.13 Carotenoids

Carotenoids are colour pigments found in deep orange fruits and vegetables, and dark green and leafy vegetables[101]. Over 600 different carotenoids have been identified[68]. While β-carotene is probably the best known and researched in terms of its protective role against breast cancer, the role of other carotenoids, including lycopene and lutein, have also been investigated[102]. Carotenoids may provide protection against breast cancer through their antioxidant properties, or indirectly through their provitamin A activity[68,98].

Rock et al.[103] examined the relationship between carotenoids, vitamin A and tumor estrogen receptor (ER) status since tumors that contain ERs are associated with improved survival and better response to hormone therapy[104]. Dietary intakes of carotenoids were associated with increased likelihood of ER positive status in women at diagnosis of primary breast cancer. In a case-control study of 46 cases and 63 controls, Zhang et al.[105] investigated the associations between risk of breast cancer and retinoid and carotenoid concentrations in breast adipose tissue. The authors found a non-significant inverse association between β-carotene and breast cancer for those women whose breast adipose tissues contained above median values of β-carotene when compared to those below or equal to the median. A non-significant protective association (OR=0.63) was also found by van't Veer[95]. A significantly protective association (RR=0.85) was noted by Howe et

al.[34] in a meta-analysis of eight studies, but the association was attenuated after adjustment for fibre and vitamin C intakes. An inverse relationship (OR=0.85) of borderline significance after adjustment for energy intakes and established health and lifestyle risk factors was found in a Canadian cohort study[73], but adjustment for dietary intakes of fibre moved the point estimates for β-carotene closer to unity suggesting that any protective effect may be confounded by other constituents of fibre containing foods. Finally, a cohort study by Hunter et al.[74] observed that risk of breast cancer was reduced (RR range from 0.80 to 0.89) in each of the four highest quintile groups (range of intakes: 385 RE to 1141 RE) when compared to the lowest quintile (<385 RE) of β-carotene intake.

Epidemiological evidence suggests that carotenoids may play a protective role in risk of, and possibly prognosis of, breast cancer. However, it is difficult to ascertain whether the protective effect associated with breast cancer risk is due to intakes of carotenoids in general, specific carotenoids such as β-carotene, or some other component of carotenoid containing foods[103]. The AICR[67]states that high dietary intakes of carotenoids may possibly decrease the risk of breast cancer.

1.3.14 Summary of the role of diet in the etiology of breast cancer

A large number of studies have been undertaken to investigate the role of diet in the etiology of breast cancer. Results to date consistently indicate that high intakes of total fat (among postmenopausal women) and alcohol are associated with increased risk of

breast cancer while vitamin A is associated with a protective effect. A protective effect may be provided by consumption of carotenoids, total dietary fibre, vitamin C, E and monounsaturated fats, and risk increased by intakes of saturated fats, but epidemiological results are less consistent for these nutrients. The roles of *trans*-fatty acids and n-3 polyunsaturated fatty acids in breast cancer etiology remain unclear because of the current paucity of evidence. More studies are required to help define the impact of these nutrients on breast cancer.

1.4 Role of non-dietary risk factors in the etiology of breast cancer

1.4.1 Overview

Currently recognized risk factors account for approximately 55 per cent of breast cancer occurrence[10]. Established non-dietary risk factors include genetics, nulliparity, early age at menarche, late age at first pregnancy and menopause, the presence of benign breast disease and obesity in postmenopausal women[38,106-108]. In general, never married women and women of higher socioeconomic status are at increased risk for breast cancer[33,108]. The impact of a number of other factors such as anthropometry (height, weight and weight gain), smoking, physical activity, length of menstrual cycles, exogenous hormone use and lactation have also been investigated.

Following is a review of the proposed mechanisms, pertinent study results and conclusions regarding the role of the non-dietary risk factors in the etiology of breast cancer. Genetics, smoking behaviour, anthropometrics (including height, weight and

weight gain), and physical activity are followed by those factors which are related to reproductive history. Factors related to reproductive history include age at menarche, length of menstrual cycles, parity and age at first birth, lactation history, use of oral contraceptives and hormone replacement therapies, benign breast disease and menopause and age at menopause. A summary of the effect of these factors follows in Table II. Terms used to describe the strength of evidence associated with each risk factor are similar to those used in Table I, page 9.

The major known risk factors for breast cancer are family history and reproductive history. While risk associated with family history is known to be related to the presence of germline mutations, mechanisms associated with the remainder of the factors are unclear. Hormonal and reproductive factors have also been most clearly associated with the etiology of breast cancer[37,109]. While the actual mechanisms remain undefined, risk appears to be in response to the cumulative lifetime exposure to estrogen and perhaps to progesterone. These hormones are not believed to be genotoxic, but may influence the rate of breast epithelial cell proliferation[38].

Once again, due to the sheer volume of literature available describing the associations between non-dietary factors and risk of breast cancer, the following review emphasizes more recent and landmark articles and comprehensive review articles.

1.4.2 Genetics

Family history of breast cancer is one of the strongest known risk factors[106], but has little impact on incidence in the general population since only five per cent to 10 per cent of women carry any genetic risk factors[110,111]. Genetics plays a role in early onset breast cancer, largely involving women under 50 years[112]. The effect of family history on risk is greatest if two or more first-degree relatives with breast cancer are diagnosed before age 40 years[113]. The probability of a breast cancer predisposing gene being present in the family increases as the number of affected women increases, as the age of the affected at the time of diagnosis decreases[114] and with the occurrence of recent bilateral breast disease among family members[113,115].

Inherited mutations in the three tumor suppressor genes BRCA1, BRCA2 and p53 confer a high probability of developing breast cancer[116,117]. Fortunately, the probability of inheriting these genetic mutations in the general population seems to be low: Ford et al.[117] estimated that only one in 400 Americans were carriers. Carriers of mutated BRCA1 or BRCA2 genes are estimated to have a lifetime risk of 85 per cent to 90 per cent probability of developing breast cancer[117-119] while risk for carriers of the mutated p53 genes has been estimated to be at least 50 per cent by age 50 years, with little increase in risk after menopause[120]. Inherited mutations of the p53 gene are most frequently associated with the Li-Fraumeni syndrome. Individuals with this syndrome

Table II.
Non-dietary risk factors and their impact on the etiology of breast cancer

Non-dietary risk factors hypothesized to increase risk	Proposed influence	Strength of evidence supporting hypothesized effect
family history	- genetic predisposition	- strong
smoking	- chemical carcinogen	- very weak
greater adult height	- biomarker for overall growth	- strong
postmenopausal obesity	- increased exposure to estrogen	- strong
early age at first menstrual cycle	- increased exposure to estrogen	- strong
shorter menstrual cycles, or unusual cycle patterns	- increased exposure to estrogen *and/or* endocrine imbalance	- weak
oral contraceptive use	- increased exposure to estrogen	- weak
hormone replacement therapy use	- increased exposure to estrogen	- weak
presence of benign breast disease	- elevated estrogen levels	- strong
late age at menopause	- increased exposure to estrogen	- strong
Non-dietary risk factors hypothesized to decrease risk		
smoking	-antiestrogenic effect of tobacco smoke	- very weak
physical activity	- influence on energy balance, estrogen levels, immune function	- inconclusive; more studies needed
premenopausal obesity	- reduced exposure to estrogen	- strong
parity, early age at birth of first child	- changes in breast tissue *and/or* estrogen exposure	- strong
increased duration of lactation	- reduced exposure to estrogen *and/or* indicator of normally balanced endocrine system	- strong

have a high risk of early onset breast cancer, childhood sarcomas, brain tumors, leukemia and adrenocortical carcinoma[120]. These three genes are likely to account for less than 10 per cent of all breast cancer cases[117]. The proportion of breast cancer cases under the age of 50 years attributable to BRCA1 is approximately five per cent, while that attributable to p53 is estimated at less than one per cent[111].

Mutations in the HRAS1 gene are more common in the general population and are associated with a lower relative risk for breast cancer compared to risks associated with BRCA1, BRCA2 or p53 mutations[116]. Eeles et al.[111] suggested that, given the prevalence of the mutations, as many as nine per cent of breast cancer cases could be attributed to the HRAS1 gene. A similar situation exists with the ataxia-telangiectasia (AT) gene. One of the hallmarks of this rare disease is an increased susceptibility to cell damage from hydroxy radicals, leading to an increased susceptibility to cancer[121]: female relatives of AT patients, presumably carriers of the gene, have been shown to be at increased risk of developing breast cancer[116]. Despite the moderate effect on risk, mutations in this gene account for a higher proportion of incident breast cancer cases because AT mutations are more common than are mutations in BRCA1, BRCA2 or p53 in the general population[111]. The proportion of breast cancer cases in women less than 40 years due to AT mutations has been estimated to be eight per cent[117].

In summary, while inheritance of mutated versions of BRCA1, BRCA2, p53, HRAS1 and AT genes confers higher than normal risks of breast cancer, relatively few individuals in

the general population are affected. The vast majority of individuals diagnosed with breast cancer have no family history of breast cancer.

1.4.3 Smoking

The effects of smoking on risk of breast cancer are uncertain. It has been suggested that it may either convey a protective effect or increase risk. Proposed mechanisms supporting the hypothesis that it plays a protective role in breast cancer are based on two premises: that breast cancer is an estrogen-related disease and that cigarette smoke has an antiestrogenic effect[122]. On the other hand, it has been suggested that smoking is associated with increased risk of breast cancer because of its association with other cancers distant from the lung, such as pancreas and bladder[123]. However, a strong association with breast cancer has never been found.

Most studies[124-126] have shown either slightly increased risk or null effect of smoking on breast cancer risk while two have shown a protective effect[127,128]. Authors of one of the most recent studies[129] united the opposing hypotheses outlined above: they suggested that the effect of smoking (active or passive) on risk may depend on the timing of exposure. They theorized that exposure before a woman's first pregnancy could cause breast cancer as a result of genotoxic mechanisms, whereas later exposure could possibly prevent breast cancer because of an antiestrogenic effect of tobacco smoke. They further suggested that with prolonged exposure, the antiestrogenic effect of smoking would oppose the genotoxic mechanisms, resulting in a null or protective effect against breast cancer.

Study results demonstrated that risk was highest among women who smoked only prior to their first pregnancy. In addition, the authors found that smoking (active and passive) was consistently associated with an increased risk. In accordance with their hypothesis, a trend (although not statistically significant) was also noted suggesting a slightly decreasing risk with increasing number of years of exposure. However, the study design was circumspect, and these results are unique to the literature.

Study results to date suggest smoking has little to no effect on risk of breast cancer.

1.4.4 Anthropometry

1.4.4.1 Height

Adult height, which is determined by genetics, hormones and nutrition in childhood and adolescence[33,130], may be considered a biomarker of overall growth[33]. Risk of postmenopausal breast cancer has been positively associated with greater adult height[131]. Animal studies[26] have demonstrated that restriction of total energy intakes modifies overall physical growth and has an inhibiting effect on induced and spontaneous mammary carcinogenesis. (See *Section 1.3.2 Total energy (kcal)* for a discussion of this risk factor.)

A study by Trentham-Dietz et al.[132] of 6548 cases and 9057 controls demonstrated a statistically significant trend of slightly increasing risk of breast cancer with increasing height among postmenopausal women (OR = 1.15; $p<0.001$). In a review of 10 case-

control studies[133], three found no association between attained height and risk while the remaining seven studies found evidence of a modest increase in risk. A review of cohort studies over the same period[133] also supported a modest association between increased height and risk. Finally, Freni et al.[33] also found a significantly increased risk among taller postmenopausal women when compared to shorter postmenopausal women who participated in the NHANES-I study.

Study results consistently support the hypothesis of an association between greater adult height attained and risk of breast cancer, especially among postmenopausal women. The AICR[67] concludes that there is convincing evidence to suggest that greater height is associated with increased risk.

1.4.4.2 Adult weight and weight gain

Increased body weight is associated with earlier age at menarche and later age at menopause[25,134], and is also known to influence the level of free estrogen during a woman's reproductive life cycle. Obesity in premenopausal women has been associated with a protective effect against breast cancer[131], while in postmenopausal women it has been associated with increased risk of breast cancer[38]. Mechanisms relating adult weight, weight gain and risk of breast cancer remain unknown, but the following have been proposed. Age is a major determinant of the hormonal profile of women: primary sources and levels of estrogen differ in pre- and postmenopausal women[135]. Fat stores in obese premenopausal women reduce the level of ovarian hormones, including estrogen, in the

general circulation, because of an increased frequency of anovulation[136]. In contrast, levels of estrogen are significantly increased in obese postmenopausal women. Estrogen production in postmenopausal women is directly correlated with body weight: heavier women, especially those with abdominal obesity[39] have higher levels of free estrogen because of the conversion of the androgen precursor androstenedione to estrone in adipose tissue, and the accompanying decreased levels of the sex hormone-binding globulin (SHBG)[40,137]. The resulting increase in unbound or free estradiol is hypothesized to increase breast cancer risk[37].

A review of 22 case-control studies[133] found that risk was consistently increased for postmenopausal women who were obese. A significantly increased risk for obese postmenopausal women was also noted by Trentham-Dietz et al.[132]. The authors also noted a somewhat decreased risk among postmenopausal women who had lost weight. Results from the Nurses' Health Study Cohort Study[138] indicated that a higher current body mass index (BMI) was associated with a lower risk among premenopausal women while a higher current BMI was associated with a significantly increased risk (RR=1.59) among postmenopausal women. A significantly increased risk among obese postmenopausal women was noted among women who took part in the NHANES-I Study[33]. A decreased (non-significant) risk among obese premenopausal women was also noted.

Study results suggest that while weight gain and obesity most likely increase risk in

postmenopausal women, these factors are associated with decreased risk in premenopausal women.

1.4.5 Physical activity

Physical activity may provide some protection against breast cancer. While exact mechanisms remain unknown, a number of different pathways have been proposed. Reduction of risk may be achieved through the influence of physical activity on energy balance, hormonal levels and/or immune function[139]. The maintenance of body weight and energy balance is influenced by overall energy expenditure[140] as reduced physical activity may lead to excess accumulation of body fat. (See *Section 1.3.2 Total energy (kcal).*) Intense physical activity may provide some protection against breast cancer because it is associated with decreased estrogen production[141]: it is known to delay menarche[25] and may lead to low estrogen levels, menstrual cycle irregularities and ultimately amenorrhea[142]. These effects may be related to energy balance and its effects on anthropometric characteristics such as body weight or percentage of body fat[134]. Strenuous physical activity during adolescence may therefore reduce lifetime risk of breast cancer[134,143]. The final mechanism proposed suggests that physical activity may influence the immune system by enhancing the capacity and numbers of natural killer cells[144]. These cells have the ability to kill spontaneously arising tumour cells, and thus may influence breast carcinogenesis.

Physical activity was not found to be strongly associated with hormone levels in a cohort

study[137] of 253 postmenopausal women, or with survival from breast cancer in an Australian study[145]. However, Friedenreich et al.[139] examined 21 cohort studies and found a statistically significant reduction in risk estimates associated with high levels of activity in 12 of the studies, a trend of decreasing risk with increasing activity in six, and no evidence of an association in only four. The results of a recently published study by Rockhill et al.[146] contribute to the evidence suggesting that adult physical activity is associated with decreased risk of breast cancer. The authors found that women who engaged in moderate or vigorous physical activity for seven or more hours per week had a relative risk of 0.82 when compared to those who engaged in similar levels of physical activity for less than one hour per week.

Inconsistencies in study results could be attributed to problems with exposure measurement since physical activity was not the main focus of most studies[139]. For example, some studies have used job titles to classify study participants into categories of activity rather than assessments of actual duration, frequency and intensity of individual activity while others failed to measure or control for dietary factors which may have confounded any associations. The absence of effect in some studies may also have reflected the limited range of activities of the women[139]. Overall, while study results suggest that physical activity decreases risk (especially among postmenopausal women), the stage of life during which activity must be practiced to reduce breast cancer risk is unknown. The intensity, duration and frequency of activity also remain unknown.

1.4.6 Reproductive history

1.4.6.1 Age at first menstrual cycle

Age at first menstrual cycle is determined by the ratio of fat to lean body mass[25], which in turn is influenced by usual diet and exercise. Early age at menarche (age 12 years or younger) is a strong risk factor for breast cancer, and girls who consume high fat, low fibre diets and are not physically active are likely to experience their first menstrual cycle at an earlier age[147,148]. Women who begin menses at an earlier age experience more menstrual ovulatory cycles over a lifetime when compared to those who begin menses later. This lifetime increase in menstrual ovulatory cycles results in greater exposure of breast tissue to ovarian hormones, thus increasing risk of breast cancer. While ovarian hormones are not genotoxic in themselves, they are known to influence the rate of mitotic activity in breast tissue[149] and do so both at the initiation and promotion stage of carcinogenesis.

Epidemiological evidence supports an association between early age at menarche and increased risk factor of breast cancer. For example, younger age at menarche was associated with a higher risk of breast cancer in an international case-control study[150] and a large American case-control study[151]. A significant protective association (RR=0.66) was also noted in the Nurses' Health Study II[152] for women who began menses at 13+ years of age when compared to women who began menses at 12 years or younger. McTiernan[106] suggests that risk is increased by 30 per cent among women aged 40 years or older who experienced their first menses when they were less than 12 years old.

1.4.6.2 Length of menstrual cycles

The usual length of menstrual cycles may impact on the risk of breast cancer. The menstrual cycle includes the follicular phase and luteal phase; the latter is not as variable in length as the follicular phase[149]. Most breast cell proliferation activity takes place during the luteal phase in response to cyclic changes in the sex steroid hormone levels[38]. Thus, it has been suggested that more frequent menses and the resulting increased exposure to the luteal phase of ovulatory menstrual cycles may increase risk[152]. Women with shorter cycles (≤28 days) may therefore be at increased risk of breast cancer when compared to women with longer ovulatory cycles (≥33 days) because they experience more luteal phases throughout their reproductive life[153,154]. Shorter cycles may also increase risk because of the accompanying higher mean plasma levels of estradiol[155]. An alternate mechanism proposed is that unusual cycle patterns (both short and long) may be a marker for endocrine disturbances that influences both cycle length and risk of breast cancer[154].

Results of a case-control study by Soini et al.[156] demonstrated that those women who had shorter menstrual cycle lengths when they were aged 20 to 39 years had increased risk of breast cancer. A cohort study conducted by Whelan et al.[154] found that women who had extremely short (<26 days) or extremely long (≥34 days) cycles at ages 25 to 29 years had nearly double the risk (RR=1.9, not significant) when compared to women with a median menstrual cycle length of 26 to 29 days. In contrast, a significantly reduced risk was associated with short and long menstrual cycle lengths at ages 18 to 22 years among

women who took part in the Nurses' Health Study II[152]. When cycles of less than 26 days were compared to those of 26 to 31 days, risk was lowered by 50 per cent. Similarly, a relative risk of 0.41 was noted when cycle lengths of greater than 39 days were compared to those of 26 to 31 days. The authors of the Nurses' Health Study II suggested that shorter and longer cycles within this younger age group might have been associated with a higher probability of anovulation, therefore explaining the decreased risk.

The impact of menstrual cycle length on risk of breast cancer remains debatable. A potential source of error associated with results from case-control studies lies in the accuracy of recall: reports of usual menstrual cycles that took place many years earlier may be inaccurate[154]. Current data suggest that irregular cycles at early ages (less than 20 years) appear to provide some protection, while at later ages may increase risk. However, more studies examining risk of breast cancer and usual cycle length within specific age groups are needed before a definitive judgement may be made.

1.4.6.3 Oral contraceptive (OC) use

Consistent associations between reproductive factors and breast cancer risk[157] support the theory that hormones play a critical role in the etiology of breast cancer. Breast cancer risk may be best understood in terms of lifetime cumulative exposure to estrogen and perhaps progesterone[38]. While these ovarian hormones (and exogenous hormones including OCs and HRT) do not appear to initiate carcinogenesis, they affect the rate of cell division[38]. In breast cancer, this is manifested in their effects on the proliferation of

breast epithelial cells. Higher rates of breast cell proliferation (as measured by a higher thymidine labeling index) have been noted among OC users when compared with non-users[158]. However, while substantial between-person variation exists, plasma estrogen levels among OC users is generally lower than in non-users[159]. Further, although the effect varies substantially by formulation, the estrogen and progestin components of OCs influence the production (in opposing directions) of sex-hormone-binding-globulin, resulting in an alteration of the percentage of bioavailable estrogen[160]. The net impact of OC use on breast cancer incidence, therefore, is difficult to predict.

Results of the Nurses' Health Study[161] indicated that long term OC use (either lifetime use or use only prior to a first full-term pregnancy) did not result in any appreciable increase in breast cancer risk in women over 40 years of age. A combined analysis of 54 studies[162] from a variety of countries provided evidence of a small (RR: 1.07 to 1.24) significant increase in risk for current users and during the first 10 years after stopping OC use, but found no significant excess risk after this period of time. Similarly, a review of case-control and cohort studies[38] found no statistically significant association between OC use and risk of breast cancer among women aged 45 years or older, but found a significantly increased risk of breast cancer (RR ranging from 1.36 to 2.28) associated with OC use among women aged 44 years of age or younger. Lastly, results of a review conducted by Hulka and Brinton[163] indicated that use of OCs at young ages or for long periods of time may be associated with increased risk when compared to non-users, but only for those women in whom breast cancer occurred at young ages.

Study results to date are inconsistent, thus, the impact of OC use on the incidence of breast cancer remains uncertain. Younger women who use OCs for extended periods of time may be at a slightly higher risk of breast cancer compared to non-users. McTiernan et al.[106] suggests that oral contraceptive use before the first pregnancy is associated with a minimally increased risk of 1.1 to 1.2.

1.4.6.4 Use of Hormone Replacement Therapy (HRT)

The role of HRT use in breast cancer etiology is presumed to be similar to that of OCs. It too has been investigated based on the assumption that breast cancer is hormonally mediated, and that use of exogenous hormones such as HRT may therefore elevate risk of breast cancer.

A Canadian case-control study[164] examining HRT usage among 607 cases and 1214 controls found that risk estimates for most duration-of-use categories were close to unity. They found no significant trend with increasing duration and no evidence of increased risk among women who used unopposed conjugated estrogens for less than 15 years and for recent users. A larger case-control study[165] of 3130 cases and 3698 controls found no association between HRT use and breast cancer risk, regardless of duration of use. Results of the Nurses' Health Study[166] observed a slightly increased risk (RR=1.3 to 1.7) when comparing postmenopausal users to nonusers, whether the women used compounds containing estrogen alone or estrogen plus progestin. Analysis also demonstrated an increased risk of breast cancer (RR=1.71) among older women aged 60 to 64 years who

had used HRT for five or more years. An analysis of 51 international studies[167] also found an elevated risk associated with use of HRT which increased with increasing duration of use, but the authors found that excess risk was reduced after HRT use ceased, and had almost completely disappeared after approximately five years post-HRT use. Harris and Lipman[38] examined the combined results of one cohort and nine case-control studies and concluded that for women who had used HRT for at least 10 years, risk of breast cancer was 1.36 times higher than for never-users. Women with a family history of breast cancer may be more susceptible to the carcinogenic effects of estrogens[38].

The degree to which HRT influences risk of breast cancer remains unknown. Long term usage may result in slightly increased risk. Some subgroups of women may be more susceptible than others to increased risk due to HRT usage. In many of the studies cited, respondents began HRT usage at the time of menopause and used it continuously. Since use of HRT is closely linked to menopause, which in turn is linked to risk factor for breast cancer, results of these studies may be biased due to confounding by menopausal status.

1.4.6.5 Benign breast disease

Benign breast disease is a heterogeneous group of lesions that includes the entire spectrum of breast abnormalities[38]. Lesions may be categorized as nonproliferative or proliferative. Proliferative lesions may be further categorized into those with and without atypical hyperplasias[168-170]. Atypical lesions possess some of the features of carcinoma in

situ, and may be categorized as either ductal or lobular[168-170]. Increased risk of breast cancer is associated only with specific types of benign breast disease. For example, when compared to those with nonproliferative lesions, women with atypical hyperplasia have approximately four to five times the risk of breast cancer, while those with proliferative lesions without atypia have approximately twice the risk[171]. As a result, atypical hyperplasia lesions are considered to be precursors for breast cancer[170].

Study results reported by Dupont et al.[168] showed no increased risk for women with nonproliferative lesions, a moderately increased risk (RR=1.6) among women with proliferative lesions without atypia, and a greater risk (RR=4.4) among women with atypical hyperplasia when compared to women in the general population. The largest risk (RR=8.9) was associated with those women with atypical hyperplasia who had family histories of breast cancer. In the Nurses' Health Study[172], premenopausal women with atypical hyperplasia were found to have more than twice the risk of postmenopausal women with the same condition (RR of 5.9 versus 2.3). However, menopausal status had no effect on risk for patients with proliferative disease without atypia, suggesting that the hormonal milieu modifies breast cancer risk in women with atypical hyperplasia. There is some biological plausibility for this hypothesis since women with benign breast disease are known to have higher estrogen levels than disease free women [173,174]. A cohort study conducted by Jacobs et al.[171] found increased risk among women with atypical hyperplasia (RR=5.8) and among women with proliferative disease without atypia (RR=3.0) when compared to women with nonproliferative disease.

Accurately identifying lesion type remains problematic because some lesions are very difficult to categorize[38]. Study results may therefore have been influenced by inaccuracies in benign breast disease categorization. However, it would appear that the majority of women with benign breast disease are not at greatly increased risk of breast cancer. Only those women with both atypical hyperplasia and a family history of breast cancer are at higher risk of breast cancer.

1.4.6.6 Parity and age at birth of first child

Parity and younger age at the time of the first child's birth have been associated with a protective effect against breast cancer. Mechanisms explaining the effects of parity on risk of breast cancer are unknown, but probably relate either to changes in breast tissue that render the tissue less susceptible to carcinogenic agents, or to long-lasting changes in the hormonal milieu. Results of animal studies[51] suggest that full cellular differentiation of the mammary gland during full term pregnancy may protect against the subsequent development of breast cancer. Alternately, Harris and Lipman[38] suggest that changes in estrogen secretion and metabolism, particularly during the first full term pregnancy, have a strong influence on risk. During the first trimester of pregnancy, the free estradiol level rises rapidly resulting in exposure to estrogen levels that are equivalent to several ovulatory cycles within a relatively short period of time[38]. The rate of increase of estradiol is particularly rapid in a woman's first pregnancy. The negative effect of increased estrogen exposure during early pregnancy is later overridden by the beneficial consequences of the completed pregnancy: parous women have higher levels of sex

hormone binding globulin and lower levels of free estradiol than do nulliparous women[175].

In 1973, MacMahon et al.[176] provided some early insights regarding the influence of pregnancy on risk of breast cancer. Study findings indicated that single and nulliparous women had approximately 1.4 times the risk of breast cancer compared to parous married women. Further, women who were less than 20 years old at the time of their first birth had approximately half the risk of nulliparous women, but risk among nulliparous women was lower than for women with a first full term pregnancy after age 35 years. A significant trend suggesting decreasing risk with increasing parity was also noted in a Mexican case-control study[177]. The authors also found a decreasing trend in risk with increasing number of liveborn children. Further, they found that late age at first birth increased risk and birth after age 29 years doubled the risk in comparison with women who had their first child at age 19 years or younger (OR=1.9). Results of studies by Newcomb et al.[178], Yoo et al.[179] and Byers et al.[180] were in accord: the authors found a decreased risk with increasing parity, and increased risk with increasing age at birth of first child.

The concordance of study results support the roles of parity and age at birth of first child as factors influencing risk of breast cancer. Young age at the time of birth of a first child and high parity protect against breast cancer. Risk of breast cancer may be increased as much as twofold for women who experience their first full term pregnancy after age 30

years when compared to women who experience their first full term pregnancy at ages younger than 30 years [106].

1.4.6.7 Lactation history

A number of mechanisms have been proposed to explain the association between lactation history and risk of breast cancer. The first assumes that the cumulative number of ovulatory cycles is directly related to breast cancer risk. (See *Section 1.4.5.2 Length of menstrual cycles.*) A longer duration of lactation is believed to be beneficial in reducing risk of breast cancer because of the delay in the return of ovulation after a completed pregnancy and accompanying decrease in total lifetime cumulative exposure to estrogen[109]. Byers et al.[180] proposed a second mechanism of action: they hypothesized that successful lactation is an indicator of a normally balanced endocrine system, and unsuccessful lactation (for example, due to insufficient milk) is correlated to an underlying hormonal imbalance that might subsequently result in increased risk of breast cancer. Alternately, pregnancy and lactation induce differentiation of breast tissue, possibly making it more resistant to carcinogenesis[181], or breast milk may protect tissues by ridding the body of fat soluble carcinogens[182]. Studies of chemically induced breast tumors in mice have documented more tumors in nipple-excised breasts than in suckled breasts[183,184]. It is believed that the obstruction of the nipple resulted in prolonged exposure to carcinogens whereas on the suckled side, carcinogens were excreted in the milk. Similarly, an early study[185] comparing breast cancer rates in women who breastfed unilaterally to those in women who breastfed from both breasts indicated increased risk of

cancer in the unsuckled breast.

Lactation is increasingly associated with a modest protective role in breast cancer. The effect seems to be most frequently observed in premenopausal women[178,179,186-188], although one study[187] found a significantly reduced risk among postmenopausal women who had breastfed their children. Risk estimates among the studies cited varied from 0.39 to 0.78. Most studies[177-179,187] also found that longer duration of lactation was associated with a reduction in breast cancer risk. For example, increasing duration of lactation was associated with a progressive reduction in breast cancer risk in a Chinese case-control study[189].

Increased duration of lactation is believed to provide a weak protective effect which may be particularly pertinent to risk of breast cancer among premenopausal women. It is unknown why the effect appears to be more pronounced among premenopausal women, but it could be because of distinct differences in disease etiology between pre- and postmenopausal women. Women who have never lactated have an increased risk of 1.2 to 1.5 for breast cancer[106].

1.4.6.8 Menopause

The age-related rate of increase in risk of breast cancer slows dramatically after menopause[4,152,154]. The relationship between age at menopause and risk of breast cancer reflects cumulative lifetime exposure to ovarian hormones. Menopause is associated with

greatly reduced levels of circulating ovarian hormones: direct ovarian estrogen production ceases at this time and estrogen is subsequently derived primarily from the metabolism of adipose tissue[37]. Serum estradiol levels in postmenopausal women are approximately constant at roughly one-third of the lowest premenopausal level, and serum progesterone levels are effectively zero[190]. Early age at menopause reduces lifelong exposure to estrogen, resulting in reduced risk. Women whose menopause occurs after the age of 55 years are estimated to have twice the risk of those whose menopause occurs before the age of 45 years[191]. Postmenopausal obesity is associated with an increased rate of breast cancer. This effect may be mediated by the effect of obesity on estrogen profiles. Specifically, postmenopausal women with abdominal obesity have increased levels of circulating estrogen when compared to lean postmenopausal women[37].

Hsieh et al.[150] found that the later a woman's age at menopause, the greater her risk of breast cancer. The authors also found that for every 5-year difference in age at menopause, the risk for breast cancer changed by about 17 per cent. Analysis of 51 international studies[167] demonstrated that risk of breast cancer among postmenopausal women declined progressively with time since menopause for each year after menopause compared to premenopausal women of similar age and childbearing history. The trend did not differ significantly between women with natural menopause and those with bilateral oopherectomy. Lastly, a study comparing women with artificially induced menopause to those who experienced natural menopause[192] at similar ages found little difference in risk.

In summary, menopause occurring after age 55 years may double the risk of breast cancer[106] due to the prolonged estrogenic state and increased number of ovulatory cycles.

1.4.7 Summary of the role of non-dietary risk factors in the etiology of breast cancer

Many risk factors known to be associated with increased risk are host factors that individuals can do little to modify. Family history, the strongest known risk factor for breast cancer, has a relatively minor impact on incidence in the general population because only a small percentage of families carry the predisposing gene(s). Strong epidemiological evidence exists that suggests that other factors, including early age at menarche and late age at menopause, postmenopausal obesity and presence of benign breast disease, increase risk of breast cancer through their influence on endogenous estrogen levels: increased lifetime exposure to estrogen appears to increase risk of breast cancer. Greater adult height is also strongly associated with increased risk of breast cancer.

In contrast, little evidence has been found to support associations between the use of oral contraceptives and/or hormone replacement therapy and increased risk of breast cancer, or to support the hypothesis that shorter or unusual menstrual cycle patterns increase risk. Likewise, it seems unlikely that cigarette smoking is implicated in the etiology of breast cancer. It has been investigated both as a risk factor, and as a protective factor, but evidence supporting either role is very weak.

The strong evidence found associating premenopausal obesity, early age at the time of birth of the first child and increased lifetime duration of lactation with decreased risk of breast cancer also supports the hypothesis that breast cancer is influenced by cumulative exposure to estrogen, since all of these factors are associated with changes in endogenous estrogen levels. Finally, although the level, intensity and duration of physical activity required to affect breast cancer risk are unknown, initial studies indicate that it provides a protective effect against the onset of breast cancer through its action in maintaining a healthy energy balance, regulating hormonal levels and/or by enhancing the effects of the immune system.

1.5 Dietary assessment

1.5.1 Overview

For reasons outlined in *Section 1.3 The role of diet in the etiology of breast cancer*, it is important to examine and clarify the roles of dietary risk factors in the etiology of breast cancer. Accurate dietary assessment is a critical issue when conducting epidemiological investigations of the role of nutritional factors in the etiology of chronic diseases. Knowledge of 'usual intake', which has been defined as an individual's mean intake over an extended period of time ranging from months to years[193], is desirable when relating nutritional intakes to risk of disease[194]. In spite of advances made in the field of dietary assessment in recent years, the measurement of human dietary intake remains a challenge with much controversy surrounding the selection of appropriate dietary assessment methodologies[195]. There are many methods of dietary assessment, and they may be

divided into two groups: those that measure current food or nutrient intakes and those that measure dietary intakes in the past. A discussion of sources of error in dietary data and a description of dietary assessment methodologies follows.

Non-response is a limitation regardless of the dietary assessment methodology utilized: respondents who participate in studies may differ from non-respondents or less compliant respondents[196]. For example, individuals who agree to participate in nutrition surveys may form a special subgroup of the population, perhaps with more education or affluence, and thus, may have different dietary habits. It is therefore important to ensure that non-respondents are not significantly different from respondents so that results obtained from a sample may be generalized to the population as a whole[197].

1.5.2 Sources of error and their impact

Any source of variance in the individual data or the group mean in dietary methodology is termed 'error'[198]. Dietary data cannot be estimated without error, but the nature and magnitude of the error depends on the collection methodology utilized and the subjects under study[199]. The reliability (or reproducibility) and validity (the degree to which the data measure what they are intended to measure[200] i.e. usual nutrient intakes) of an instrument are influenced by the type and degree of error present. There are many potential sources of error in dietary assessment, but all may be grouped into two broad categories: random error and bias[18].

Random error is typified by the daily fluctuation in dietary intake. It includes within- and between-subject error across all days of dietary data collection[201] as well as measurement errors[18]. Beaton et al.[198] found that within- and between-subject factors were the major contributors to variance for estimates of dietary intakes of protein, carbohydrate, fat and fat types. Tarasuk and Beaton[202] and others[198,203] have documented substantial intra-subject variations in daily nutrient intakes which can exceed inter-subject differences.

Random measurement errors may arise from miscommunications (such as misunderstanding the intent of a question), incomplete dietary recalls and/or inaccurately quantified portion sizes[201]. Random errors decrease reliability. Errors of this nature result in increased variance and decreased statistical power when group mean intakes are compared. While random errors cannot be totally eliminated, the impact may be reduced by using food models, standardized probing and interview techniques[201], by increasing the number of observation days per subject and/or by increasing the number of subjects observed[18,199,201].

Multiple days of dietary data are required to estimate average usual nutrient intakes of individuals[201]. The number of days required depends on the intra-subject variation in daily intakes of the nutrients of interest. For example, Willett[194] estimated that only four days of dietary data were required to estimate an individual's total fat intake (adjusted for total caloric intake) to within 20 per cent of their true mean intake 95 per cent of the time while 106 days of data were required to estimate vitamin A intakes to within 20 per cent

of true mean intake 95 per cent of the time. The higher intrasubject variation observed for micronutrients may be explained by their high concentration in certain foods[194] (such as vitamin A content in liver) which are seldom consumed on a daily basis. Thus, more days are required to estimate intake of these nutrients.

Bias refers to the systematic, intentional or unintentional, under- or over-reporting of an intake[18]. While bias may be exhibited by respondents and/or interviewers, and/or be associated with the methodology of the study, Gibson[201] suggests that respondent bias is a major source of systematic error. Examples of respondent bias include the under-reporting of food intakes by women[204-206] and overweight persons[199,205-207], or poor dietary recall by the elderly[203,208]. Inaccurate portion size estimates are another source of potential bias. Inaccurate estimates of portion sizes consumed may be due to the failure of interviewers to use appropriate recording techniques, and/or to the failure of subjects to accurately report portion sizes. For example, women are reportedly more competent than men at accurately estimating portion sizes of foods consumed[203]. However, this increased competency may be due to their greater experience in food handling rather than to gender differences[209]. While interviewers should be trained in the use of proper recording techniques to minimize this source of bias[209], studies examining the benefits of subject training[210,211] reported limited success: some improvement in portion size estimation was reported among students who had been trained, but training benefits declined quickly[212].

Methodological errors such as errors in the food composition data base[199] may also

contribute to bias. The nutrient content of a food item consumed by a respondent may differ considerably from that used to generate the database tables. Selenium is an extreme example of this situation: selenium content in American corn can vary by as much as 200-fold due to differences in selenium soil levels[213]. Differences in food analysis techniques may also give different nutrient analyses which could complicate results[43,201]. However, efforts are made to choose 'representative' foods, and standardized analytic techniques are utilized in the construction of large databases[199] such as the 1997 Canadian Nutrient File[214] and the USDA databases. Nevertheless, these sources of error could lead to inaccurate estimates of between country differences when making comparisons of food items and nutrients consumed due to differences in databases and food analysis techniques.

1.5.3 Dietary assessment methodologies

1.5.3.1 Weighed food record

This dietary methodology, considered the gold standard of dietary assessment methods[201], requires the respondent to weigh and record details of all foods and beverages consumed (including amount consumed, brand names used and food preparation methods) at the time of consumption during a specified time interval (usually three to seven days) including at least one weekend day[198,203]. Gibson[201] suggests that this is the most precise method available for estimating food and/or nutrient intakes of individuals.

This method is inappropriate for use in population based surveys because of the following

limitations. Firstly, there is a high respondent burden: respondents must be highly motivated, literate and numerate[201]. Secondly, the constant record keeping required may result in raising awareness of the food eaten to the point where eating behavior is altered[215]. When the records are being used to represent an individual's usual intake, which is the case in population based surveys, this effect is undesirable. Lastly, the cost of processing these records is usually high: weighed food records require highly trained personnel for review, decision making and coding[201].

Some training of subjects is required in order to ensure record accuracy[201]. Errors in the estimation of usual intake may be incorporated through recording errors, or by misreading the weighing scale[201]. Errors and inaccuracies may also be introduced if food portions cannot be weighed because meals are eaten away from home. Further, when a large number of recording days are required, respondents may either complete their records less frequently than recommended, or alter their reports or usual eating patterns to simplify the record keeping: the result of either of these circumstances will be decreased accuracy in the estimate of usual dietary intake[197].

The 7-day weighed food record is sometimes used as the standard against which other dietary assessment methods may be validated[203]. A comparison such as this would provide an estimate of 'relative' validity. Variation in results between the weighed food record and the method being validated could be due either to unreliability of the method utilized, or simply to normal differences in daily food intakes[203].

1.5.3.2 Food diary

Food diaries differ from weighed food records in that food portions consumed are estimated with household measures rather than weighed[201]. As with weighed food records, respondents are generally asked to record all foods and beverages, including amounts, at the time of consumption. Variation in subjects ability to accurately estimate their portion sizes is therefore a primary limitation.

Some respondent training is generally required so that the diary is sufficiently detailed and accurate. Use of this method requires that the respondent be sufficiently motivated to record their food intake and literate[201], which may limit the use of this method to educated subjects.

1.5.3.3 24-Hour recall

This widely used dietary assessment method requires the use of a trained interviewer to elicit complete information regarding the respondent's dietary intake for the 24 hours prior to the interview, or in the preceding day[201]. Food models or standard spoons and cups may be used as aids to increase respondent accuracy in estimating portion sizes[201]. The accuracy of the collected data using this method is dependent on the cooperation, memory recall and communication abilities of the respondent, and the skill of the interviewer in probing for details[216]. Bias may be introduced if interviewer probing techniques are not standardized[201].

Advantages of the 24 hour recall include its simplicity, ease of application and low respondent burden[216]. Collection and processing of the data are labor intensive since daily dietary intakes are highly variable, but the method is relatively inexpensive to use[216]. It is not appropriate to use a single 24-hour recall if one wishes to characterize an individual's usual diet[216]. However, multiple recalls may be used to estimate the average dietary intake of individuals over an extended period of time[216,217]. The 24-hour recall may also be used to assess the average intake of groups of subjects i.e. to typify average food intakes of large population groups[201].

1.5.3.4 Diet history

This dietary assessment method was pioneered by Burke in 1947. The diet history focuses on the respondent's usual food or nutrient intake over a relatively long period of time. It is an interview method consisting of two, or sometimes three parts[201,203]. The first part consists of a 24-hour recall, and a determination of the respondent's usual dietary pattern including detailed descriptions of food items and portion sizes usually consumed at and between meals. A 'cross-check' is completed in the second part of the interview: the respondent is queried about food preferences, purchasing information and the use of each food to verify and clarify information given in the first part of the interview. The last part of the diet history consists of a three day food diary using household measures. The food diary is considered by many to be the least useful, and is often dropped[201].

While this methodology has been shown to estimate nutrient intakes over long periods of time it is a time consuming, expensive method requiring skilled personnel, and is therefore unsuitable for large surveys[201].

1.5.3.5 Food frequency questionnaire

The food frequency questionnaire (FFQ) is used to collect information about the respondent's usual long term dietary intake. The period of recall may range from weeks to years. This method is frequently employed in epidemiological studies since usual long term diet (intake over weeks, months or years) is considered the more important exposure compared to short term (intake over days) dietary habits[218]. However, to be most useful, the food items included in the questionnaire must reflect the particular dietary patterns of the population where it is used[201,218].

A FFQ consists of two components: the food list and the frequency response section. The food list must be comprehensive, pertinent to the exposure(s) of interest and population specific[219]. Individual food items within the list must contain a significant quantity of the nutrient(s) of interest. Further, while food items must be consumed reasonably often in order to be included, consumption frequency and/or amount must vary from person to person[218]. Willett[218] suggests that development of an appropriate food list for the FFQ may be approached in several different ways: it may be based on prior information of an association of a food item with the outcome of interest in the study; it may include all foods that are potentially important sources of the nutrient of interest, or it may include

only frequently consumed foods that contain the nutrient of interest. A final approach in developing a food list is to use food items identified from diet records or 24 hour recalls collected from the population of interest. In this last case, those foods that make the most significant contributions to total intakes of a nutrient by the sample group as a whole are identified and included in the FFQ food list[218]. Inaccuracies may result from an incomplete food list, or from errors in estimations of frequency of consumption of food items[196,220,221].

A semi-quantitative FFQ assesses the frequency of consumption of specific foods and nutrients, using defined serving sizes. The frequency response section may be open-ended (response categories not defined) or closed-ended (response categories such as '2-4 times per week' are defined). The accuracy of respondent estimates of portion sizes consumed are improved with the use of food models[201] and open-ended frequency responses[222].

FFQ have demonstrated validity in measuring long term diet[218] and may be used to rank individuals within a population in regards to their energy and nutrient intakes[223]. They also have a modest subject burden, and relatively low costs associated with their application[224] and thus tend to have higher response rates than do other dietary assessment methods including weighed food records and diet histories[218]. For these reasons, they are particularly well suited for large scale nutritional epidemiological studies.

1.5.4 Selection of a dietary assessment method for use in this research

After careful consideration of the available methods, a FFQ was deemed the best instrument for use in this research. FFQs are useful in nutritional epidemiological studies, particularly in studies of diseases with long latency periods[197] such as breast cancer, because they provide reasonable estimates of usual long term intakes[201]. The use of FFQs also avoids possible bias associated with changes in usual diet due to subject knowledge of diagnosis of illness by asking subjects to recall their former diet in the period prior to diagnosis[220].

Willett[218] states that while dietary intake over a number of years is the exposure of interest in nutritional epidemiological studies of many chronic diseases, diet within the same subject tends to be reasonably similar from year to year. Thus a one year time frame, providing information describing usual food use throughout all seasons, is frequently used in these studies[83,84,95,223,225].

Although a FFQ was developed for use in the 1995 Prince Edward Island Nutrition Survey, it was designed to assess primarily total fat and carotenoids and the food list was not based on dietary patterns of the Prince Edward Island (PEI) population. Therefore a new, more comprehensive instrument was needed to investigate the possible role of several dietary factors in the etiology of breast cancer among PEI women.

1.5.5 Assessing population adequacy of dietary intake

1.5.5.1 Overview

Canada's nutritional guidelines were established for the healthy population, and describe recommended intakes of energy and other nutrients sufficient to support health while providing maximum protection against chronic diseases[24]. Recommendations for usual levels of nutrient intakes are described by the Recommended Nutrient Intakes (RNIs), and Dietary Reference Intakes (DRIs). The RNIs were last revised and published in 1990. The DRIs are newer standards, jointly developed and produced by Canada and United States in an effort to harmonize dietary reference intakes for both countries, and will ultimately replace the Canadian RNIs[15].

Nutrient requirements vary by age, sex, physical activity, body size and physiological state[201]. Recommended intakes for many nutrients are stratified by age and gender. Although it is usual to list recommendations for males and females separately, differences (with a few exceptions) are related to body size more than gender. Depending on the nutrient, recommendations are based on energy intake, age, gender and/or body weight. Some exceptions apply: data describing requirements for some nutrients in certain strata (e.g. adolescents and the elderly) are very limited[24]. In these cases, nutrient requirements are extrapolated from other age strata[24]. Regardless of the basis, each requirement is expressed as a daily rate. However, since consumption varies daily, some deviation around this average value over a number of days is expected.

Energy intake recommendations are based on estimates of average energy requirements for groups of individuals defined by age and sex strata, and are expressed as daily intake values. This estimate is used because it is recognized that excessive energy intakes over long periods of time are detrimental to health. The recommended energy intake is defined as that which will maintain body weight within the range of desirable body mass index (BMI) for those in a specific age and sex strata[24]. BMI is an index of weight-for-height[15]; values greater than 25 or lower than 20 are associated with increased risk of chronic disease[15].

Recommended nutrient intakes assume that requirements are normally distributed among individuals within a given age strata, and traditionally have been set at the average requirement for a specific age and sex group plus two standard deviations[201,226]. Thus, the recommended daily dietary intake levels are sufficient to meet the nutrient requirements of nearly all (97% to 98%) individuals within a given age and gender group[15]. This conservative approach has been adopted because the risk to health is associated primarily with inadequate intakes[24].

1.5.5.2 Canadian nutritional guidelines: DRIs and RNIs

The first DRIs were produced in 1997 and described recommended daily intake levels for calcium, phosphorus, magnesium, vitamin D and fluoride[227]. Since then, a second report has been released which describes DRIs for folate, other B vitamins (including thiamin, riboflavin, niacin and vitamin B_6) and choline[228]. Reports on other nutrients will follow.

The DRIs include several standards. Those relevant to assessing dietary adequacy include Estimated Average Requirement (EAR), Recommended Dietary Allowance (RDA) and Adequate Intake (AI)[227]. The EAR is the nutrient intake value that is estimated to meet the needs of 50 per cent of the individuals in a certain age and gender group, and is intended to be used to assess the adequacy of group intakes. Where insufficient data exist to establish an EAR, an Adequate Intake (AI) level may be used. The AI, based on observed or experimentally determined approximations of average nutrient intakes by a defined population, is that level that should support health. The RDA is similar to the RNI in that it is set two standard deviations above the EAR. Nutrient intake levels described by these standards are intended to serve as a goal for daily dietary intakes by individuals.

1.5.5.3 Interpretation of dietary data

An assessment of population dietary adequacy requires a comparison to recommended intake levels. Since these levels are recommended intakes over time, it is important that the population dietary data to be compared represent 'usual diet'. The RNIs and EAR (or AI in the case of inadequate information) are among the standards used to assess the dietary adequacy of populations. A common misuse of these standards is to conclude that intakes that are less than recommended are deficient or inadequate. True nutritional adequacy cannot be determined solely from dietary data: biochemical and clinical data must also be considered[201]. Therefore, all that can be concluded about nutrient intake levels that are lower than the RNIs or DRIs is that they are 'less than recommended', or 'might be a problem'[226]. The further the intake falls below the recommended level, and

the longer the duration of the low intake, the greater the probability of inadequacy[229].

1.6 Objectives of the research

Breast cancer remains a significant health concern for all women. Despite considerable efforts, current knowledge of established risk factors and their mechanisms only accounts for about half of the breast cancer cases around the world. While many of the established non-dietary risk factors for breast cancer such as family history and age at menarche and menopause cannot be modified, dietary risk factors are more amenable to change. The consumption of some dietary components may provide an avenue for women to modify their risk of breast cancer. While exact mechanisms remain unclear, proposed mechanisms include influencing age at first menstrual cycle (total energy and resulting energy balance), estrogen levels (total dietary fibre) and cell growth (n-3 fatty acids). In addition, consumption of carotenoids, monounsaturated fats, vitamins C and E may provide protection against cellular damage through the provision of antioxidants inherent in these dietary components.

It is important to investigate the impact of diet on the risk of breast cancer in many different populations in order to gain a better understanding of its role in breast cancer etiology. Prince Edward Island is a good location to carry out such a study because the population is relatively stable, and primarily rural. Since agriculture and fishing are among the primary industries of the Island[230], the population may have different dietary patterns than urban populations previously studied[231]. Although the PEI Nutrition Survey

was conducted in 1995, results are not yet available. A comparison of PEI to national weekly food expenditures, however, supports this belief: in 1996, Islanders spent more of their weekly food expenditure on fish and other marine products, and less on vegetables than the national average (2.9% versus 2.4%, and 5.7% versus 6.8%, respectively)[232]. With the exception of a study conducted by Johnson et al.[233] which focused primarily on non-dietary risk factors associated with breast cancer across Canada, little research has been conducted investigating the relationship between diet and risk of breast cancer in PEI women even though it has the highest incidence rate of all types of cancers (excluding non-melanoma skin cancer) among these women[234]. Further, there are few current data describing dietary adequacy of Canadian women. Provincial nutrition surveys have been conducted over the past decade, but only Nova Scotia and Quebec have published results to date.

Based on a review of the literature, it is hypothesized that Island women recently diagnosed with breast cancer would have significantly lower dietary intakes of n-3 fatty acids, monounsaturated fats, total dietary fibre, and carotenoids than would healthy women, resident in PEI.

This research had three specific objectives.

The first objective was to develop and pilot test a semi-quantitative food frequency questionnaire designed to assess dietary intakes relevant to breast cancer, including n-3

fatty acids, monounsaturated fats, total dietary fibre and carotenoids, as well as other dietary components (Chapter 2).

The second objective was to assess dietary intakes of nutrients relevant to breast cancer and to assess the adequacy of usual nutrient intakes in women with recently diagnosed breast cancer and women never diagnosed with breast cancer, resident in Prince Edward Island (Chapter 3).

The final objective was to document the presence of non-dietary risk factors in those same women, and to develop a model, including nutrients consumed, to predict breast cancer risk (Chapter 4).

2. DEVELOPMENT OF A FOOD FREQUENCY QUESTIONNAIRE FOR USE IN BREAST CANCER RESEARCH IN PRINCE EDWARD ISLAND, CANADA

2.1 Introduction

Research results point to the significance of diet in breast cancer. (See *Chapter 1, Section 1.3 The role of diet in the etiology of breast cancer* for a full discussion.) However, accurate dietary assessment is a critical issue when investigating associations between usual dietary habits and risk of breast cancer. A methodology to assess usual food intakes of individuals was first developed by Burke[235] in the mid-1940s. This method, the diet history, is still used today and includes a 24-hour recall, a formalized list of questions about the use of specific foods over the previous month, and a menu recorded for three days. However, while this method provides detailed information regarding food intake, it is very labour intensive and unsuitable for large surveys[201]. Semi-quantitative food frequency questionnaires (FFQ) are now widely used in epidemiological studies[218], especially in addressing issues of the role of usual diet in chronic diseases[197] such as breast cancer. This is because of their documented validity for accurately estimating usual long term dietary intake[220,236], their ability to rank individuals according to their usual nutrient intakes[223,237], their ability to predict disease outcome[238] and their ease of administration[203,221,237]. These instruments are used to assess the frequency of consumption of specific foods and nutrients using defined serving sizes during a specified time period, usually one year[218]. For these reasons, a FFQ was deemed the most appropriate tool to assess usual dietary intakes in a study of diet and breast cancer in Prince Edward Island (PEI), Canada.

The validity of a FFQ instrument is dependent on how well the food listing reflects the major food sources of the nutrients of interest, the dietary patterns of population members in the geographical area where it is used, and the rapidly changing food supply[224]. Food items to be included in a FFQ are therefore best generated from information on the dietary habits of the population under study. A FFQ was developed for use in the 1990 Nova Scotia Nutrition Survey[239] and adapted for use in the 1995 PEI Nutrition Survey[240]. This provincial survey included 2000 PEI adults and was conducted in collaboration with the Bureau of Nutritional Sciences, Health Canada. The FFQ used in this survey was found to be inappropriate for use in the current breast cancer research in PEI because the food list was not developed using dietary intakes of the PEI population. Further, because the primary focus of the 1995 PEI Nutrition Survey was to assess total fat and carotenoids, the use of this instrument could have led to the failure to correctly identify associations between other specified nutrients and breast cancer[43,133]. For example, since n-3 polyunsaturated fats were not among the nutrients of interest in the 1995 survey, the list would not reflect all significant food sources of this fat component. Application of this instrument in the current research could therefore result in an underestimate of the usual intakes of n-3 polyunsaturated fats, which, in turn, could possibly result in a biased estimate of the relationship between n-3 polyunsaturated fat intakes and breast cancer.

To date, Canadian studies investigating the role of diet in breast cancer etiology have been conducted primarily in urban settings. In contrast, the population of Prince Edward Island (PEI) is primarily rural, and is characterized by distinctive dietary patterns

(Chapter 1). Only one study[233] has examined the role of diet in breast cancer in PEI. However, the primary focus of this study was non-dietary risk factors associated with breast cancer, thus dietary factors were examined only as potential confounders. A study of usual dietary habits among Islanders would therefore provide added insights regarding the possible role of diet in breast cancer etiology.

For these reasons a new, more comprehensive instrument was created to assess the role of dietary components in the etiology of breast cancer among PEI women. It was based on dietary patterns of PEI women, and included those foods that make significant contributions to the nutrients of interest in the study, namely: total energy (kcal), fat (g) and fat types (monounsaturated (g), saturated (g), n-3 polyunsaturated fats (g) and *trans*-fatty acids (g)), dietary fibre (g), alcohol (g), vitamins C (mg), E (mg) and A (RE) and carotenoids (RE). Attention was focused on these dietary components because of previous research indicating that they may influence the risk of developing breast cancer. (See review in *Chapter 1, Section 1.3 The role of diet in the etiology of breast cancer.*) Additional nutrients were also evaluated in order to assess nutritional adequacy among the study participants.

The objective of this paper is to describe the development of a semi-quantitative, population specific FFQ, intended for use primarily in breast cancer research in Prince Edward Island, Canada. The first phase involved the development of the FFQ food list and format; in Phase II, a pilot test was conducted in women with newly diagnosed breast

cancer and women never diagnosed with breast cancer to verify the performance of the questionnaire food list length, contents and format. Cases and controls were included in the pilot test to ensure that the food items listed were pertinent to both groups of women, since there is considerable evidence suggesting that they have different dietary habits (Chapter 1).

2.2 Phase I: Instrument development

2.2.1 Food list

A base listing of specific foods currently eaten by PEI women was developed using the 24-hour recalls collected as part of the 1995 Prince Edward Island Nutrition Survey[240]. This provincial survey was part of a national study to determine usual dietary practices and intakes of specified nutrients among Canadians. The peer reviewed, standardized protocol was developed for use in the 1990 Nova Scotia Nutrition Survey[239] and subsequently used by Alberta, Saskatchewan, Quebec and PEI. Data were collected during in-home interviews conducted by community-based health professionals who underwent two weeks of intensive training. The data were subsequently reviewed by each interviewer, regional facilitators and a quality control supervisor before undergoing a final review by the Bureau of Nutritional Sciences of Health Canada.

In this survey, approximately 1000 male and 1000 female non-institutionalized adults aged 18 to 74 years, resident in PEI, were randomly selected from the Island Health Information Service and interviewed during the spring and fall of that year. For the

current study, a random sample of 200 24-hour recalls was drawn from the female participants of the 1995 PEI Nutrition Survey, with equal representation from both seasons. These recalls were used to generate the base list of foods for the new FFQ, according to the method described by Martin-Moreno et al.[219]. Food use data generated by the 24-hour recalls were first entered and translated into nutrient intakes using the CANDAT Research Oriented Nutrient Calculation System[241] which utilizes data provided by the Canadian Nutrient File (CNF) 1997[214] as the basis of food item nutrient content. The CNF is a food composition database containing average values for the nutrient composition of 4668 food items. Much of the data have been derived from the United States Department of Agriculture[41,56,242-265], and modified for Canadian levels of fortification and regulatory standards[214]. Approximately 750 different food items were identified from the 24-hour recalls.

This food list was then reduced in length, since a FFQ food list must include only those foods that make a significant contribution to the research objectives. Food lists that are overly long may tire or bore the respondent, leading to a decreased accuracy of response. Frequency analyses and descriptive statistics[266] were used to identify food items for inclusion in the final FFQ food list based on the following criteria: 1) frequency of consumption; 2) total amount (g) consumed; and 3) contribution made to the specified nutrients of interest[219]. In addition, some food items (e.g. 'shellfish') were included to reflect regional eating patterns. To ensure that the final food list was comprehensive and included all important items relevant to breast cancer risk, it was cross-checked against

FFQ food lists used in other nutritional epidemiological studies, including the Block 95 Food Questionnaire[267], the Environmental Health Survey[233] and the 1995 PEI Nutrition Survey Food Frequency Questionnaire[240]. The Block 95 Questionnaire was developed and validated in American populations[268-271], and has been used in nutritional epidemiology studies throughout the United States. The FFQ included in the recent Canadian Environmental Health Survey was developed by combining food listings from instruments previously developed and validated on American populations by Willett and Block, as well as one developed and used in an urban Toronto study conducted through the National Cancer Institute of Canada (S. Dubois, personal communication, June 18, 1997). This cross checking process resulted in the addition of two food items to the final food list: 'cantaloupe' and 'tacos, burritos or fajitas with meat or beans'. These items were added because they could make significant contributions to carotenoid and total energy intakes, respectively, if consumed.

Consistent with the methodology used by Martin-Moreno et al.[219] in developing a FFQ for use in a large population-based case-control study, PEI dietitians and nutritionists were asked to identify any additional foods commonly consumed by PEI women. Parsnips were added to the final food list on their recommendation because this item would make a contribution to total energy and dietary fibre intakes if consumed frequently.

In accordance with the methodology used by Jain[231], some food items in the FFQ food list were grouped together in order to reduce the length of the list. Sixty-six per cent of the

listed food items included more than one food. This is comparable to the number of food item groupings included in the Enhanced Cancer Surveillance Survey[233] and the Block 95 FFQ[267] (65% and 80% respectively). Food groupings were based on similarity of nutrient content per usual serving (for example, orange and grapefruit juices), botanical/biological similarity (for example, the grouping of green and yellow snap beans as one item) and the expected respondents' perception of similar food types (for example, recognition that cream of wheat and cooked oatmeal are types of the food item 'cooked cereal').

The final food list in the newly developed FFQ included 119 food items divided into 14 different categories. These food categories, the number of food items included in each category and the rationale for food item selection are included in Table III. A more detailed rationale for individual food item selection and inclusion may be found in Appendix A.

2.2.2 FFQ format

Response formats for FFQs may be open-ended (respondent answers in terms of actual frequency of consumption per day, per week or month), or closed-ended (respondent ticks a box indicating consumption three to four times per week)[218]. An open-ended response format was used in the current study since this format has been associated with increased accuracy of respondent reports of frequency of food item consumption[218]. For example, respondents could specify whether they consumed a food item once per day, four times per week or 25 times per month. The format utilized was adapted from that developed

for the 1990 Nova Scotia Nutrition Survey and modified for the 1997 New Brunswick Nutrition Survey[239]. The questionnaire also included specified portion sizes with each food item to aid in the accuracy of respondent recall regarding food portion sizes consumed[207,208].

2.2.3 Vitamin and mineral supplements and prescription drugs

Information regarding the usage of vitamin and mineral supplements taken orally was collected from all PEI respondents. This information included supplement name(s) and Drug Information Number (DIN), frequency of consumption (number of times taken per day, week or month), how much was taken (number of tablets, caplets, etc.) and for how many years the supplement was taken (range from less than one year to 10 years or more). Similar information was collected to document the use of prescription drugs taken orally.

2.3 Phase II: Pilot test

A pilot test of the questionnaire was conducted to verify the performance of the FFQ in regards to the food list length, contents and format. A description of the pilot test follows.

Table III.
FFQ food groups, number of food items included, and rationale for food item selection

Food Group	# food items included	Rationale for food item selection
Fruits	10	vitamin C, carotenoid and fibre content
Vegetables	20	vitamin C and E, carotenoids and/or n-3 polyunsaturated fat, fibre content
Soups	4	fat, vitamin C and fibre content
Dairy	10	fat content
Fish	21	n-3 polyunsaturated fat content; regional eating patterns
Meat and Poultry	11	fat, protein, iron, zinc and B vitamin content
Processed and Luncheon Meats	4	fat content
Pasta and Rice	4	fat, vitamin C and calcium content
Breads and Sweets	8	fat and fibre content
Cereals	5	added sugar, fibre and fat content
Salad Dressings	4	fat and fat type content
Beverages	9	vitamin C, alcohol content where pertinent
Other Foods	9	fat, n-3 polyunsaturated fat content

2.3.1 Materials and methods

Histologically confirmed cases were identified through the PEI Cancer Registry[234]. They included all non-institutionalized women aged 18 to 80 years who were diagnosed for the first time with primary, invasive ductal and/or lobular breast cancer during the period June 1 1997 to June 17 1998. Initial case contact was made with the consent of the attending physician.

Controls were randomly selected from the 1995 PEI Nutrition Survey[240] and were category matched to cases by age (± 3 years) and county of residence. Women with a previous diagnosis of breast cancer, or with a family history of breast cancer (mother or sister with breast cancer) were excluded as controls because they may have changed their diet as a result of this history[272].

Exclusion criteria for cases and controls included: 1) primary place of residence for the five years prior to interview (or date of diagnosis of breast cancer for cases) was not PEI; 2) hospitalization for serious illness at the time of interviewer contact; 3) following a medically prescribed diet for kidney disease, inflammatory bowel disease (i.e. Crohn's Disease or colitis) or liver disease (ie cirrhosis); 4) death prior to interview. The first three criteria were applied to ensure the similarity of dietary exposures among all respondents. Potential respondents who died before being interviewed were excluded from the study because information gained directly from a respondent has been shown to be more accurate than that gained by proxy[273,274].

Potential differences between eligible participants and non-participants were assessed through the use of a non-response questionnaire. Questions were adapted from a similar questionnaire that had been developed by Health Canada and used in the 1995 PEI Nutrition Survey[240]. They focussed on the usual type(s) of bread and milk consumed, the use of nutritional supplements and smoking habits. Non-participants in the study were asked the questions at the time of the first telephone contact while participants were asked the questions at the end of their in-home interview.

Two interviewers attended a one day training session and were provided with a manual outlining interview protocol (Appendix A, 7.3). The FFQ was administered, using portion sized models, during in-home interviews conducted from April through July, 1998. A collection of standard hardboard shapes of various surface areas and thicknesses, plastic glasses, cups, bowls, graduated, 3-dimensional food models and metal measuring spoons, developed for the Saskatchewan Nutrition Survey, was used to assist in assessing the overall size and volume of foods consumed. For example, the 3-dimensional plastic mound 'MO-M', used in the current FFQ to assess the volume of blueberries consumed, is equivalent to one-half cup (118.3 ml). See Appendix A, 7.4 for portion-size models used in the survey. The time period of recall was the year prior to the interview (for controls) or the year prior to the date of diagnosis (for cases). After each interview, the interviewer recorded each respondent's comments on the FFQ food list length, contents and format (including food item organization, portion size and response format). Interviewers also recorded their own perceptions in regards to respondent reception of

food list length, contents and format after each interview.

2.3.2 Nutrient and statistical analysis

Food use data were entered and translated into nutrient intakes using the CANDAT Research Oriented Nutrient Calculation System[241], as previously described. Frequency and range of consumption of individual food items and an assessment of the contribution that each food item made to the nutrients of interest was conducted using SAS Release 6.11 for Windows[266]. Initial analysis of food use was conducted first for the entire sample, then separately for cases and controls. A full report describing and comparing nutrient intakes of cases and controls may be found in Chapter 3.

2.3.3 Results

2.3.3.1 Sample description

Seventy-one women were diagnosed with breast cancer during the study period. Seventeen were excluded for the following reasons: death prior to interview (n=2); age greater than 80 years (n=6); location of primary residence (n=1); and lastly, previous diagnosis of breast cancer (n=8). Four eligible cases refused to participate. Four of the cases interviewed exhibited poor memory recall and/or confusion when queried about their past dietary intakes. They were therefore not included in this analysis, leaving a total of 46 cases.

Sixty-four women were contacted and asked to participate in the study as controls.

Interviewers could not locate one individual and hospitalization for severe illness precluded the participation of two other controls. Eight controls were excluded because of a family history of breast cancer in the immediate family including self, mother or siblings. Two died prior to interviewer contact and one refused to participate in the study, leaving a total of 50 controls. Response rates for both cases and controls were very high: 92 per cent (50 of 54 eligible cases agreed to participate) and 98 per cent (50 of 51 eligible controls agreed to participate), respectively. Analysis of the non-response questionnaire found no significant differences between the 100 participants, and the one eligible control and four eligible cases who refused to participate. The sociodemographic profile of the sample may be found in Chapter 4.

2.3.3.2 Evaluation of food list length, contents and format

In accordance with convention[218,219,231], the frequency of consumption of foods on the food list was evaluated to ensure that food items were consumed frequently enough and in sufficient quantity by cases and controls to warrant continued inclusion in the list. Interviewers noted that some foods were consumed frequently and in significant quantities only when 'in season' (i.e. strawberries, blueberries/cranberries, smelts, eels, herring and mackerel). In addition, interviewers noted that some respondents (primarily older women living in rural areas) were unfamiliar with the item 'Tacos, Burritos or Fajitas with meat or beans' listed in the *Meats and Poultry* group. Frequency and range of consumption of these seasonal and unfamiliar food items is reported in Table IV. Examination of the frequency of consumption of individual food items indicated that 14

foods were consumed by fewer than five respondents (5%). These items included lamb, sweetened cereals, smelts, eels, herring and lake trout (all prepared with and without added fat), mackerel (prepared with added fat), tuna with no fat added, walnuts and mayonnaise >65% fat content, including tartar sauce. Examination also showed that 25 or more individuals consumed at least one portion per month of strawberries and/or blueberries or cranberries and nine individuals consumed at least one portion per month of 'tacos, burritos or fajitas with meat or beans' (Table IV).

Time to administer the FFQ averaged approximately one hour (range: 40 to 75 minutes). While nine respondents (nine per cent) found the questionnaire to be too long, the remainder reported no problems with the length. No problems with the format of the questionnaire were reported.

TABLE IV.
Frequency (%) and consumption (number of portions consumed per month) of seasonal, unfamiliar and infrequently (<5 respondents) consumed food items

Food item	Frequency of consumption (%)			# portions consumed per month
	Sample (n = 96)	Cases (n = 46)	Controls (n = 50)	
Seasonal food items				
strawberries	29	26	32	1 - 16
blueberries/cranberries	28	22	34	1 - 8
Unfamiliar food items				
tacos, burritos or fajitas with meat or beans	10	9	10	2 - 12
Infrequently consumed food items				
lamb and mutton	1	2	0	10
sweetened cereals	4	2	6	2-30
walnuts	3	2	4	2 - 3
mayonnaise >65% fat content	3	0	6	1
smelts -baked or broiled	2	4	0	1 - 6
smelts -prepared with added fat or fried	2	2	2	4 - 6
eels -baked or broiled	0	0	0	0
eels -prepared with added fat or fried	0	0	0	0
herring - baked /broiled /pickled, smoked or kippered	3	2	4	1 - 8
herring -prepared with added fat or fried	1	0	2	4
lake trout -steamed/baked/broiled	0	0	0	0
lake trout -prepared with added fat or fried	2	2	2	2 - 3
mackerel -prepared with added fat or fried	3	4	2	3 - 8
tuna -steamed/baked/broiled	1	0	2	7

2.3.4 Discussion

The initial FFQ food list was developed from data collected as part of a province-wide nutrition survey[240] which took place throughout the spring and fall seasons of 1995, and thus accounted for seasonal variations in diet. The final food item selection for the FFQ food list for the present study was based on the frequency of consumption by PEI women, total amount consumed and on the contribution to the nutrients of interest. The development also involved consultation with PEI dietitians and nutritionists who are likely to be familiar with typical food use patterns among PEI women. Finally, to ensure its comprehensiveness, the food list was also compared to those included in other widely used food frequency questionnaires, including the Block 95 Questionnaire[267], the Canadian Environmental Health Survey FFQ[233] and the 1995 PEI Nutrition Survey FFQ[240]. By using this approach to select foods for inclusion in the FFQ food list, important contributors to nutrient intakes were unlikely to be missed[218].

The optimal number of food items to be included in a FFQ is dependent on a number of factors including whether the purpose is to measure intake of a few foods or nutrients, or to make a comprehensive assessment of total diet[218]. Shorter food lists (15 to 20 food items) are appropriate for the assessment of specific nutrients of interest (e.g. total fat), but may underestimate total energy intake[224,275]. Longer food lists (more than 100 food items) are more likely to provide an accurate estimate of intakes of multiple nutrients and energy[218,224,275]. However, to avoid respondent fatigue and boredom which can impair concentration and subject recall, only food items which are consumed frequently enough

to make significant contributions to the nutrients of interest should be included in the food list[218]. The FFQ used in this study included 119 food items in order to allow the assessment of intakes of total energy as well as a number of nutrients. This length is similar to that used by Martin-Moreno et al.[219] (118 food items), and Trichopoulou et al.[84] (115 food items) in their investigations of population intakes of total energy and multiple nutrients. The food list length in the current study was well received; ninety-one per cent of the respondents (n=91) felt that the food list length was satisfactory.

Seventeen food items on the FFQ food list were identified by interviewers and/or respondents as 'seasonal', 'unfamiliar' and/or 'infrequently consumed' (Table IV). Examination of the frequency and range of consumption of these foods showed that three of the 17 food items were actually consumed by 20 per cent or more of the total sample, warranting their continued inclusion in the food list.

The 14 remaining food items were rarely or never consumed (Section 2.3.3.2). While one of these items, 'sweetened cereals' was consumed by only four per cent of the sample, the quantity consumed was highly variable (two to 30 portions per month). Continued inclusion of this item in the food list is therefore recommended because of the high frequency of consumption by some individuals.

In accordance with the methodology utilized by Jain[231], the food list could be shortened by omitting the remaining 13 food items consumed infrequently. If these food items were

omitted, the food list would be shortened to 106 items. Omission of these infrequently consumed items would potentially reduce the accuracy of assessment in regards to the nutrients of interest contained in those foods, but the results of the pilot test indicated that so few individuals consumed those food items that their effective contribution to the nutrients of interest was negligible. The advantages of excluding seldom eaten food items would include a reduced food list, reduced time required for the interview, and a subsequently reduced subject burden.

Ten of the 13 infrequently consumed food items were fish. This finding was contrary to expectations given that residents of PEI consumed more fish and fish products per week than did those from other provinces according to average weekly household food expenditures data[232] provided by Statistics Canada. However, these data reflect household rather than individual food expenditures, and may not reflect actual consumption at the individual level. Further, inter-provincial differences in consumption of fish and fish products described by this data could be due to differences in shellfish, rather than finfish, consumption.

The FFQ format was well received by the participants. This is not surprising given that a similar format was used successfully over the past decade in most Canadian provincial nutrition surveys including Nova Scotia and Quebec[239,276]. Portion sizes were included for each food item since their use has been shown to increase the accuracy of respondent estimations of intakes[277-279]. Graduated 3-dimensional food models and an assortment of

plastic cups, glasses and bowls were used to aid respondents in assessing the size and volume of foods consumed since it has been suggested that the use of models such as these prevents the tendency to 'direct' response, a phenomenon observed when simulated plastic food models representing 'average' portion sizes are used[280].

An open-ended response format was selected for use in the FFQ developed for this study. The use of this type of format allows for enhanced precision of reporting in comparison to closed-ended response formats[218,222]. For example, the restricted number of response categories in a closed-ended format may result in loss of information if reported intakes do not fall within predetermined categories[222]. This could limit the discriminatory capacity of the questionnaire, and lead to nondifferential misclassification[218]. In contrast, an open-ended response format allows for the recording of exact frequencies of food item consumption, thus maximizing the quality of exposure measurement[222].

The process followed in developing the FFQ food list was modeled after that used by Martin-Moreno et al.[219]. Researchers in that study developed a FFQ for use in assessing the role of diet in the etiology of breast and colorectal cancer among Spanish women. To accomplish this, they analyzed single 24-hour recalls collected from a random sample of women over a period of one year to identify those foods most commonly eaten and to identify the most important food sources of specific nutrients. The researchers also consulted with dietitians and nutritionists to help identify relevant food items to be included in the FFQ. Their final food list included 118 food items structured into 11

categories. A similar process was followed by Overvad et al.[281] and Jain[231] in developing their FFQs, although their food lists were based on diet histories and seven-day food records, respectively. While it may be argued that single 24-hour recalls may not represent an individual's usual diet[216] this method has been found to generate valid estimates of group nutrient intakes[201], thus providing a sound basis for the development of the FFQ food list in the present research.

The average long term diet (intakes over weeks, months or years) is the exposure of interest when assessing the role of diet in the etiology of chronic diseases because the latency period of chronic disease is variable and/or unknown[224]. In this case, we chose to assess usual diet over a one year term so that foods eaten throughout all seasons of the year would be represented and assessed.

A potential limitation of the pilot test lies in the differing period of recall: while controls were asked to report on their usual diet during the year prior to the interview date, cases were asked to report on their usual dietary intakes during the year prior to diagnosis since it was believed that they may have changed their diet as a result of their illness and/or treatment of illness[272]. To minimize the effects of this problem, only cases diagnosed within the year prior to the interview period were admitted to the study.

Further analysis of food use by cases and controls should be conducted to determine whether there are any particular food use patterns that may be useful in differentiating

dietary exposures. For example, it would be interesting to compare the consumption of fruits and vegetables among cases and controls since it has been suggested that higher intakes may be associated with decreased risk of many cancers, including breast cancer[282].

This research has successfully met the objectives of developing and pilot testing a population specific FFQ. Since the quality of a dietary assessment is dependent on the validity (e.g. the extent to which the instrument accurately measures usual nutrient intakes) and reliability (or reproducibility) of the instrument used[220], future research should be conducted to establish the validity and reliability of the FFQ.

The methodology discussed in this paper could be used successfully by other researchers wishing to develop population specific food frequency questionnaires for use in assessing the role of diet in the etiology of disease. Dietary data available through the recently conducted provincial surveys would provide a suitable basis for the development of a population specific FFQ.

3. DESCRIPTIVE ANALYSIS OF DIETARY RISK FACTORS FOR BREAST CANCER IN PRINCE EDWARD ISLAND

3.1 Introduction

Age-standardized breast cancer incidence rates in Canadian women are among the highest of any country in the world at 76.9 cases per 100,000[1], ranking second only to those among American women at approximately 85.0 cases per 100,000[1]. Despite recent research describing the roles of genetics and hormones in breast cancer incidence, current knowledge does not totally explain risk; identified risk factors such as family history[106], age at the birth of the first child[176,178-180], age at menarche[153,283,284], and menopause[150,191] account for only about 55 per cent of new cases[38]. Incidence rates of migrants and their offspring who have moved from low- to high-incidence countries soon mirror those of the new country[11] suggesting that environmental factors including diet and lifestyle may have a substantial effect on risk of breast cancer[11,108,133].

Unlike non-modifiable risk factors such as family history, diet may provide a means by which women can alter their risk of breast cancer. Consequently, it is important to investigate and define the role of specific dietary components in the etiology of breast cancer. Research findings to date suggest that at high levels of intake, total dietary fibre provides a protective effect against breast cancer[34,73]. Results of a Canadian cohort study[73] demonstrated a reduced risk of breast cancer (RR=0.68) associated with intakes of 25 g per day (or greater) of dietary fibre. A protective effect associated with dietary fibre intakes was also noted in a meta-analysis of 12 case-control studies[34]. Consumption of

carotenoids has also been associated with a protective effect against breast cancer[73,74]. Further, improved survival and prognosis has been noted among those women who consumed a carotenoid rich diet before diagnosis of breast cancer[285,286]. Intakes of some fat types have been associated with a reduced risk of breast cancer as well. Examples of these fat types include monounsaturated fatty acids[83-85], found primarily in olive and canola oils, and n-3 polyunsaturated fatty acids (n-3 PUFAs), found primarily in fish oils. While there is a paucity of epidemiological evidence regarding the effects of intakes of n-3 PUFAs on the etiology of breast cancer, results of animal[86,89,90] and ecological[42,91,92] studies suggest that intakes may either enhance the immune response and/or inhibit breast cancer cell growth, thus providing a protective effect against breast cancer. n-3 PUFAs are considered to be essential fatty acids and must therefore be obtained from dietary sources[15]. In contrast, *trans*-fatty acids have been associated with increased risk of breast cancer[56,57], although few epidemiological studies have been conducted to date.

Although breast cancer is currently the most commonly diagnosed cancer in Prince Edward Island (PEI) women (excluding non-melanoma skin cancer)[234] there has been limited research conducted to assess the impact of diet on the incidence of this disease in this province. While the Enhanced Cancer Surveillance Study[233] collected some dietary and health related data from residents of PEI in 1996, their primary focus was an assessment of environment related exposures, including water quality, pesticide and herbicide exposure, relating to all cancers. The objective of the current study is to describe and compare nutrient profiles of women with breast cancer and healthy women

in Prince Edward Island. A secondary objective is to assess dietary adequacy, since there is a lack of current data describing the quality of dietary intakes among Canadian women.

3.2 Materials and methods

3.2.1. Sample selection

Cases were identified through the PEI Cancer Registry[234]. They included all non-institutionalized women aged 18 to 80 years who were diagnosed for the first time with primary, invasive ductal and/or lobular breast cancer, during the period June 1 1997 to June 17 1998. Initial case contact was made with the consent of the attending physician.

Controls were randomly selected from participants in the 1995 PEI Nutrition Survey[240] and were category matched to cases by age (± 3 years) and county of residence. Healthy women with a history of breast cancer, or with a family history of breast cancer (mother or sister with breast cancer) were excluded as controls because they may have changed their diet as a result of their history[272].

Exclusion criteria for cases and controls included: 1) primary place of residence for the five years prior to interview (or date of diagnosis of breast cancer for cases) was not PEI; 2) hospitalization for serious illness at the time of interviewer contact; 3) following a medically prescribed diet for kidney disease, inflammatory bowel disease (i.e. Crohn's Disease or colitis) or liver disease (ie cirrhosis); 4) death prior to interview. The first three criteria were applied to ensure the similarity of dietary exposures among all

respondents. Potential respondents who died before being interviewed were excluded from the study because information gained directly from a respondent has been shown to be more accurate than that gained by proxy[273,274].

The research received approval from both the Ethics Committee of the University of Prince Edward Island, and the Ethics Committee of the Queen Elizabeth Hospital, Prince Edward Island. Cases signed a consent form at the time of the interview, while tacit consent was assumed from the controls when they agreed to be interviewed. A non-response questionnaire was utilized to assess potential differences between participants and non-participants. Questions were adapted from a similar questionnaire previously developed by Health Canada for use in the 1995 PEI Nutrition Survey[240]. Participants completed the questionnaire at the end of their in-home interview while non-participants in the study were asked the questions at the time of the first telephone contact.

3.2.2 Data collection

A population specific, semi-quantitative FFQ was developed for use in assessing exposure to pertinent dietary risk factors for breast cancer in PEI (Chapter 2). It included 119 food items and was designed to assess total energy (kcal) as well as intakes of the following nutrients: total carbohydrate (g) and fat (g); protein (g); iron (mg); dietary fibre (g); vitamins C (mg), E (mg), A (RE) and B_6 (mg); carotenoids (RE); calcium (mg); riboflavin (mg); niacin (NE); folate (μg); zinc (mg); thiamin (mg); alcohol (g) and fat types including monounsaturated (g) and saturated fatty acids (g), n-3 and n-6

polyunsaturated fatty acids (g) and *trans*-fatty acids (g). Nutrients to be assessed were selected because they may play a role in the etiology of breast cancer and/or because they are commonly reported when assessing dietary adequacy[24]. Cases were asked to report on their usual diet during the year prior to diagnosis while controls reported their diet of the year prior to the interview date. Intakes of vitamin supplements and orally dosed prescription drugs were also assessed as part of the questionnaire.

Two interviewers attended a one day training session and were given a manual outlining interview protocol in order to increase consistency of approach. A copy of the manual may be found in Appendix A, 7.3. The FFQ and a health and lifestyle questionnaire to assess exposure to known non-dietary risk factors for breast cancer were administered during in-home interviews conducted from April through July, 1998. Results from the health and lifestyle questionnaire may be found in Chapter 4.

3.2.3 Data analysis

Response rates were calculated by comparing the number of eligible participating women to the number of eligible women. Food use data were translated into nutrient intake data using the Candat Research Oriented Nutrient Calculation System[241] which utilizes data provided by the Canadian Nutrient File 1997[214] as the basis of food item nutrient content. Means, medians and percentiles of nutrient intakes were computed for all study subjects combined, and for cases and controls separately, by age groups defined by the Recommended Nutrient Intakes (RNIs) and Dietary Reference Intakes (DRIs), first

including and then excluding vitamin supplements from the comparisons. The Shapiro-Wilk statistic was used to assess the normality of nutrient distributions. Single point estimates of intake were reported using means (± standard deviation) or medians (and interquartile range) where distribution is nonparametric. T-tests, chi-square tests and the Wilcoxon rank sum test were used to assess differences between cases and controls. All statistical tests were computed with SAS Release 6.11 for Windows[266]. Statistical significance was assumed for p values less than 0.05 unless otherwise stated.

Dietary adequacy of both groups of women was assessed by comparisons made to standard Canadian recommendations including the RNIs[24] and DRIs[227,228]. The DRIs are new recommendations that are being released gradually by nutrient group and will eventually replace the RNIs. These reports are the result of a collaborative effort by the National Academy of Sciences, Food and Nutrition Board and Health Canada to harmonize nutrient recommendations between countries. Adequacy was assessed using food sources only and with the inclusion of supplements. Intakes of total carbohydrate and fat were calculated as a percentage of total energy, then compared to recommended levels described in the 1990 Nutrition Recommendations[24]. In accordance with convention, the adequacy of each micronutrient was assessed by expressing the amount consumed as a percentage of the recommended standard for each nutrient (i.e. 66 per cent of the RNI or 100 per cent of the DRI). Specifically, intakes of calcium, riboflavin, thiamin, niacin, folate and vitamin B_6 were compared to the appropriate DRI standard[227,228] while intakes of protein, iron, zinc, vitamin C, E and A were compared to

values specified by the RNI[24] since a DRI has not yet been released for these nutrients.

3.3 Results

Seventeen of the 71 women diagnosed with breast cancer during the specified time period were excluded based on age (>80 years old), location of primary residence, previous diagnosis of breast cancer and death before contact. Four eligible cases refused to participate. Four of the cases interviewed exhibited poor memory recall and/or confusion when queried about their past dietary intakes. They were therefore not included in this analysis, leaving a total of 46 cases.

Interviewers could not locate one control, hospitalization for severe illness precluded the participation of two other controls, and two were ineligible because of death prior to interviewer contact. Eight controls were excluded because of a prior history of breast cancer in themselves or a family member. One control refused to participate in the study, leaving a total of 50 controls. Fifty of 54 eligible cases and 50 of 51 eligible controls participated, giving response rates of 92 per cent and 98 per cent, respectively. Analysis of the non-response questionnaire found no significant differences between the participants and the four non-participants.

The majority of the sample (37 cases and 34 controls) were postmenopausal. Mean age at menopause was similar for cases and controls (45.2 ± 6.5 years and 45.0 ± 7.4 years, respectively). A full description of the demographic characteristics of the sample may be

found in Chapter 4.

Levels of nutrient intakes from food sources among cases and controls were very similar (Table V). Significant differences in nutrient intakes between cases and controls were noted only for carotenoids (Table VI). Controls aged 50 years and older (n=37) consumed more carotenoids than did cases of comparable ages (n=34) (950 RE and 598 RE, respectively; p=0.01). The introduction of vitamin supplements into the analysis did not alter this finding. Although not statistically significant, an effect was also noted suggesting that controls of all ages (n=50) consumed more fibre than did cases of all ages (n=46) (16.5 g and 13 g, respectively; p=0.06) (Table VI). There were no significant differences between cases and controls in regards to the types or amounts of fats and spreads used on breads and rolls, vegetables, or in home prepared foods.

Dietary adequacy of the sample was examined next (Tables VII through IX). Calcium, iron (for women aged 34 to 49 years), vitamin E and folate intakes were less than recommended (Tables VIII and IX). Intakes of energy and the remaining nutrients including protein, iron (for women aged 50 years and older), zinc, vitamin C, niacin, thiamin, riboflavin and vitamin B_6 met or exceeded RNI[24] and DRI[227,228](Tables VII, VIII and IX). The percent of calories derived from total fat and carbohydrate differed from recommended levels. The sample had higher than recommended intakes of fat (range from approximately 34% to 36% compared to the recommended 30%[24]), and lower intakes of carbohydrate than recommended (approximately 50% compared to the

recommended 55%[24]).

Thirty-four percent of the cases (n=17) and 42 per cent of the controls (n=21) used at least one vitamin or mineral supplement (at least once per month) during the time period of interest. Supplements included single as well as multiple nutrient formulations. No statistically significant differences were found between cases and controls regarding supplement types and/or amounts consumed. See Appendix B, Tables IX, X and XI for a full description of supplement use by cases and controls.

A variety of prescription drugs were used by 37 cases and 41 controls. No statistically significant differences were found between cases and controls in regards to the type of prescription drugs used. A full list of the drugs used may be found in Appendix B, Table XII.

3.4 Discussion

Carotenoids were found to be associated with a significantly reduced risk for breast cancer among women aged 50 years and older in this study. These findings are in agreement with other studies which have found similar effects[34,53,73,95,97]. Although not significant, intakes of total dietary fibre were higher among controls when compared to cases, suggesting a reduced risk with increased intakes. This effect is consistent with other observations in the literature[34,73]. There were no significant differences between cases and controls in intakes of the remainder of the nutrients, including n-3 PUFAs and

TABLE V.
Cases and controls: actual daily intakes of macro- and micronutrients, from food sources only, by age

	Cases			Controls		
	34-49 years	50-74 years	75+ years	34-49 years	50-74 years	75+ years
	n=12	n=30	n=4	n=13	n=33	n=4
energy (kcal)	2057.4 ± 681.1	1812.4 (1504.9,2132.8)[a]	1817.0 ± 419.7	1842.7 ± 576.4	2070.2 ± 630.5	2231.2 ± 841.5
protein (g)	84.2 ± 25.9	67.0 (57.4,97.9)[a]	66.3 ± 18.9	73.7 ± 19.4	79.0 (61.5,108.6)[a]	91.5 ± 40.3
carbohydrate (g)	252.4 ± 93.1	225.1 (183.4,279.8)[a]	235.2 ± 36.9	236.8 ± 80.8	259.6 ± 83.8	280.7 ± 121.4
total fat (g)	80.5 ± 29.7	73.7 ± 31.5	72.5 ± 27.6	68.8 ± 27.8	78.1 ± 28.0	87.8 ± 33.0
saturated fat (g)	27.3 ± 10.92	20.1 (16.3,28.1)[a]	26.1 ± 14.0	20.8 ± 9.3	27.3 ± 11.1	29.0 ± 1.4
polyunsaturated fat (g)	14.5 ± 6.2	14.0 ± 6.2	13.6 ± 3.7	14.5 ± 6.9	13.4 ± 5.6	16.4 ± 7.3
monounsaturated fat (g)	32.2 ± 11.8	29.4 ± 12.5	26.9 ± 9.5	27.4 ± 10.6	30.8 ± 12.0	35.1 ± 12.2
n-3 PUFA (g)	1.9 ± 1.2	1.6 ± 0.8	1.7 ± 0.5	1.6 ± 0.8	1.5 ± 0.7	1.9 ± 0.8
n-6 PUFA (g)	12.1 ± 5.0	11.6 ± 5.3	11.5 ± 3.4	12.3 ± 6.2	11.2 ± 5.0	13.4 ± 5.9
trans-fatty acids (g)	0.8 (0.5,1.6)[a]	0.8 (0.3,2.6)[a]	0.7 ± 0.6	0.5 (0.1,1.5)[a]	1.4 ± 1.6	2.9 ± 1.6
alcohol (g)	0.9 (0,4.3)[a]	0 (0,3.0)[a]	0.2 (0,1.2)[a]	0.8 (0,3.5)[a]	0 (0,1.5)[a]	0 (0,1.0)[a]
total dietary fibre[b] (g)	14.6 ± 7.4	15.1 ± 8.5	15.73 ± 7.0	13.4 (12.6,18.7)[a]	17.5 ± 5.8	21.1 ± 10.7
carotenoids[c] (RE)	738.8 ± 555.5	602.5 (350.0,935.0)[a]	590.8 ± 241.7	554.5 ± 277.2	969.6 ± 669.6	1804.2 ± 913.6
vitamin E (mg)	4.0 ± 3.12	2.3 (1.3,3.7)[a]	1.7 ± 1.0	2.9 (1.2,4.4)[a]	2.6(1.7,4.2)[a]	2.4 ± 0.7

TABLE V (cont'd)

	Cases			Controls		
	34-49 years	50-74 years	75+ years	34-49 years	50-74 years	75+ years
	n=12	n=30	n=4	n=13	n=33	n=4
vitamin C (mg)	117.5 (76.2,219.7)[a]	116.6 (78.8,192.4)[a]	129.0 ± 20.5	122.1 ± 47.6	120.4 (81.7,175.9)[a]	80.4 (70.3,142.1)[a]
vitamin A (RE)	1364.9 ± 820.8	1384.6 ± 763.2	975.5 ± 150.6	1169.6 ± 362.7	1702.6 ± 921.2	2562.9 ± 1230.2
iron (mg)	11.2 ± 3.7	10.0 (8.0,12.5)[a]	10.6 ± 2.5	10.8 ± 3.07	12.0 ± 3.5	14.2 ± 7.9
zinc (mg)	11.2 ± 3.6	8.9 (7.0,12.0)[a]	9.0 ± 1.8	10.1 ± 3.2	11.6 ± 4.1	12.3 ± 6.8
vitamin B6 (mg)	1.9 ± 0.6	1.8 (1.4,2.2)[a]	1.35 ± 0.4	1.8 ± 0.4	2.9 ± 0.7	2.2 ± 1.0
calcium (mg)	934.2 ± 447.5	608.7 (525.8,977.4)[a]	643.3 ± 277.2	656.1 ± 254.1	858.8 (550.8,1266.7)[a]	985.2 ± 523.7
riboflavin (mg)	2.0 ± 0.8	1.6 (1.3,2.1)[a]	1.4 ± 0.4	1.4 (1.2,1.6)[a]	2.1 ± 0.8	2.2 ± 1.3
thiamin (mg)	1.5 ± 0.4	1.5 ± 0.6	1.3 ± 0.3	1.2 (1.1,1.4)[a]	1.6 ± 0.6	1.61 ± 1.8
folate (μg)	247.8 ± 128.8	200.6 (175.8,256.0)[a]	235.5 ± 39.2	236.1 ± 66.8	222.1 (189.3,285.9)[a]	236.1 ± 92.6
niacin (NE)	34.9 ± 9.8	31.3 (26.4,40.3)[a]	28.6 ± 7.4	33.1 ± 8.2	36.1 ± 11.6	37.5 ± 16.2

[a] median intake (interquartile range); all other reported values are mean intake ± standard deviation
[b] intakes differed between all cases and all controls (p=0.06)
[c] intakes differed significantly between cases and controls aged 50+ years (p=0.03)

TABLE VI.
Cases and controls: a comparison of median intakes of carotenoids and total dietary fibre, from food sources only

	age	cases		controls		exact *p* value for Wilcoxon rank sum two-sided test
		n	median	n	median	
carotenoids (RE)	50+ years	34	598	37	950	0.03
total dietary fibre (g)	all ages	46	13	50	16.5	0.06

TABLE VII.
Comparison of macronutrient intakes to recommended intakes among all respondents, by age

	34-49 years (n=25)			50-74 years (n=63)			75+ years (n=8)		
	actual intake	recommended intake	actual intake as % recommended	actual intake	recommended intake	actual intake as % recommended	actual intake	recommended intake	actual intake as % recommended
energy (kcal)	1945.7 ± 625.1	1900	102.4	1899.3 (2412.4,1517.2)*	1800	111.6	2024.1 ± 654.2	1700	119.1
protein (g)	78.7 ± 22.9	51	154.3	74.3 (59.7,103.6)*	54	137.6	78.9 ± 32.1	55	143.4
	actual intake	recommended intake (as % of total energy)	actual intake as % recommended	actual intake	recommended intake (as % of total energy)	actual intake as % recommended	actual intake	recommended intake (as % of total energy)	actual intake as % recommended
carbohydrate (g)	227.4 (165.8,270.4)*	55	46.7	231.9 (184.9,292.6)*	55	48.8	258.0 ± 86.5	55	51.8
total fat (g)	74.4 ± 28.7	30	34.4	71.8 (52.8,96.3)*	30	34	80.2 ± 29.3	30	35.7

*median intake (interquartile range); all other reported values are mean intake ± standard deviation

TABLE VIII.
Comparison of micronutrient intakes among all respondents to Recommended Nutrient Intakes (RNI) (1990), by age

	34 - 49 years (n=25)			50 - 75 years (n=63)			75+ years (n=8)		
	actual intake[b]	recommended intake[b]	actual intake as % RNI	actual intake[b]	recommended intake[b]	actual intake as % RNI	actual intake[b]	recommended intake[b]	actual intake as % RNI
iron (mg)	11.0 ± 3.3	13	84.6	10.7 (8.3,13.7)[a]	8	133.8	12.4 ± 5.8	8	155
zinc (mg)	10.6 ± 3.4	9	117.8	9.8 (7.5,14.3)[a]	9	108.9	10.6 ± 4.9	9	117.8
vitamin C (mg)	135.9 (81.7,169.9)[a]	30	453	117.8 (79.2,183.8)[a]	30	392.7	117.6 ± 44.0	30	392
vitamin E (mg)	2.9 (1.2,5.9)[a]	6	48.3	2.5 (1.5,4.2)[a]	6	41.7	2.0 ± 0.8	5	40

[a] median intake (interquartile range); all other reported values are actual mean intake ± standard deviation
[b] actual and recommended intakes are expressed in the units specified for each nutrient

TABLE IX.
Comparison of nutrient intakes among all respondents to Dietary Reference Intakes (DRI) (1998), by age

	31-50 years (n=27)			51+ years (n=69)		
	actual intake	recommended intake	actual intake as % DRI	actual intake	recommended intake	actual intake as % DRI
calcium (mg)[b]	725.3 (491.4,1174.0)[a]	1000	72.5	730.8 (525.8,1077.4)[a]	1200	60.9
riboflavin (mg)[c]	1.6 (1.2,2.3)[a]	0.9	177.8	1.6 (1.4,2.3)[a]	0.9	177.8
thiamin (mg)[c]	1.3 (1.1,1.7)[a]	0.9	144.4	1.4 (1.1,1.8)[a]	0.9	155.6
niacin (NE)[c]	34.8 ± 9.0	11	316.4	32.1 (25.8,41.2)[a]	11	291.8
folate (μg)[c]	226.2 (190.4,278.4)[a]	320	70.7	207.0 (181.3,288.8)[a]	320	64.7
vitamin B_6 (mg)[c]	1.9 ± 0.5	1.1	172.7	1.8 (1.5,2.4)[a]	1.3	138.5

[a] median intake (interquartile range); all other reported values are actual mean intake ± standard deviation
[b] calculated as per cent 'Adequate Intake' (DRI)
[c] calculated as per cent 'Estimated Average Requirement' (DRI)

monounsaturated fatty acids, either when all cases were grouped and compared to all controls, or when comparisons were made between cases and controls after stratification by age. The lack of significant difference between cases and controls in n-3 PUFAs intakes may be explained in part by the infrequent consumption of fish (the primary source of n-3 PUFAs). (See *Chapter 2, Section 2.3.3 Results.*)

The American Institute for Cancer Research (AICR)[67] states that dietary intakes of fibre and carotenoids may decrease the risk of breast cancer. Total dietary fibre is found primarily in fruits, vegetables and cereals[15]. Fibre may help prevent breast cancer either by reducing intestinal reabsorption of estrogen[93], through its role in weight control or by increasing insulin sensitivity[287]. Carotenoids are part of the vitamin A family, but are available only from plant sources[15]. The carotenoid best known and most frequently investigated is β-carotene, but researchers have also examined the effects of other carotenoids such as lycopene and lutein on cancer risk[15]. It was not possible to assess the level of specific types of carotenoids consumed in this research since the Canadian Nutrient File[214] database includes data only on total carotenoids in foods. While precise mechanisms remain unknown, carotenoids are well known for their role as antioxidants, protecting cells against oxidative DNA damage believed to play a role in the initiation, promotion and progression of tumors[69]. They may also protect against breast cancer after conversion to retinol[98] which has been shown to inhibit the growth of human breast carcinoma cells *in vitro*[99].

Block et al.[288] has demonstrated that failure to include supplements in total nutrient intakes can lead to biased estimates of intakes. Use of vitamin supplements was therefore assessed among PEI respondents. While cases and controls consumed a variety of single and multiple vitamin and mineral supplements, no significant differences in total nutrient intakes were found between cases and controls either when supplement intakes were included with food nutrient data, or when supplement intakes were analyzed separately. The lack of differences may be attributed to the relatively low numbers of cases and controls who consumed supplements regularly (34% of the cases, 42% of the controls), and the relatively low doses consumed. Other studies[73,74] which have examined the relationship between supplement usage and risk of breast cancer have also found no significant associations between the use of most supplements and risk of breast cancer. The exception was a finding by Hunter et al.[74] who reported a statistically significant 40 to 50 per cent increase in risk of breast cancer in association with intakes of more than 250 mg per day (approximately 833% of the RNI) of vitamin C supplements. No such association was noted among PEI respondents. On PEI, only a small number of women consumed vitamin C supplements (11 cases, 9 controls) and fewer than half of these women (5 cases, 4 controls) consumed 250 mg or more on a regular basis.

Energy intakes in cases and controls for the majority of the sample exceeded recommended intakes. Only controls aged 34 to 49 years (n=13) had energy intakes somewhat lower than recommended (1812.4 ± 576.4 kcal versus recommended intakes of 1900 kcal). Assessing the adequacy of energy intakes using only RNI standards is

problematic because recommendations are based on estimates of average energy requirements for age and sex strata[24], and therefore may exceed the needs of approximately 50 per cent of the individuals within a stratum (assuming a normal distribution of energy intakes)[226]. However, energy intakes which are less than recommended should not necessarily be considered inadequate. An individual's body weight, height and level of physical activity should also be considered when assessing energy status. Body mass index (BMI), defined as weight in kilograms divided by the square of height in metres, is often used for such assessments. In the present research, almost half of the women (46%) had BMIs of 26 or greater, suggesting 'overweight'. In comparison, only 28 per cent of women of comparable ages from across the rest of Canada had similarly high BMIs[289]. The prevalence of high BMI values among PEI women support the conclusion that many of the cases and controls are consuming well in excess of their individual energy requirement.

Respondents of all ages consumed diets with somewhat lower than recommended levels of calcium, folate and vitamin E, while those aged 34 to 49 years had lower than recommended dietary intakes of iron. Dietary intakes of the remainder of the nutrients met or exceeded the recommended levels[24,227,228]. Lower than recommended intake levels should not necessarily be interpreted as 'deficient' or 'inadequate' since risk of deficiency depends on the frequency, degree and duration that usual intakes fall below recommended levels[229]. Because two different sets of standards (DRIs and RNIs) currently exist, it is difficult to compare the relative level of inadequacy among nutrients assessed in this

study, or to make comparisons to the level of nutrient inadequacies reported in past studies. For example, the assessment of the adequacy of group intakes of riboflavin, thiamin, niacin, folate and vitamin B_6 are based on the DRI standard 'Estimated Average Requirement' (EAR) which is the nutrient intake value that is estimated to meet or exceed the needs of 50 per cent of the individuals in a sex and age strata[228]. In contrast, the adequacy of iron intakes is determined using the RNI, which is set at the mean requirement plus two standard deviations for each sex and age strata, and therefore exceeds the needs of all but two to three per cent of those individuals. In the present research, increased risk of nutrient inadequacy was defined using a cut off of less than 66 per cent of the RNI[290] or 100 per cent of the EAR[228]. Although there are problems with misclassification associated with the use of such cut off points, this is currently the conventional approach to the assessment of dietary adequacy. Finally, regardless of the dietary standard used, a comprehensive nutritional assessment should also include biochemical, clinical and anthropometric data[201].

The fact that PEI women had low intakes of calcium, folate and iron (in younger women) is not unusual: similar patterns were also noted in women from Nova Scotia[239] and Quebec[276]. Women aged 20 to 44 years from Ontario also had low intakes of iron[291]. Energy intakes among PEI women of all age strata were higher than those among women of comparable ages from Nova Scotia or Quebec, but were slightly lower than those among Ontario women. For example, PEI women aged 34 to 49 years had a mean intake of 1945 kcal while women of similar ages (35 to 49 years) from Nova Scotia and Quebec

had intakes of 1571 kcal and 1727 kcal, respectively. Ontario women aged 20 to 44 years had mean daily intakes of 2000 kcal. More PEI women aged 35 to 49 years in the current study had higher BMIs (values of 27 or greater) than did women of similar ages from Nova Scotia, Ontario or Quebec (38% versus 34%, 31% and 24.6%, respectively). Macro- and micronutrient intakes among PEI women were higher than in either Nova Scotia or Quebec, and may account for the higher BMI levels observed. While Ontario women aged 20 to 44 years had slightly higher energy intakes, they had lower mean BMIs than did women from PEI. Since the Ontario report did not include intakes of many of the macro- and micronutrients, it is difficult to account for these differences. However, it is possible that because the women were younger (20 to 44 years in Ontario versus 34 to 49 years in PEI), they led more active lifestyles and thus had lower BMIs. Alcohol consumption (assessed as a percentage of total energy) among PEI women of all age strata was lower than that among women of comparable ages from Nova Scotia and considerably less than that among women from Quebec. For example, alcohol accounted for 0.3 per cent of total energy intakes among PEI women aged 34 to 49 years, compared to one per cent among women aged 35 to 49 from Nova Scotia and 2.9 per cent from women of similar ages from Quebec. While iron intakes among younger women from all four provinces were low, women from Ontario had the highest intakes at 94 per cent of the recommended level. Iron intakes among women from PEI and Nova Scotia were the lowest at 85 and 82 per cent of the recommended level, respectively.

A one year time frame was utilized so that usual diet could be assessed throughout all

seasons of the year, and to minimize potential problems associated with longer recall periods[218]. However, recall bias may have introduced some error into the data: controls were asked to recall their diet during the year prior to the interview while cases were asked to recall their usual diet during the year prior to diagnosis because they may have changed their usual diet as a result of their illness and/or treatment of illness[292]. Cases may therefore have found it more difficult to remember and accurately report on their diet. A further difficulty in relating dietary exposures to disease incidence lies in the fact that the latency period associated with breast cancer is unknown[53,102,133]. Thus, a one year recall period may be insufficient to capture critical dietary exposures[102].

In order to minimize the length of the FFQ food listing and avoid respondent fatigue, food items of similar composition were grouped and listed as a single item, and a representative food code utilized for nutrient analysis. This is similar to the method utilized by Block et al.[293]. The selection of each individual representative food code used to generate nutrient profiles was based on the frequency of consumption of the 1995 PEI Nutrition Survey[240] respondents and the concentration of the nutrients of interest in the food. For example, because apples and pears are similar in vitamin C, dietary fibre and energy content, they were listed together as one item. The food code for 'apples' was selected as the representative code because apples were more frequently consumed by the 1995 PEI Nutrition Survey respondents than were pears (frequency of consumption of apples: 30; frequency of consumption of pears: 3). Nevertheless, the use of a single food code in these instances may have resulted in an under- or over-estimation of some

nutrient intakes, leading to inaccuracies in risk associated with breast cancer and/or in estimations of nutritional adequacy.

Incomplete data in the Canadian Nutrient File[214] database may have limited the ability to examine relationships between nutrient intakes and risk of breast cancer. Similarly, it would also have limited the ability to accurately assess the adequacy of nutrient intakes. For example, values for vitamin E (mg) content were available for only 2.7 per cent of the 4668 foods listed. This lack of available data is the probable cause of the low vitamin E intake levels noted in the sample. Similarly, the assessment of *trans*-fatty acids in the diet was limited by the lack of accurate food composition data (fewer than 2% of the foods listed in the database included values for this nutrient).

Although this study involved all eligible cases identified within the period of a year, the sample size was small and therefore lacked sufficient power to detect more significant differences between cases and controls. Larger sample sizes would have increased the power which then may have resulted in more conclusive results. For example, to be 80 per cent certain of correctly detecting a significant difference in dietary intakes of carotenoids between cases and controls of all ages (with 95% confidence and a similar level of overall variation), a minimum of 86 cases and 123 controls would have been required. Multivariate analysis including health and lifestyle factors may provide additional insights regarding the significance and relative importance of these dietary findings on risk of breast cancer in PEI women.

4. MODELLING OF DIETARY AND NON-DIETARY RISK FACTORS FOR BREAST CANCER IN PRINCE EDWARD ISLAND, CANADA

4.1 Introduction

Some dietary and non-dietary factors for breast cancer are linked. For example, total energy intake and physical activity influence body size and subsequently, risk of breast cancer. The combination of chronic overnutrition and a low level of physical exercise leads to a positive energy balance and will eventually result in excessive body fatness[15]. The effects of obesity on risk of breast cancer are dependent on menopausal status: it is associated with decreased risk in premenopausal women[131] but with an increased risk in postmenopausal women[33,38]. This difference may be explained by the dual effects of obesity on endogenous estrogen levels. Specifically, obese premenopausal women tend to have more anovulatory menstrual cycles, and therefore lower levels of estrogen[136]. In contrast, while estrogen levels decrease at the time of menopause, obese postmenopausal women, particularly those with abdominal obesity, have increased levels of estrogen due to the metabolic conversion of androgens to estrogen in adipose tissue[39,40]. The increased estrogen levels are associated with an increased risk of breast cancer[41].

Strong evidence has been found to suggest that earlier age at menarche[153,283,284] and late age at menopause[150,191] are associated with an increased risk of breast cancer, suggesting that breast cancer is hormonally mediated. Evidence regarding the effects of other non-dietary factors also supports the role of hormones as mediators in the etiology of breast cancer. Hormonal changes associated with menopausal status and other health factors are

known to influence breast cancer etiology. Usual dietary habits, in turn, are known to affect hormonal status. For example, overnutrition has been associated with earlier age at menarche[25,147,148], which is an established risk factor for breast cancer.

While research consistently supports the role of age at menarche and menopause in the etiology of breast cancer, the same cannot be said for the role of other non-dietary risk factors such as physical activity and oral contraceptive (OC) use. Evidence to date suggests that physical activity may be associated with a protective effect against breast cancer[139], but the strength of association remains weak. Methodological limitations in these studies, including incomplete measurements of physical activity over a woman's lifetime and inadequate control for potential confounding factors such as diet[139,294], have made it difficult to assess the role of physical activity in the etiology of breast cancer. OC use has been associated with a minimally increased risk of breast cancer[106,166], but study results to date remain inconclusive. Variability in study results may be due to changes in the formulations of OCs throughout the years and the resulting effects on the level of bioavailable estrogen[38].

While the effects of some non-dietary factors such as family history on risk of breast cancer are relatively well understood, the effects of many others are less clear. There has been limited research to assess the impact of non-dietary factors on the etiology of breast cancer in PEI, despite the fact that this disease is currently the most commonly diagnosed cancer among Prince Edward Island women[234]. The purpose of this paper is to develop

and describe a multivariate model, controlling for dietary and non-dietary risk factors, to predict risk of breast cancer among women resident in Prince Edward Island, Canada.

4.2 Materials and methods

4.2.1 Sample selection

Cases were identified through the PEI Cancer Registry[234]. They included all non-institutionalized women aged 18 to 80 years who were diagnosed for the first time with primary, invasive ductal and/or lobular breast cancer, during the period June 1 1997 to June 17 1998. Initial case contact was made with the consent of the attending physician.

Controls were randomly selected from the 1995 PEI Nutrition Survey[240] and were category matched to cases by age (± 3 years) and county of residence. Women previously diagnosed with breast cancer, or with a family history of breast cancer (mother or sister with breast cancer) were excluded as controls because they may have changed their diet as a result of this history[272]. The first three criteria were applied to ensure the similarity of dietary exposures among all respondents. Potential respondents who died before being interviewed were excluded from the study because information gained directly from a respondent has been shown to be more accurate than that gained by proxy[273,274].

Exclusion criteria for cases and controls included: 1) primary place of residence for the five years prior to interview (or date of diagnosis of breast cancer for cases) was not PEI; 2) hospitalization for serious illness at the time of interviewer contact; 3) following a

medically prescribed diet for kidney disease, inflammatory bowel disease (i.e. Crohn's Disease or colitis) or liver disease (ie cirrhosis); 4) death prior to interview.

4.2.2 Data collection

A Health and Lifestyle Questionnaire (Appendix C, 9.1) was administered by personal interview to collect information regarding exposure to risk factors associated with breast cancer including family history of breast cancer, reproductive history, usual exercise patterns (for the year prior to diagnosis for cases, or prior to the interview for the controls) and personal health history. Sociodemographic information including income, education and marital status was also collected. Questions were adapted from several sources including the 1996 EPIC Health and Lifestyles Questionnaire[295], 1996 National Population Health Survey[296], and the 1995 Prince Edward Island Nutrition Survey[240] (which in turn was adapted from an instrument used in the 1990 Nova Scotia Nutrition Survey[239]).

A population specific, semi-quantitative Food Frequency Questionnaire (FFQ) (Appendix A, 7.1) was utilized to assess total energy intake as well as intakes of specific nutrients over the year prior to diagnosis (for cases), or interview (for controls). Development of the FFQ and univariate analysis of nutrient data has been described elsewhere (Chapters 2 and 3). Nutrients assessed included total energy (kcal), fat (g) and fat types, dietary fibre (g), alcohol (g), vitamins C (mg), E (mg) and A (RE), carotenoids (RE), and others.

The Health and Lifestyle Questionnaire and FFQ were administered during in-home interviews, conducted from April through July, 1998. Two interviewers attended a one day training session in order to increase the consistency of their approach. Anthropometric measurements including standing height, weight, waist and hip measurements were recorded. These measures were used to assess waist to hip ratios and body mass index (BMI). BMI was determined by dividing the weight (in kilograms) by the square of the height (in meters)[15]. Waist to hip ratios give an indication of fat distribution while BMI is an index of weight-for-height commonly used to classify overweight and obesity in adults[15]. Both the waist to hip ratio and BMI are used to identify individuals and groups at increased risk of morbidity and mortality[15]. For example, a waist to hip ratio equal to or greater than 0.8 (in women) or a BMI exceeding 25 is associated with increased health risks[15].

The research received approval from the Ethics Committee of the University of Prince Edward Island and the Ethics Committee of the Queen Elizabeth Hospital, Prince Edward Island. Cases signed a consent form at the time of the interview, while tacit consent was assumed from the controls when they agreed to be interviewed.

Potential differences between respondents and non-respondents were assessed through the use of the non-response questionnaire. Questions were adapted from a similar questionnaire used in the 1995 PEI Nutrition Survey. Response rate calculations were based on eligibility of respondents and non-respondents.

4.2.3 Statistical analysis

Non-dietary variables are listed in Table X. A full list of these variables including units may be found in Appendix C. Descriptive statistics including means, medians and percentiles, tests of correlation and logistic regression analysis were done using SAS Release 6.11 for Windows[266]. Student t-tests, Wilcoxon rank sum tests and chi-square tests were utilized to assess differences between cases and controls in means, medians and proportions, respectively. Variables (non-dietary as well as dietary) found to be significantly different ($p \leq 0.1$) between cases and controls were selected for inclusion in a logistic regression model to predict risk of breast cancer. Food use data were entered and translated into nutrient intakes using the CANDAT Research Oriented Nutrient Calculation System[241].

A multivariate energy density model[106] was used to control for confounding by total energy on intakes of energy yielding nutrients. This model requires that total energy (kcal) intake be included as a separate term, while the nutrients are entered into the model as a proportion of total energy intake. For example, the model included carotenoids entered as carotenoids/total energy as well as total energy. Variables were offered to the model individually, in combination with others and with defined age parameters (i.e. age $\geq$ 50 years) in order to identify the best fitting model. Inclusion of variables in the final model was dependent on an assessment of the following statistics: Akaike Information Criterion (AIC), Schwartz Criterion (SC), p-value associated with each coefficient parameter estimate, the association of predicted probabilities and observed responses,

odds ratios and associated Wald confidence limits, and the Hosmer and Lemeshow goodness of fit statistic[297-299]. The adequacy of fit of the final model was assessed through an examination of residual diagnostics plots including Pearson, Deviance and Hat Matrix standardized residuals[297-299]. Outliers identified in the residual plots were examined to see if they held extreme values compared to others within their case-control status, and/or within the entire sample. If the value was extreme, it was first checked for accuracy, then the model was re-fitted without that respondent. Model diagnostics were then compared to earlier models to determine whether the change had improved the fit.

4.3 Results

4.3.1 Sample description

Seventy-one women were diagnosed with breast cancer during the study period. Seventeen were excluded for the following reasons: age >80 years (n=6); location of primary residence (n=1); death prior to interview (n=2) and lastly, previous diagnosis of breast cancer (n=8). Four eligible cases refused to participate, leaving a total of 50 cases.

Sixty-four women were identified as potential controls in the study. Thirteen women were excluded from participation for the following reasons: could not be located (n=1); hospitalization for severe illness (n=2); death prior to contact (n=2); family history of breast cancer in the immediate family including self, mother or siblings (n=8). One eligible control refused to participate in the study. Response rates for both cases and controls were very high: 92 per cent and 98 per cent respectively. These rates were

Table X.
Non-dietary variables

Demographics
education; marital status; age
Anthropometrics
height; weight; waist and hip measurements
Family History
health histories of mother, father and siblings #1 to 16
Physical Activity
usual hours per week of physical activity; engagement in vigorous activity; hours per week of vigorous activity; stair flights climbed per day; usual daily activities or work habits
Personal Health History and Lifestyle Habits
history of cigarette smoking; age at menarche and menopause; usual menstrual cycle length; # menstrual periods in the past 12 months; OC and HRT use; age at first use for OC and/or HRT; length of time OC and/or HRT used; OC and/or HRT brand last used; age at last use of OC and/or HRT; hysterectomy and/or oophorectomy; age at time of these surgical procedures; # ovaries removed; presence and type of any benign breast disease; ever pregnant; ever had any children; age at first birth
Details about children (for 1 to 12 children)
gender; year of birth; whether breastfed; duration of breastfeeding; stillbirths and/or miscarriages; year(s) of stillbirths and/or miscarriages
Eating habits
changes; reasons for changes; following special diet; type(s) special diet(s) currently followed; maximum and minimum adult weight; experienced weight loss or gain; reason(s) for weight gain or loss
General
race or colour; income

calculated after consideration of exclusion criteria. Specifically, 51 of 54 (92%) eligible cases participated while 50 of 51 (98%) eligible controls participated. Analysis of the non-response questionnaire found no significant differences between the 100 participants and the five non-participants.

The majority of the cases and controls who participated in the study were married or living common-law. Although the differences were not significant, more controls than cases had completed their secondary education and had an income of $40,000 or more during 1997 (Table XI). Ages of cases and controls ranged from 34 to 80 years (mean age: 58.6 ± 11.7 years).

4.3.2 Anthropometrics

Mean waist to hip ratio was similar for cases and controls (cases: 0.79; controls: 0.80). Twenty-two cases (44%) and 23 controls (49%) were judged to be overweight based on their BMI (BMI ≥ 26) (Table XII). Three controls refused to have their waist and hip measurements taken and so were excluded from this analysis.

4.3.3 Family health history

Eleven of the 50 cases had a family history of breast cancer (defined as a diagnosis of breast cancer in the respondent's mother or sibling(s)). By design, none of the controls had a family history of breast cancer.

4.3.4 Physical activity

There was a significant difference in the number of hours spent by cases and controls of all ages in vigorous exercise (p=.03). Cases (n=50) reported that they exercised vigorously for a median of 0 hours per week (range: 0 to 2) in the year prior to their diagnosis, while controls (n=50) reported that they exercised vigorously for a median of 2.25 hours per week (range: 0 to 4). Analysis by menopausal status showed that there was also a significant difference (p=.05) in the number of hours spent in vigorous exercise between postmenopausal cases (n=37) and controls (n=34). Postmenopausal cases spent a median of 0 hours per week (range: 0 to 1), while postmenopausal controls spent a median of 1 hour per week (range: 0 to 4) in vigorous exercise. There was no significant difference in the number of hours spent in vigorous exercise between premenopausal cases (n=13) and controls (n=16) (Table XIII).

Table XI.
Sociodemographics

	married (%)	completed secondary school (%)	Income (x $1000)		
			≤$20 (%)	$30-39.9 (%)	≥$40 (%)
Cases (n=50)	58	58	28	36	36
Controls (n=50)	64	68	24	28	48

Table XII.
Anthropometrics

	cases [a]		controls [a]	
	mean	± std dev	mean	± std dev
height (m)	1.6	0.1	1.6	0.05
weight (kg)	66.8	14.2	69.3	16.7
waist (cm)	82	14.6	80.0 [b]	22.6
hip (cm)	104.2	11.5	104.2 [b]	13.2
BMI (waist/height^2)	26.7	6.8	27.2	6
waist:hip ratio	0.79	0.1	0.80 [b]	0.1

[a] *sample size of 50 applicable to all cells except where otherwise noted*
[b] *sample size of 47*

TABLE XIII.
Mean number of hours spent per week in vigorous exercise by
(a) cases and controls, *and*
(b) postmenopausal cases and controls

total sample	n	median # hours/week	interquartile range of hours/week
cases	50	0	(0,2)
controls	50	2.25	(0,4)
premenopausal only			
cases	13	1	(0,4)
controls	16	3.5	(2,5.5)
postmenopausal only			
cases	37	0	(0,1)
controls	34	1	(0,4)

4.3.5 Personal health history and lifestyle

Smoking history (Table XIV), weight gain and weight loss patterns (Table XV) were similar for cases and controls. Weight losses were attributed to dieting and/or illness while weight gains were attributed to diet, lack of exercise, treatment associated with illness, smoking cessation and depression.

While the differences were not statistically significant, more cases than controls had experienced at least one episode of benign breast disease (20 cases, 12 controls). Five cases and six controls had had one or both ovaries removed (oophorectomy) while 10 cases and 16 controls had had a hysterectomy. Just over half of all cases and controls had used oral contraceptives (OC) (27 cases, 27 controls) while fewer had used Hormone Replacement Therapy (HRT) (15 cases, 20 controls) (Table XV).

4.3.6 Reproductive history

Age at menarche, length of menstrual cycles, age at first full term birth and number of children borne were similar for cases and controls (Tables XVI, XVII and XVIII). Mean age at menarche for cases and controls was 12 to 13 years. The majority of cases and controls (35 cases, 34 controls) had usual menstrual cycle lengths of 25 to 29 days. Age of cases at the time of first full term birth was, on average, approximately 25 years while controls were slightly younger (approximately 23 years) at the time of their first full term birth. Median number of children borne by both cases and controls was three (range for each: 1 to 12). Thirty-eight cases and 34 controls were postmenopausal. Mean age at the

time of menopause was similar (cases: 45.6 years; controls: 45.0 years) (Table XVI).

No significant differences were found between parous cases (n=43) and controls (n=43) in the length of time spent breastfeeding. Mean lifetime duration of breastfeeding for these cases was 11.8 weeks, and for controls was 19.9 weeks. A weak effect was found suggesting that controls who breastfed their children had a longer lifetime history of duration of breastfeeding than did the cases (p=0.07) who breastfed their children. Those cases who breastfed their children (n=17) did so for a lifetime mean total of 29.8 weeks while controls (n=13) breastfed for a lifetime mean total of 65.9 weeks (Table XVIII).

TABLE XIV.
Lifestyle - Cigarette smoking patterns

	Cases (n=50)	Controls (n=50)
never smoked (n) *(%)*	23 *(46)*	26 *(52)*
smoked 100 or more cigarettes (n) *(%)*	27 *(54)*	24 *(48)*
mean age at smoking cessation (years)	47	37
continue to smoke (n) *(%)*	6 *(12)*	7 *(14)*

TABLE XV.
Personal Health History

	% Cases (n = 50)	% Controls (n = 50)
weight gain (≥6.8 kg compared to weight in 1993)	24	16
weight loss (≤6.8 kg compared to weight in 1993)	16	2
at least 1 episode of benign breast disease	40	24
had ovaries removed (oophorectomy)	10	12
had a hysterectomy	20	32
Oral Contraceptive (OC) use	54	54
Hormone Replacement Therapy (HRT) use	30	40
	Cases (years)	**Controls (years)**
mean age at time of oophorectomy	39.2	49
mean age at time of hysterectomy	37.6	42.9
mean age at first OC use	25	24.8
mean # years of OC use	5.8 (range: 0.1-29)	5.1 (range: 0.1-18)
mean age at first HRT use	51	50.8
mean # years of HRT use	5.2 (range: 0.2-24)	7.2 (range: 0.2 - 26)

TABLE XVI.
Age at menarche and menopause

	Cases (n=50)	Controls (n=50)
age at menarche (n) *(%)*:		
≤ 11 years	5 *(10)*	11 *(22)*
12 - 13 years	28 *(56)*	24 *(48)*
≥ 14 years	16 *(32)*	15 *(30)*
unknown	1 *(0.05)*	0
premenopausal (n) *(%)*	13 *(26)*	16 *(32)*
postmenopausal (n) *(%)*	37 *(74)*	34 *(68)*
age at menopause (years ± std dev)	45.2 ± 6.5	45.0 ± 7.4

TABLE XVII.
Menstrual cycle length

	cases (n=50)	controls (n=50)
menstrual cycle length (n) *(%)*:		
≤ 24 days	1 *(2)*	3 *(6)*
25-29 days	35 *(70)*	34 *(68)*
≥ 30 days	5 *(10)*	5 *(10)*
none, irregular or continuous OC use	7 *(14)*	7 *(14)*

TABLE XVIII.
Reproductive and lactation history

	cases (n=50)	controls (n=50)
Reproductive history:		
number of women who experienced at least 1 full term birth (n) *(%)*	43 *(86)*	43 *(86)*
mean age at first birth (years)	24.8 years	23.1 years
median # of children borne	3	3
number of parous women (n) *(%)*	43 *(86)*	43 *(86)*
mean lifetime duration of breastfeeding (± std dev)	11.8 weeks (± 212.9) 95% CI: (5.10, 18.54)	19.9 weeks (± 45.6) 95% CI: (5.88, 33.95)
number of parous women who practised breastfeeding (n) *(%)*	17 *(34)*	13 *(26)*
mean lifetime duration of breastfeeding (± std dev)	29.8 weeks (± 26.2) 95% CI: (16.41, 43.30)	65.9 weeks (± 63.2) 95% CI: (27.67, 104.10)

4.3.7 Univariate comparisons of nutrient intakes

Univariate comparison of nutrient intakes between controls and cases indicated that controls aged 50 years and older consumed significantly more carotenoids than did cases of the same age group ($p=0.03$). A weak effect was also found suggesting that controls of all ages consumed relatively more total dietary fibre than did cases ($p=0.06$). No other significant differences in nutrient intakes were found between cases and controls.

4.3.8 Multivariate analysis

Variables were identified as potentially useful predictors for risk of breast cancer in a multivariate model if the p-value associated with the difference between cases and controls in univariate analysis was less than or equal to 0.10 (Table XIX). Variables included vigorous physical exercise (hours/week), lifetime duration of lactation (weeks), carotenoids (RE), total dietary fibre (g), age, and age greater than or equal to 50 years. Fifty cases and 50 controls were included in models involving cases and controls of all ages, while 34 cases and 37 controls were included in models involving cases and controls aged 50 years and older. Age less than 50 years was not included as sample sizes would be too small (16 cases and 13 controls). Carotenoids and total dietary fibre were included in the models as a proportion of total energy, in accordance with the requirements for the energy density model used[106].

Age is a factor in breast cancer incidence, and can influence nutrient intakes and level of physical exercise. It was therefore considered a potential confounder. To test this, odds

ratios were calculated for carotenoids and physical exercise first for cases and controls of all ages and then by age strata (less than 50 years, and 50+ years). The resulting values were then compared. Differences between odds ratios associated with carotenoid intakes among cases and controls of all ages versus age stratified odds ratios confirmed age as a confounder. Similarly, age was also found to be a confounding variable in regard to relating for hours per week of vigorous physical exercise to breast cancer incidence. No interaction was found between any of the variables.

Four cases previously judged to have 'unreliable' dietary recalls were excluded from all models. Models including lactation history were excluded as the p-value associated with Hosmer-Lemeshow Goodness of Fit statistic was less than 0.05 indicating that the data did not fit the model well. Six models are presented in Table XX. Model #6 included carotenoids, total dietary fibre, total energy, hours per week of vigorous physical exercise and age for all cases and controls. Model #5 was similar to model #6, but excluded dietary fibre. Model #4 included carotenoids, vigorous exercise, total kcal and age 50+ years. Model #3 was similar to model #6 but limited cases and controls to those aged 50 or greater. Model #2 also limited cases and controls to those aged 50+ years, and included carotenoids, vigorous exercise and total kcal. Model #1 was considered to be the best fitting model after consideration of the various parameters illustrated in Table XX. This model included hours per week of vigorous physical exercise, carotenoids and total energy for cases and controls, aged 50 years and older, but excluded three of the original 34 cases after examination of their extreme values associated with hours of

vigorous exercise (reference number 1254), carotenoids (reference number 1257) and kcal (reference number 1268). Model diagnostics (including AIC, SC, CI associated with odds ratios and the concordance of predicted probabilities and observed responses) all improved with the exclusion of these cases.

Model #1, the best fitting model, indicated that while total energy intake had no effect on risk of breast cancer, carotenoid intakes and vigorous physical exercise were associated with a reduced risk of breast cancer in women aged 50 years and older. Specifically, if physical exercise was held constant, the odds of developing breast cancer were 0.15 among women aged 50 years and older who reported daily dietary intakes of at least 950 RE carotenoids versus women of similar ages who consumed less than 950 RE carotenoids. Similarly, if carotenoid intake was held constant, odds of developing breast cancer were 0.76 among women aged 50 years and older who exercised vigorously for 2.25 hours per week versus women of similar ages who exercised vigorously for less than 2.25 hours per week.

TABLE XIX.
Variables identified from univariate analyses as potentially useful predictors ($p \leq 0.1$) of breast cancer in PEI women

		Cases		Controls		
Variable name (units)	**age (years)**	**n**	**mean**	**n**	**mean**	**p-value**
Non-dietary variables						
lifetime duration of lactation (weeks)	all ages	17	29.8	13	65.9	0.07
			median		**median**	
exercise (hours/week)	all ages	50	0	50	2.25	0.03
age	-	50	59	50	59	-
age 50+ years	50+	34	62	37	62	-
Dietary variables			**median**		**median**	
carotenoids (RE)	50+ only	34	598	37	950	0.03
total dietary fibre (g)	all ages	46	13	50	16.5	0.06

TABLE XX.
Logistic regression energy density models[a] predicting breast cancer in PEI women

	age ≥ 50 years			all ages (46 cases, 50 controls)		
	Model #1; 31 cases, 37 controls	**Model #2; 34 cases, 37 controls**	**Model #3; 34 cases, 37 controls**	**Model #4**	**Model #5**	**Model #6**
AIC: intercept only	95.738	100.3	100.3	134.918	134.918	134.918
SC: intercept only	97.957	102.563	102.563	137.482	137.482	137.482
parameter estimate (*p*):				**(1) parameter estimate (*p*):**		
intercept	2.8659 *(0.01)*	2.3526 *(0.02)*	2.8304 *(0.04)*	1.8465 *(0.05)*	2.4855 *(0.09)*	3.3610 *(0.04)*
carotenoids /total kcal	-1.9116 *(0.04)*	-1.6854 *(0.05)*	-1.5111 *(0.10)*	-1.3290 *(0.09)*	-1.2872 *(0.10)*	-0.9481 *(0.25)*
vigorous exercise	-0.2770 *(0.03)*	-0.2146 *(0.05)*	-0.2141 *(0.04)*	-0.2276 *(0.01)*	-0.2405 *(0.01)*	-0.2453 *(0.01)*
total kcal	-0.00088 *(0.06)*	-0.00064 *(0.12)*	-0.00069 *(0.10)*	-0.00038 *(0.28)*	-0.00038 *(0.28)*	-0.2453 *(0.01)*
total dietary fibre /total kcal	(1)	(1)	-55.7388 *(0.54)*	(1)	(1)	-94.6112 *(0.25)*
				age (1)	-0.0130 *(0.52)*	-0.0144 *(0.48)*
				age 50+ years -0.1696 *(0.74)*	(1)	(1)
(1): excluded from model				(1): excluded from model		

[a]Willett WC, Howe GR, Kushi LH. Adjustment for total energy intake in epidemiologic studies. American Journal of Clinical Nutrition 1997; 65:1220S-1228S.

Table XX (cont'd)

	age ≥ 50 years			all ages (46 cases, 50 controls)		
	Model #1; 31 cases, 37 controls	**Model #2; 34 cases, 37 controls**	**Model #3; 34 cases, 37 controls**	**Model #4**	**Model #5**	**Model #6**
Odds ratios (*Confidence interval*):				**Odds ratios (*Confidence interval*):**		
carotenoids /total kcal	0.15 *(0.02,0.96)*	0.18 *(0.03, 1.02)*	0.22 *(0.04,1.30)*	0.26 *(0.06,1.22)*	0.28 *(0.06,1.27)*	0.39 *(0.08,2.00)*
vigorous exercise	0.76 *(0.59, 0.98)*	0.81 *(0.653, 0.99)*	0.81 *(0.655,0.994)*	0.80 *(0.66,0.96)*	0.79 *(0.65,0.95)*	0.78 *(0.65,0.95)*
total kcal	0.99 *(0.99, 1.00)*	0.99 *(0.99, 1.00)*	0.99 *(0.998,1.00)*	1.00 *(0.99,1.00)*	1.00 *(0.99,1.00)*	1.00 *(0.99,1.00)*
total dietary fibre /total kcal	(1)	(1)	0 *(0,999)*	(1)	(1)	0 *(0,999)*
				age (1)	0.99 *(0.95,1.03)*	0.99 *(0.95,1.03)*
				age 50+ years 0.84 *(0.30,2.35)*	(1)	(1)
(1): excluded from model				(1): excluded from model		

*Willett WC, Howe GR, Kushi LH. Adjustment for total energy intake in epidemiologic studies. American Journal of Clinical Nutrition 1997; 65:1220S-1228S.

Table XX (cont'd)

	age ≥ 50 years			all ages (46 cases, 50 controls)			
	Model #1;	**Model #2; 34 cases, 37 controls**	**Model #3; 34 cases, 37 controls**		**Model #4**	**Model #5**	**Model #6**
Association of predicted probabilities and observed responses:				**Association of predicted probabilities and observed responses:**			
% concordant	74.2	70.2	71.3	% concordant	68.3	68.2	70.4
% discordant	25.5	29.4	28.5	% discordant	31.3	31.5	29.4
% tied	0.3	0.4	0.2	% tied	0.3	0.3	0.2
Hosmer-Lemeshow Goodness of Fit	χ^2 = 14.211, 8 df; p=0.07	χ^2 = 8.669, 8 df; p=0.37	χ^2 = 5.622 8 df; p=0.69	Hosmer-Lemeshow Goodness of Fit	χ^2 = 6.882 8 df; p=0.44	χ^2 = 8.411, 8 df; p=0.39	χ^2 = 12.982, 8 df; p=0.11

[a]Willett WC, Howe GR, Kushi LH. Adjustment for total energy intake in epidemiologic studies. American Journal of Clinical Nutrition 1997; 65:1220S-1228S.

4.4 Discussion

Statistically significant differences between cases and controls in this study suggest that vigorous exercise is associated with a reduced risk of breast cancer for controls of all ages. While this effect was also observed at the postmenopausal level, associated confidence intervals overlapped indicating a lack of statistical significance. Although previous research describing the association between physical activity and breast cancer has been somewhat inconsistent, overall evidence suggests that increased physical activity is associated with a decreased risk[139,294,300]. While exact biologic pathways have not been determined, it has been suggested that risk may be mediated through changes in energy balance, body mass, endogenous hormones, and/or immunologic parameters[25,140,294]. Regular physical exercise can help to regulate energy balance and prevent the accumulation of adipose tissue. These factors are particularly important among postmenopausal women because obesity in these women has consistently been associated with increased levels of bioavailable estrogen[39,40] which in turn is associated with increased risk of breast cancer[41]. In contrast to a recent examination of physical exercise patterns among Canadian women aged 45 to 64 years which found that 58 per cent regularly exercised vigorously[301], only 34 per cent of PEI study participants of similar ages reported engaging in regular vigorous exercise.

The lack of regular vigorous exercise coupled with higher than recommended energy intakes (Chapter 3) likely explains the elevated waist to hip ratios and BMIs noted among many of the cases and controls. In particular, abdominal obesity (indicated by waist to

hip ratios greater than 0.8), was noted among 40 per cent (n=15) postmenopausal cases and 41 per cent (n=14) postmenopausal controls. As noted earlier, abdominal obesity is an established risk factor for breast cancer among postmenopausal women.

Although not statistically significant, increased lifetime duration of lactation among parous women who had breastfed their children was also found to be associated with a reduced risk of breast cancer. However, confidence intervals associated with this variable also overlapped indicating no significant difference between cases and controls. A growing number of studies have found that prolonged lactation may be a protective factor in the incidence of breast cancer[154,177-180,187,188], primarily for premenopausal women. A number of mechanisms have been postulated to explain this effect. It has been suggested that breastfeeding may exert a protective effect by delaying the re-establishment of ovulation; that hormonal changes including the changes in prolactin and estrogen production during lactation provide some protection; that lactation may 'flush out' carcinogens; or that increased risk is associated with a malfunctioning of the breast tissue resulting in an inability to lactate[177-179,182,187]. Although the difference in duration of time spent breastfeeding between parous cases and controls who breastfed their children was large, it was not significant. The age at parity and the number of children borne do not appear to explain the observed difference in duration since both were similar between cases and controls. Education and income may have confounded the relationship between lactation and risk of breast cancer in this study. Specifically, Canadian women who breastfeed and continue to breastfeed for longer periods of time are, on average, better

educated and have higher incomes[302], and higher socioeconomic status has been associated with increased risk of breast cancer (Chapter 1).

Study results describing lactation history may have been influenced by recall bias, but a case-control study conducted by Paganini-Hill and Ross[303] found evidence of good reliability in self-reported reproductive histories. The time frame of the question regarding exercise habits may also have introduced some error in the data: controls were asked about their usual exercise habits during the year prior to the interview while cases were asked to report their usual exercise habits during the year prior to their diagnosis of breast cancer. Finally, the broad nature of the exercise questions may have led to some inaccuracies. Precise measurements of usual physical activity were not made because exercise was not the primary focus of the questionnaire.

Confounding by total energy intakes can be a serious problem in epidemiological studies examining diet and chronic disease. Physical activity, differences in body size, and differences in metabolic efficiency can all contribute to variations in total energy intake[35]. Thus, if any of these variables are associated with disease risk, confounding by total energy can occur. Levels of nutrient intakes are also correlated with total energy intake[35]. Some nutrients, such as total fat, contribute directly to total energy. Other nutrients, such as carotenoids, are associated indirectly to total energy intake: those who consume more total energy also consume, on average, increased amounts of specific nutrients. A multivariate nutrient density model was therefore used to predict risk of breast cancer

among the PEI women sampled. Use of this model controlled for confounding by energy adjustment[304], and corrected for differences in intakes that were due to differences in energy intake among individuals[305]. The model included nutrients as a proportion of total energy, while total energy and non-dietary risk factors were included as covariates. The coefficient for the nutrient density (i.e. carotenoids/total energy) represents the relation of carotenoids in total diet with risk of breast cancer, while covariates for total energy and hours per week of vigorous exercise are kept constant[35,304].

Criteria for determination of the best model included p values associated with parameter estimates, odds ratios and associated confidence intervals, association of predicted probabilities and observed responses and the Hosmer-Lemeshow Goodness of Fit statistic. According to these criteria, Model #1 provided the best fit to the data. This model indicated that intake of carotenoids (as a proportion of total energy intake) and hours of vigorous exercise were the best predictors of breast cancer status in women aged 50 years and older in this sample. Specifically, daily dietary intakes of carotenoid in excess of 950 RE (the amount found in approximately 40 ml of boiled carrots) and 25 minutes of vigorous exercise per day provided a significantly protective effect to these women. Odds ratios and associated confidence intervals for carotenoids and vigorous exercise were 0.15 (0.02, 0.96) and 0.76 (0.59, 0.98) respectively. Total energy had a negligible effect on risk, which is in agreement with a number of studies[130,133,306]. The role of carotenoids in the incidence of breast cancer remains to be clarified, but the American Institute for Cancer Research has suggested that it may decrease risk[67]. As discussed in

Chapter 3, previous research has suggested that dietary intakes of carotenoids may reduce the risk either directly, as an anti-oxidant[307,308], or indirectly after conversion to retinol[98].

4.5 Conclusions

While the study included all breast cancer cases identified within the past year within the selection criteria, the small sample size resulted in lower power making it difficult to detect significant differences between cases and controls. Future research should be expanded to include a larger sample size so that biologically significant differences may be more easily detected. This could be accomplished by including all primary, incident breast cancer cases identified in PEI in subsequent years, or by including primary, incident breast cancer cases from other Maritime provinces. It should be noted, however, that if women from other provinces were to be included the FFQ would have to be modified to reflect Maritime-wide dietary patterns.

The majority of the non-dietary factors examined in this study are modifiable and thus may provide practical ways for the general population to reduce their risk for breast cancer. Data from this sample indicated that both vigorous physical exercise and prolonged lactation were protective against breast cancer in this sample. Results from modelling dietary and non-dietary risk factors suggest that dietary intakes of carotenoids and vigorous physical exercise were associated with a reduced risk of breast cancer among PEI women aged 50 years and older. These results are consistent with previous research findings, and with the current knowledge of biologic mechanisms associated

with the risk and incidence of breast cancer.

The model developed suggests that these women may help to decrease their risk by vigorously exercising for a minimum of 25 minutes per day and through daily consumption of at least 950 RE of carotenoids. These nutrients are found primarily in orange coloured fruits and vegetables, and dark green leafy vegetables. These findings are in accord with public health recommendations which recommend 20 to 30 minutes per day of vigorous physical exercise[309], and the consumption of a balanced diet including a variety of fruits or vegetables[310] to help reduce the risk of other serious health conditions including coronary heart disease and diabetes.

5. DISCUSSION AND CONCLUSIONS

5.1 Introduction

Research results to date have associated some dietary components with increased risk of breast cancer and others with decreased risk, but more research is needed to clearly delineate the role of diet in the etiology of breast cancer (Chapter 1). Current evidence suggests that n-3 fatty acids, monounsaturated fats, total dietary fibre and carotenoids are associated with a protective effect[34,42,73,74,84,85,91,92] against breast cancer incidence, although the levels at which an effect has been observed vary from study to study.

A food frequency questionnaire (FFQ) is the most frequently used instrument to assess usual dietary intakes in observational studies of diet and chronic disease because of its demonstrated validity in measuring long term diet and its relatively low subject burden[218]. However, in order to be most useful, the FFQ must be population specific, reflecting culturally specific eating patterns[218,311] since dietary patterns are known to vary by region and ethnicity[231]. Differences in Canadian and American eating patterns illustrate this point: a recent study found that Canadians consumed 20 per cent less red meat and 30 per cent less chicken than did Americans[312]. Recently, Jain[231] emphasized the importance of considering differences in dietary patterns between cultural groups when developing FFQs. She examined usual diet among the 'general Canadian' (primarily individuals of British or European descent), south Asian and Chinese communities in Toronto, Canada and found that the distinct dietary patterns within these communities necessitated the development of three culture specific FFQs for use in a study of diet in cardiovascular

disease.

Prince Edward Island is a small, rural province where fishing and agriculture are among the primary industries[230], giving reason to believe that it may have dietary patterns distinctive from other Canadians (Chapter 1). Although a provincial nutrition survey was conducted in 1995, results are not yet available. A FFQ was deemed the best instrument to use in an investigation of the role of usual diet in breast cancer, but at the time of this research, no population specific FFQ pertinent to Prince Edward Island existed. A new instrument was therefore developed to assess the impact of diet on breast cancer etiology in PEI women. A second questionnaire was also developed to assess exposures to health and lifestyle factors. The questionnaires were subsequently pilot tested among 50 women with recently diagnosed breast cancer and 50 women never diagnosed with breast cancer, resident in PEI.

5.2 Synthesis and discussion of research results

5.2.1 Food Frequency Questionnaire

The methodology utilized in developing the FFQ for this study was similar to that used by Martin-Moreno et al.[219] in their study examining the role of dietary fat and vegetable oils in the etiology of breast cancer among Spanish women. The first phase of FFQ development involved the creation of a comprehensive list of foods currently consumed by PEI women. Dietary data collected as part of the 1995 PEI Nutrition Survey[240] was used to generate a base list of more than 750 foods consumed on PEI. The fact that the

food list was based on foods consumed by respondents of the 1995 PEI Nutrition Survey during the spring and fall seasons of the year may have led to the omission of foods consumed during other seasons. However, the FFQ food list was cross-checked against FFQ food lists used in similar research situations to ensure that the food list was comprehensive and included all food items expected to make a significant contribution to the nutrients of interest. Criteria for selection of food items to be included in the final food list are described in Chapter 2. The final FFQ food list included 119 items, which is similar to that used in other studies examining the role of diet in breast cancer[84,219]. Based on comments made by the respondents and interviewers, the FFQ food list length and format were judged to be acceptable.

An initial analysis of the frequency of use of food items found that 13 of the 119 food items listed in the FFQ were rarely, if ever, consumed by the respondents. Various fish accounted for 10 of the 13 food items rarely consumed. This was somewhat surprising since the fishery is a leading industry on the Island[234]. However, seasonal availability may have negatively influenced consumption of some fish types, such as herring and mackerel, because only those food items that were consumed at least once per month for the 12 months prior to the interview were recorded on the FFQ. Thus, consumption of seasonal food items such as herring (which are commonly caught and consumed only during the winter and spring), may not have been frequent enough throughout the remaining months of the year to be recorded on the FFQ. Health beliefs among respondents may also have influenced fish consumption. For example, the fear that fish

may contain some toxins or other disease-causing agents that may cause harm may have negatively influenced the frequency of fish consumption among some women[313]. Further, consumption levels are known to vary widely according to cost and preference[314].

Other food items infrequently consumed were 'walnuts', 'lamb and mutton', and 'mayonnaise of greater than 65% fat content, including tartar sauce'. If these food items were omitted, the revised food list would contain 106 items. A shorter list could help to reduce interview time required and subsequently, subject burden[218].

5.2.2 Analysis of dietary risk factors

Nutrient intakes for all nutrients among cases and controls were very similar. However, controls aged 50 years and older were found to consume significantly more carotenoids than did cases of the same age suggesting that their intake was associated with a reduced risk of breast cancer (37 controls, median intake: 950 RE; 34 cases, median intake: 598 RE) ($p=0.03$). Although not statistically significant, a reduced risk of breast cancer was also associated with increased fibre intakes (46 cases, median intake: 13.0 g; 50 controls, median intake: 16.5 g) ($p=0.06$). These findings are consistent with other research. Contrary to study findings presented by Block[288] suggesting that vitamin and mineral supplements can make significant contributions to nutrient intakes, no significant differences were found between cases and controls in regard to the usage of vitamin and mineral supplements in this study, either when analyzed separately, or when included with food nutrient data. These findings may be attributed to the small number of

respondents who regularly consumed supplements and the relatively low doses consumed (Chapter 3).

Dietary intakes of the remaining nutrients examined among cases and controls were very similar, but, on the whole were lower than levels implicated in breast cancer risk reported in other studies. Variations in nutrient level intakes between PEI respondents and others studied could be due to differences in dietary patterns between populations, or to differences in data collection methodologies[201]. See Chapter 1 for a full discussion of the challenges associated with dietary assessment.

Aside from these issues, a threshold effect may explain why nutrient associations with breast cancer risk were found in some studies, but not among PEI respondents. For example, consumption of total fat intake reported by PEI cases and controls ranged from approximately 68.8 grams per day to 87.8 grams per day, while a meta-analysis conducted by Howe et al.[34] found that intake of total fat was significantly associated with increased risk of breast cancer, but only at or exceeding intake levels of 100 grams per day. The lack of significant association noted in regards to intake of total dietary fibre and vitamin A among PEI women may also have been due to lower levels of consumption among PEI cases and controls than among those in other studies where an effect was noted. While Rohan et al.[73] observed a significantly protective association between total dietary fibre and breast cancer, intake among his study population was much higher than the median intake observed among all PEI respondents (25 g and 14.6 g, respectively). Similarly,

while vitamin A intakes from food sources among PEI cases and controls ranged from approximately 976 RE to 2563 RE, a significantly protective effect was only noted at intakes exceeding 4240 RE in a meta-analysis of 12 case-control studies[34].

Examination of dietary adequacy among PEI women found that dietary mean intakes of calcium, folate and iron (for ages 34 to 49 years) were less than recommended. Similar findings were also observed in other provincial nutrition surveys[239,276]. Although vitamin E intakes among PEI women were also below recommended levels, lack of available data in the nutrient database used to calculate intakes is the most probable cause: only 2.7 per cent of the 4668 foods listed in the Canadian Nutrient File 1997[214] included an analysis of vitamin E content. Analysis included all vitamin E components since all have antioxidant properties[15]. Many of the women in this study had higher than recommended total energy intakes (54%) and low levels of physical activity (51%). These factors may explain why the prevalence of overweight in this sample (demonstrated by BMI values of 26 or greater) was higher than the national average (45% versus 28%, respectively).

5.2.3 Analysis of non-dietary risk factors

A significant reduction in breast cancer risk was associated with an increased number of hours spent in vigorous physical exercise by women of all ages. A weak protective effect was noted in association with prolonged history of lactation in parous women of all ages who had breastfed their children (Chapter 4). These findings are consistent with previous research findings and with proposed biological mechanisms (Chapter 1). While physical

exercise was not the primary focus of the current study, it was included to allow for the assessment of possible confounding effects. However, the general nature of exposure assessment in this study, as in others, has made it difficult to determine which aspect(s) of physical activity (duration, intensity or type of activity) most influence risk. Furthermore, it may have introduced some misclassification bias. Despite these limitations, study results to date suggest that breast cancer risk may be modified through physical activity. Studies using standardized, more precise measures of exposure are required to determine the intensity, duration and frequency of physical activity required to affect risk.

A growing number of studies have also found that a prolonged history of lactation provides some protection against breast cancer, but this effect has been observed primarily in premenopausal women. Due to the small sample size in our study, analysis of this factor included pre- and postmenopausal women who had practiced lactation. The inclusion of both groups of women may have introduced confounding and thus, masked any true effects.

5.2.4 Multivariate analysis

A multivariate logistic regression model was utilized to predict breast cancer in PEI women. Terms included vigorous exercise, carotenoids and total energy. Since analysis was based on food intake data rather than supplement intakes, the consumption of carotenoids among sample respondents was associated with energy intakes. In order to control for the potentially confounding effects of total energy (kcal) on carotenoid

intakes, carotenoids were entered into the model as a proportion of total energy, and total energy was added as a separate variable[35]. The model indicated that vigorous physical exercise and intakes of carotenoids (as a proportion of total energy) were associated with a reduced risk of breast cancer among women aged 50 years and older (Chapter 4). As in a number of other studies[130,133,306], total energy had a negligible effect (OR: 0.999, CI [0.998, 1.000]).

It had been hypothesized that PEI women recently diagnosed with breast cancer would have significantly lower intakes of n-3 fatty acids, monounsaturated fatty acids, total dietary fibre and carotenoids than would PEI women never diagnosed with breast cancer. Study findings support the hypothesized relationship between carotenoid intake and risk of breast cancer, but the remaining nutrients (n-3 fatty acids, monounsaturated fats and total dietary fibre) were not found to be associated with cancer risk. A larger sample size would be required before ruling out the role of these and other dietary factors for breast cancer in Island women.

Potential limitations associated with the study include selection bias, 'training' effects and recall bias. Selecting study controls from the group of women who had previously been interviewed for the 1995 PEI Nutrition Survey may have introduced selection bias[315], and thus may limit the generalizability of our results. Controls who had been previously interviewed for the 1995 PEI Nutrition Survey may have experienced a 'training' effect[210], possibly leading them to provide more accurate estimates of the food

items and portion sizes consumed. Controls may also have improved their usual diet due to increased awareness as a result of participating in the provincial survey. However, as discussed in Chapter 1, benefits gained from training subjects in portion size estimation are likely to be short-term[212], lasting only a matter of weeks. Thus, any training effect would likely have been lost during the three year period between the time of administration of the 1995 PEI Nutrition Survey and the current research. Further, few differences in dietary intakes were observed between cases and controls, suggesting that the impact of any training effect on controls was minimal. A one year recall period may have been insufficient to capture dietary exposures[102] relevant to breast cancer, since the duration of the latency period associated with this disease is unknown[53,102,133]. However, this period is commonly used since usual diet within the same subject tends to be reasonably similar from year to year[218]. Furthermore, the use of a one year recall period minimizes any memory problems associated with estimating dietary intakes over longer periods[207]. While differences in the recall period asked of cases and controls may have introduced bias into study results, this was minimized by admitting only cases diagnosed within the year prior to the interview period.

Current study results are consistent with other research suggesting that usual dietary intakes and lifestyle influence the etiology of breast cancer: diet and lifestyle risk factors such as physical exercise appear to play key roles in the incidence of breast cancer among women aged 50 years and older. The findings further support suggestions that causal factors underlying pre- and postmenopausal breast cancer differ, as the majority (88 %) of

the women in the sample aged 50 years and older were postmenopausal. Although PEI women in this sample were younger at the time of menopause than the national average (45 years versus 51 years[316], respectively), the younger age may be an artifact of the small sample size employed in the study. Future studies involving larger sample sizes may clarify whether age at menopause among all PEI women is different from that experienced by women from across the rest of Canada.

5.3 Future direction

An important component of this study is the methodology that was utilized in the development of the FFQ. However, future studies should include an assessment of the FFQ validity and reliability. Validity describes the extent to which the FFQ captures true usual diet[317], while the reliability of the instrument describes the extent to which repeated measurements produce the same results in the same situation[311,317]. The results of these tests would confirm that the FFQ food list includes foods consumed by PEI women, and thus, that our study findings are germane to PEI women. Subsequently, the instrument could be employed in larger samples by including all primary, incident breast cancer cases identified in PEI in subsequent years. The application of the FFQ to a larger sample would increase the power of the study, as compared to the current study, so that biologically significant differences between cases and controls could be more easily detected.

An assessment of 'content' validity would determine the degree to which the FFQ food

list represents the original food items used to develop the food list (i.e. assess the comprehensiveness of the FFQ food list). According to the methodology established by Jain[231], the food items on the original 200 24-hour recalls (collected as part of the 1995 PEI Nutrition Survey) would be recoded using only the codes which represent foods on the FFQ food list. The resulting nutrient values generated from the recoding process would then be compared to the nutrient values generated from the original 24-hour recalls. High correlations between the two sets of nutrient values would indicate that the food codes used in the FFQ are representative of the food items reported in the 24-hour recalls.

Subsequently, an assessment should be conducted to determine the 'relative' validity of the dietary assessment methodology used. True usual intakes are never known for certain[318], thus, nutrient intakes collected using the method being tested are compared to those collected using a method considered to be more precise[201] to produce an estimate of 'relative' validity. The relative validity of a FFQ is conventionally determined through a comparison to the results of a dietary assessment using the weighed food record methodology[220,319]. However, the interpretation of this comparison is complicated by the fact that weighed food records have been found to cause a subject to alter their usual intakes[215]. Further, since daily food intakes may differ from usual food use, weighed food records may differ from those collected with a FFQ. Thus, differences in the results between the two methodologies could be attributed to alterations in the subjects food intakes or true differences in actual intake[203], rather than to differences in instrument

validity. These potential issues must be taken into account when interpreting relative validity.

Tests for reliability assess the reproducibility of results[311,317]. Tests for 'test-retest' reliability would provide an estimate of the stability of an instrument[320]. This test would require the re-administration of the FFQ to the same set of respondents by the same interviewer. Correlations between the results of the first and subsequent administrations by interviewer would then be compared. High correlations indicate that the FFQ is consistent in its assessment of nutrient intakes. 'Inter-rater' reliability is similar to test-retest reliability, but comparisons of results are made between interviewers, thus providing an assessment of the consistency of agreement between interviewers[320]. To achieve this, different interviewers administer the same instrument to the same respondents. Results from the different interviewers are subsequently compared for consistency of agreement among responses. A high percentage of agreement among responses between interviewers would be considered as evidence of good inter-rater reliability.

Current study results found that carotenoids and total dietary fibre, found primarily in fruits and vegetables[15], were associated with a reduced risk of breast cancer. In contrast, no significant differences were observed between cases and controls in n-3 polyunsaturated fatty acids (n-3 PUFAs) intakes. This is likely due to the fact that fish, the primary source of n-3 PUFAs, were infrequently consumed by all respondents. These

results suggest a future research focus on the effects of consumption of fruits and vegetables. However, because foods linked to cancer risk are composed of such a wide variety of nutritive and non-nutritive components, the effects of consumption of single constituents such as total dietary fibre and carotenoids on risk of breast cancer are difficult to ascertain. Further, because they are found in the same food sources, intakes of pertinent dietary components are correlated, although in varying degrees. For example, while a minimal correlation was noted between intakes of carotenoids and fibre among PEI women of all ages ($r=0.26$, $p<0.05$), a much greater correlation was noted between intakes of total saturated fat and total energy (kcal) ($r=.89$, $p<0.05$).

The potential for effect modification or confounding by the many other components present in foods is an added complication in understanding the effects of a single component. Results of a Canadian cohort study[73] illustrate this problem. In this study, relatively high intakes of total dietary fibre were associated with a reduced risk of breast cancer. An inverse relationship was also noted between intakes of carotenoids and breast cancer risk after adjustment for energy intakes and established health and lifestyle risk factors. However, further adjustment for dietary intakes of fibre attenuated the relationship suggesting a confounding effect. The protective effect associated with consumption of these food items might also have been mediated by some other components of carotenoid- and fibre-rich foods. Until the role of individual nutrients in breast cancer pathogenesis is more clearly defined, consumption of a well balanced diet with particular emphasis on fruit and vegetable intakes is recommended over

supplemental sources of nutrients because these foods are an important source of fibre, carotenoids and many other nutrient and non-nutrient components which may be protective against breast cancer.

Health Canada (1998) recommends the consumption of a balanced diet that includes five to 10 daily servings of a variety of fruits or vegetables[310]. Further, it is suggested that individuals choose dark green and orange vegetables and orange fruits more often. However, studies of fruit and vegetable consumption indicate that Canadians are not following these dietary recommendations. At the national level, only 30 per cent of Canadians reported consumption of at least five servings of fruit and vegetables per day[321], and most believed that they should eat only three to five servings of fruit and vegetables per day[322]. At this time, the number of servings of fruits and vegetables currently consumed by Islanders is unknown. Preliminary analysis of data collected for the 1995 PEI Nutrition Survey estimate that Islanders aged 18 to 74 years consumed a median level of 2.1 (men) and 2.9 (women) servings per day of fruits and vegetables (excluding those high in starch such as potatoes, corn and bananas/plantain)[323]. Further analysis of food use reported in the current study will be conducted to examine intakes relative to recommendations.

A variety of factors are known to influence the adoption of healthy eating behaviours. For example, a study conducted in Washington state[324] examining predictors of fruit and vegetable intakes found that demographic characteristics, health-related behavior and

belief in an association between diet and cancer were stronger predictors of fruit intake than vegetable intake. Intrinsic motivations including such factors as 'to stay healthy' and 'to prevent cancer or other serious illness' were also strong predictors of fruit intake. In contrast, extrinsic motivations such as 'to control a medical problem' were not significantly associated with either fruit or vegetable intakes. Thus, intrinsic motivations, and in particular, motives to stay healthy, are one of the key components to successful nutrition interventions. However, a study of diet-cancer beliefs and their relationship to healthful diets[272] found that while participants believed that what they ate was related to their chances of getting cancer, those aged 60 years and older were least likely to believe in that connection. Since Canadian breast cancer incidence is highest among women of 50 years and older, educating women of this age group that their usual diet can be linked to cancer could provide the basis on which to encourage the adoption of more healthful dietary habits, which subsequently may help to reduce the incidence of breast cancer.

It is expected that a new program, '5 to 10 a day...Are you getting enough?', will soon be launched by the Canadian Cancer Society. The goal of this program is to reduce the risk of cancer and cardiovascular disease by encouraging Canadians to consume at least five to10 servings of fruits and vegetables per day[322]. It is modeled after a similar program ('5 A Day for Better Health Program') currently in operation in the United States (US). The US program has enjoyed limited success; a brief educational intervention delivered via telephone and follow-up mailouts was associated with a significant increase in self-reported fruit and vegetable intake[325]. However, a later study[326] examining fruit and

vegetable consumption among adults in seven regions observed significant variability in daily fruit and vegetable consumption, suggesting that educational messages should be tailored to different population segments.

5.4 Conclusions

Study findings suggest that diet and lifestyle-related risk factors may play a key role in the etiology of breast cancer among PEI women. Results from the current study among PEI women confirm findings from other studies in demonstrating that some dietary components, such as carotenoids and fibre, are associated with a reduced risk of breast cancer. The fact that these findings were most pertinent to women aged 50 years and older adds to the growing body of evidence suggesting that pre- and postmenopausal breast cancer etiology differs. Current multivariate results among PEI women support existing recommendations for regular vigorous exercise and consumption of a balanced, moderate diet that includes dark green and orange vegetables and orange fruit more often.

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7. APPENDIX A

7.1 Food Frequency Questionnaire

PART I. This section deals with the frequency of consumption of specific foods during the past year, ***(or year prior to diagnosis).***

FOOD	FREQUENCY			PORTION SIZE OR MODEL	COMMENTS/ CALCULATIONS
	DAY	WEEK	MONTH		
FRUITS					
01. Bananas				1unit	
02. Oranges, grapefruit				1unit	
03. Apples, pears				1 med	
04. Blueberries, cranberries				MO-M	
05. Strawberries				BO-M	
06. Rhubarb, cooked				BO-M	
07. Kiwifruit				1 med	
08. Cantaloupe				1/4 med or MO-M	
09. Pineapple				MO-M	
10. Other fruit including grapes, plums				10 grapes or 1 plum	
VEGETABLES					
11. Brussels sprouts, broccoli				MO-M	
12. Cabbage				MO-M	
13. Snap beans, green or yellow				MO-M	
14. Corn (fresh, frozen or canned)				MO-M	
15. Peas, green				MO-M	
16. Carrots or mixed vegetables containing carrots				MO-M	
17. Coleslaw				MO-M	
18. Lettuce, all kinds				BO-M	

FOOD	FREQUENCY			PORTION SIZE OR MODEL	COMMENTS/ CALCULATIONS
	DAY	WEEK	MONTH		
19. Spinach - raw				MO-M	
20. Spinach - cooked				MO-M	
21. Sweet peppers				1 unit	
22. Tomatoes, fresh or canned				1 med or MO-M	
23. Winter squash				MO-M	
24. Potatoes - mashed, boiled or baked - no fat added				MOL or 1 medium	
25. Potatoes - scalloped, or mashed with milk and fat, or potato salad with mayo type dressing				MO-L	
26. Potatoes -oven baked french fries				MO-L	
27. Potatoes - pan-fried or deep fried french fries				MO-L	
28. Sweet potatoes or yams				MO-M	
29. Turnip, parsnips				MO-M	
30. Other vegetables including raw and cooked onions, cucumber and summer squash				MO-M	
SOUPS					
31. Bouillion, or clear soups with noodles				BO-M	
32. Cream soups				BO-M	
33. Vegetable soups with carrots and/or tomatoes				BO-M	
34. Lentil, pea and bean soups; or baked beans or lentils				BO-M	

FOOD	FREQUENCY			PORTION SIZE OR MODEL	COMMENTS/ CALCULATIONS
	DAY	WEEK	MONTH		
DAIRY					
35. Cheese, regular fat - more than 24% b.f. ie cheddar, mozzarella				1 slice, 2 TBL or 1/3 PC-S	
36. Light cheese -10 to 24% b.f. ie reduced fat cheddar				1 slice, 2 TBL or 1/3 PCS	
37. Cottage cheese or any cheese less than 10% b.f.				MO-S	
38. Ice cream - regular or rich				½ cup	
39. Low fat ice cream, frozen yogurt, ice milk or sherbet, light yogurt (1% or less b.f.)				½ cup 175 g	
40. Yogourt (reg fat content) and milk puddings				½ cup 175 g	
41. Sour cream - regular or low fat				1 TBL	
42. Whipping cream, whipped				1 TBL	
43. Eggs - poached or hard cooked				1 large	
44. Eggs - cooked with added fat				1 large	
FISH					
45. Smelts baked/broiled				PC-S	
46. Smelts - with added fat or fried				PC-S	
47. Eels baked/broiled				PC-S	
48. Eels - with added fat or fried				PC-S	
49. Herring baked/broiled/pickled/ smoked/kippered				PC-S	

FOOD	FREQUENCY			PORTION SIZE OR MODEL	COMMENTS/ CALCULATIONS
	DAY	WEEK	MONTH		
50. Herring - with added fat or fried				PC-S	
51. Lake trout steamed/baked/broiled				PC-S	
52. Lake trout - with added fat or fried				PC-S	
53. Salmon (canned, fresh, frozen) steamed/baked/ broiled				PC-S	
54. Salmon - with added fat or fried				PC-S	
55. Mackerel steamed/baked/broiled				PC-S	
56. Mackerel - with added fat or fried				PC-S	
57. Tuna - albacore (canned, fresh, frozen) steamed/baked/broiled				PC-S	
58. Tuna - albacore - with added fat or fried				PC-S	
59. All other fish steamed/baked/broiled				PC-S	
60. All other fish - with added fat or fried				PC-S	
61. Fish fillets - deep fat fried				PC-S	
62. Shellfish (shrimp, crab, mussels, oysters) steamed/baked/broiled				10 units or MO-M (w/o shell)	
63. Shellfish - with added fat or fried				10 units or MO-M (w/o shell)	
64. Lobster steamed/broiled				3/4 - 1 lb or ½ cup w/o shell	

FOOD	FREQUENCY			PORTION SIZE OR MODEL	COMMENTS/ CALCULATIONS
	DAY	WEEK	MONTH		
65. Lobster - with added fat				3/4 - 1 lb or ½ cup w/o shell	
MEATS AND POULTRY					
66. Beef roast or steak				PC-S	
67. Beef, ground **med and reg,** fried or broiled				PC-S	
68. Beef, ground **lean,** fried or broiled				PC-S	
69. Pork and ham: roasts, chops and other cuts				PC-S	
70. Poultry: turkey and chicken - roasted, no skin				PC-S	
71. Poultry: turkey and chicken - roasted with skin				PC-S	
72. Poultry: breaded or battered and fried				PC-S	
73. Liver, all types				PC-S	
74. Lamb and mutton				PC-S	
75. Tacos, Burritos or Fajitas with meat or beans				1 Unit	
76. Pizza				1 Slice	

FOOD	FREQUENCY			PORTION SIZE OR MODEL	COMMENTS/ CALCULATIONS
	DAY	WEEK	MONTH		
PROCESSED MEATS, LUNCHEON MEATS					
77. Wieners or hot dogs, Sausage				1 Unit	
78. Pepperoni, Salami, Bologna				1 Slice	
79. Smoked meat, Corned Beef, Ham Slices				1 Slice	
80. Bacon, cooked				1 Strip	
PASTA, RICE					
81. Pasta with creamy cheese sauces like macaroni and cheese				MO-L	
82. Spaghetti, lasagna, other pasta with tomato sauce				MO-L	
83. Pasta salad, other pasta				MO-L	
84. Rice, or dishes made with rice				MO-M	
BREADS AND SWEETS					
85. Pancakes or waffles				CR-L	
86. Crackers, soda				1 Cracker	
87. Snack crackers				1 Cracker	
88. Cookies				1 Cookie	
89. Cakes, pies, donuts, cake type muffins, cupcakes, biscuits				1 Unit	
90. Muffins - high fibre				1 Unit	
91. Breads, whole grain (including bread, rolls, bagels, English muffins etc.)				1 Slice	
92. Breads, white (including bread, rolls, bagels, English muffins etc.)				1 Slice	

FOOD	FREQUENCY			PORTION SIZE OR MODEL	COMMENTS/ CALCULATIONS
	DAY	WEEK	MONTH		
CEREALS					
93. Fibre cereals (Raisin Bran, Shredded Wheat, etc.)				BO-M	
94. Sweetened cereals (Frosted Flakes etc.)				BO-M	
95. Other cold cereals (Cheerios, Corn Flakes etc.)				BO-M	
96. Cooked cereals (Oatmeal, Cream of Wheat etc)				BO-M	
97. Breakfast or cereal bars, granola bars				1 Unit	
OTHER FOODS					
98. Salsa, taco sauce, ketchup				1 TBL	
99. Peanuts, peanut butter				2 TBL or 30 g	
100. Walnuts				1 TBL or 15 g	
101. Jam, molasses				1 TBL	
102. White or brown sugar				1 TBL	
103. Chocolate candy, candy bars				1 small bar or 1 oz.	
104. Other candy or jelly				1 TBL	
105. Potato chips, tortilla chips, cheesies, cheese puffs, oil-popped popcorn				BO-L	
106. Pretzels				BO-L	

FOOD	FREQUENCY			PORTION SIZE OR MODEL	COMMENTS/ CALCULATIONS
	DAY	WEEK	MONTH		
BEVERAGES					
107. Pineapple juice, cranberry cocktail				GL-S	
108. Apple, orange, grapefruit juices				GL-S	
109. Tomato or vegetable juices, or cocktails				GL-S	
110. Fruit flavoured beverages containing added vitamin C				GL-M	
111. Regular soft drinks (not diet)				GL-M	
112. Beer				1 Bottle	
113. Wine or wine coolers				4 FOZ wine or 1 Bottle cooler	
114. Liquor				1 FOZ	
AS A <u>BEVERAGE</u>, WHAT KIND OF MILK DID YOU DRINK? ***(DO <u>NOT</u> READ LIST)***					
115. skim				1 cup	
116. 1%				1 cup	
117. 2%				1 cup	
118. whole				1 cup	
119. evaporated - whole and 2%-**undiluted**				1 cup	
120. evaporated - skim **-undiluted**				1 cup	
121. evaporated - whole and 2% **-diluted**				1 cup	
122. triple milk - **undiluted**				1 cup	
123. triple milk **-diluted ratio 2:1**				1 cup	

FOOD	FREQUENCY			PORTION SIZE OR MODEL	COMMENTS/ CALCULATIONS
	DAY	WEEK	MONTH		
124. triple milk **- other dilution**				1 cup	
125. other types of milk (please specify)					
126. did not drink milk (please check)					
ON CEREALS, WHAT KIND OF MILK DID YOU USE? ***(DO NOT READ LIST)***					
127. skim				½ cup	
128. 1%				½ cup	
129. 2%				½ cup	
130. whole				½ cup	
131. evaporated - whole and 2% **-undiluted**				½ cup	
132. evaporated - skim **-undiluted**				½ cup	
133. evaporated - whole and 2% **-diluted**				½ cup	
134. triple milk - **undiluted**				½ cup	
135. triple milk **-diluted ratio 2:1**				½ cup	
136. triple milk **- other dilution**				½ cup	
137. cream 10%				½ cup	
138. cream 18%				½ cup	
139. other types of milk (please specify)					
140. did not eat cereals (please check)					

FOOD	FREQUENCY			PORTION SIZE OR MODEL	COMMENTS/ CALCULATIONS
	DAY	WEEK	MONTH		
IN TEA AND COFFEE, WHAT KIND OF MILK DID YOU USE? ***(DO NOT READ LIST)***					
141. skim				1 TBL	
142. 1%				1 TBL	
143. 2%				1 TBL	
144. whole				1 TBL	
145. evaporated - whole and 2% -**undiluted**				1 TBL	
146. evaporated - skim -**undiluted**				1 TBL	
147. evaporated - whole and 2% -**diluted**				1 TBL	
148. triple milk - **undiluted**				1 TBL	
149. triple milk -**diluted ratio 2:1**				1 TBL	
150. triple milk - **other dilution**				1 TBL	
151. cream 10%				1 TBL	
152. cream 18%				1 TBL	
153. other types of milk (please specify)					
154. did not use milk or cream (please check)					
155. used coffee whitener (please check)					
156. did not drink tea or coffee (please check)					
SALAD DRESSINGS					
157. Salad dressings, regular fat content				1 TBL	
158. Mayonnaise type salad dressing, regular fat content				1 TBL	
159. Mayonnaise type salad dressing, low fat				1 TBL	

FOOD	FREQUENCY			PORTION SIZE OR MODEL	COMMENTS/ CALCULATIONS
	DAY	WEEK	MONTH		
160. Mayonnaise >65%, including tartar sauce				1 TBL	
FATS AND SPREADS					
ON BREADS AND ROLLS, WHAT TYPE(S) OF FAT OR SPREAD DID YOU USUALLY USE? (DO NOT READ LIST)					
161. Butter				1 TSP	
162. 20/80 spread				1 TSP	
163. 50/50 spread				1 TSP	
164. Lard, bacon or pork fat				1 TSP	
Margarine tub (DO NOT READ LIST)					
165. unspecified vegetable oils				1 TSP	
166. Monarch (soy)				1 TSP	
167. Blue Bonnet (soy)				1 TSP	
168. Lactantia, Low Energy (soy)				1 TSP	
169. Others (soy)				1 TSP	
170. Country Crock (canola)				1 TSP	
171. West (canola)				1 TSP	
172 Others (canola, and canola/corn)				1 TSP	
173. Canola and soy				1 TSP	
174. Canola and linola				1 TSP	
175. Olive oil				1 TSP	
176. Other tub margarine (please specify)					

FOOD	FREQUENCY			PORTION SIZE OR MODEL	COMMENTS/ CALCULATIONS
	DAY	WEEK	MONTH		
Margarine stick (DO NOT READ LIST)					
177. Baxter's (unspecified vegetable oils)				1 TSP	
178. Chef Master (unspecified vegetable oils)				1 TSP	
179. Other (unspecified vegetable oils)				1 TSP	
180. Blue Bonnet or Parkay (soy and canola)				1 TSP	
181. Imperial (canola and soy)				1 TSP	
182. Fleischmann's (corn and canola)				1 TSP	
183. other stick margarine (please specify)					
184. did not use fat or spread on bread or rolls (please check)					
ON VEGETABLES, WHAT TYPE(S) OF FAT OR SPREADS DID YOU USUALLY USE? (DO NOT READ LIST)					
185. Butter				1 TSP	
186. 20/80 spread				1 TSP	
187. 50/50 spread				1 TSP	
188. Lard, bacon or pork fat				1 TSP	
Margarine tub (DO NOT READ LIST)					
189. unspecified vegetable oils				1 TSP	
190. Monarch (soy)				1 TSP	
191. Blue Bonnet (soy)				1 TSP	
192. Lactantia Low Energy (soy)				1 TSP	
193. others (soy)				1 TSP	

FOOD	FREQUENCY			PORTION SIZE OR MODEL	COMMENTS/ CALCULATIONS
	DAY	WEEK	MONTH		
194. Country Crock (canola)				1 TSP	
195. Others (canola, and canola/corn)				1 TSP	
196. Others (canola and soy)				1 TSP	
197. Others (canola and linola)				1 TSP	
198. olive oil				1 TSP	
199. other tub margarine (please specify)					
Margarine stick (DO NOT READ LIST)					
200. Baxter's (unspecified vegetable oils)				1 TSP	
201. Chef Master (unspecified vegetable oils)				1 TSP	
202. Other (unspecified vegetable oils)				1 TSP	
203. Blue Bonnet or Parkay (soy and canola)				1 TSP	
204. Imperial (canola and soy)				1 TSP	
205. Fleischmann's (corn and canola)				1 TSP	
206. other stick margarine (please specify)					
207. did not use fat or fat spread on vegetables (please check)					

PART II This section deals only with home-made foods and uses of fat during the past year.

If you ate home prepared pan-fried or stir-fried foods at least once each month in the past year, what was the main kind of fat or oil *usually* used? Mark the one or two used most often. (DO NOT READ LIST)	
main source	**OILS**
	208. unspecified vegetable oil
	209. corn
	210. canola
	211. olive
	212. other (please specify)
	MARGARINE - TUB
	213. unspecified vegetable oils
	214. Monarch (soy)
	215. Blue Bonnet (soy)
	216. Lactantia, low Energy (soy)
	217. Others (soy)
	218. Country Crock (canola)
	219. West (canola)
	220. Others (canola, and canola/corn)
	221. Canola and soy
	222. Canola and linola
	223. Olive oil
	224. Other tub margarine (please specify)

	MARGARINE - STICK
	225. Baxter's (unspecified vegetable oils)
	226. Chef Master (unspecified vegetable oils)
	227. Other (unspecified vegetable oils)
	228. Blue Bonnet and Parkay (soy and canola)
	229. Imperial (canola and soy)
	230. Fleischmann's (corn and canola)
	231. Other stick margarine (please specify)
	OTHER FATS
	232. Lard, bacon/animal fat
	233. Shortening
	234. 20/80 spread
	235. 50/50 spread
	236. Do not know
	237. Did not eat home prepared pan-fried or stir-fried foods (please check)
If you ate home prepared deep-fat-fried foods at least once per month in the last year, what kinds of fat or oil did you usually use? Mark the one or two used most often. (DO NOT READ LIST)	
main source	**OILS**
	238. unspecified vegetable oil
	239. corn
	240. canola
	241. olive
	242. other (please specify)
	MARGARINE - TUB
	243. unspecified vegetable oils
	244. Monarch (soy)
	245. Blue Bonnet (soy)
	246. Lactantia, low Energy (soy)
	247. Others (soy)

	248. Country Crock (canola)
	249. West (canola)
	250. Others (canola, and canola/corn)
	251. Canola and soy
	252. Canola and linola
	253. Olive oil
	254. Other tub margarine (please specify)
	MARGARINE - STICK
	255. Baxter's (unspecified vegetable oils)
	256. Chef Master (unspecified vegetable oils)
	257. Other (unspecified vegetable oils)
	258. Blue Bonnet and Parkay (soy and canola)
	259. Imperial (canola and soy)
	260. Fleischmann's (corn and canola)
	261. Other stick margarine (please specify)
	OTHER FATS
	262. Lard, bacon/animal fat
	263. Shortening
	264. 20/80 spread
	265. 50/50 spread
	266. Do not know
	267. Did not eat home prepared deep-fat-fried foods (please check)

If you ate home prepared baked products at least once per month in the last year, what kinds of fat or oil did you *usually* use in baking? Mark the one or two used most often. (DO NOT READ LIST)	
main source	**OILS**
	268. unspecified vegetable oil
	269. corn
	270. canola
	271. olive
	272. other (please specify)
	MARGARINE - TUB
	273. unspecified vegetable oils
	274. Monarch (soy)
	275. Blue Bonnet (soy)
	276. Lactantia, low Energy (soy)
	277. Others (soy)
	278. Country Crock (canola)
	279. West (canola)
	280. Others (canola, and canola/corn)
	281. Canola and soy
	282. Canola and linola
	283. Olive oil
	284. Other tub margarine (please specify)
	MARGARINE - STICK
	285. Baxter's (unspecified vegetable oils)
	286. Chef Master (unspecified vegetable oils)
	287. Other (unspecified vegetable oils)
	288. Blue Bonnet and Parkay (soy and canola)
	289. Imperial (canola and soy)
	290. Fleischmann's (corn and canola)
	291. Other stick margarine (please specify)

	OTHER FATS
	292. Lard, bacon/animal fat
	293. Shortening
	294. 20/80 spread
	295. 50/50 spread
	296. Do not know
	297. Did not eat home prepared baked products (please check)

NUTRIENT SUPPLEMENT FORM

PART III. This section deals with the frequency of consumption of supplements.

1. Did you take any vitamin or mineral supplements in the past year ***(or year prior to diagnosis)***? ☐ Yes ☐ No
2. Please tell me all vitamin or mineral supplements with their DIN (when available) that you took during the last year ***(or year prior to diagnosis)***.
3. How often was each of these supplements taken during that time period? (Number of times per day, per week or per month)
4. How many pills (capsules, etc.) were usually taken on each occasion?
5. For how many years have you been taking this vitamin or mineral supplement?

SUPPLEMENT NAME	DIN	HOW OFTEN?			HOW MUCH	FOR HOW MANY YEARS IN TOTAL?						
		day	week	month	# pills/tab/cap/tsp, etc	less than 1 yr	1 year	2 years	3-4 years	5 yrs	6-9 years	10+ years

PRESCRIPTION DRUGS FORM

PART IV. This section deals with the consumption of prescription drugs

1. Did you take any prescription drugs in the past year ***(or year prior to diagnosis)***? ☐ Yes ☐ No
2. Please tell me the names of all prescription drugs with their DIN (when available) that you took during the last year ***(or year prior to diagnosis)***.
3. For how many years have you been taking this prescription drug?

NAME OF PRESCRIPTION DRUG	DIN	FOR HOW MANY YEARS IN TOTAL?						
		less than 1 yr	1 year	2 years	3-4 years	5 years	6-9 years	10+ years

7.2 Rationale for FFQ food list contents and groupings

Note: 1. all nutrient values are provided by Canadian Nutrient File 1997 through CANDAT Research Oriented Nutrient Calculation System, and
2. all nutrient values in tables are per 100 grams

FRUITS

1. **bananas**: significant consumption by sample (frequency of consumption = 40/200)
2. **oranges, grapefruit**: includes whole fruits (not juice)- all varieties of oranges and grapefruit; fresh or canned segments; similar in vitamin C and fibre content

3. **apples, pears**: includes whole fruits and fruit made into sauce - fresh or canned; similar in vitamin C, fibre and kcal content

	kcal	vit C	tdf	freq of consumption
apples	59	5.7	3	30/200
pears	59	5.7	1.9	3/200

4. **blueberries, cranberries**: includes whole fruits, fresh or frozen or canned; and sauces similar in vitamin C and fibre content

	kcal	vit C	tdf	freq of consumption
blueberries	56	13	2.6	3/200
cranberries	49	13.5	4.2	2/200
strawberries	*30*	*56.7*	*2.2*	*3/200*

5. **strawberries:** includes fresh, frozen or sauce; significantly different in vitamin C content from other berries (see above); consumption by sample = 3/200

6. **rhubarb, cooked, sugar added**: included in list for fibre content; frequency of consumption by sample = 5/200

7. **kiwifruit:** included for vitamin C and fibre content; suggested by PEI dietitians

	kcal	vit C	tdf	freq of consumption
kiwifruit	61	75	3.4	2/200

8. **cantaloupe:** included on both Block 95 Food Questionnaire and the Environmental Health Survey; does not include honeydew or watermelon because of large differences in carotenoids and vitamin C (less drastic, but still significant)

	kcal	tdf	vit C	carot	freq of consumption
cantaloupe	35	0.7	42	322	1/200
watermelon	*32*	*0.4*	*9.6*	*37*	*0*
honeydew	*35*	*0.8*	*24.8*	*4*	*1/200*

9. **pineapple**; including fresh or canned; nutrient profile is dissimilar to other fruits therefore given its own listing

	kcal	vit C	tdf	freq of consumption
pineapple	32	7.7	0.72	6/200

10. **other fruit including grapes, plums**: listed together because of similarities in vitamin C and fibre content

	kcal	vit C	tdf	freq of consumption
grapes	71	10.8	1.2	9/200
plums	55	9.5	1.6	2/200

VEGETABLES

11. **brussels sprouts, broccoli;** similar in fibre, vitamins C and A content

	kcal	fibre	vit A (IU)	vit C	freq of consumption
brussels sprouts	39	1.37	719	62	1/200
broccoli	28	1.11	1388	74.6	6/200

Cauliflower is not included because of low consumption rates and low/moderate values of vitamin A, vitamin C and kcal

12. **cabbage** includes cabbage raw and cooked, source of fibre, vitamins A and C; significant source of n3 (see table below)

13. **snap beans, green or yellow**: significant source of n3 fatty acids

14. **corn fresh, frozen or canned**: source of carotenoids and vitamin E (frequency of consumption = 12/200)

15. **green peas**: includes fresh, frozen, boiled or raw (frequency of consumption = 19/200)
cannot be included with green beans - peas have significantly lower n3 content

16. **carrots or mixed vegetables containing carrots**: frequency of consumption: 55+/200; same grouping as used in Block 95 Food Questionnaire; good source of carotenoids

17. **coleslaw**: listed separately from cabbage because of differences in vitamin A, kcal and fat content

	kcal	fibre	vit A (IU)	vit C	frequency of consumption	n3	n6
cabbage	22	0.6	132	20.1	5/200	0.11	0.09
coleslaw	148	0.64	341	8.4	5/200	0.78	5.678

18. **lettuce**: -all types grouped together

	kcal	tdf	vit A (IU)	vit C	frequency of consumption
romaine	16	1.7	2600	24	7/200
head or iceberg	13	0.51	330	3.9	33/200

19. **spinach, raw**: significant source of n3

	MO-M	kcal	carot	vit C	folate	frequency of consumption
spinach raw	29.6 g	22	672	28.1	194.4	1/200
spinach cooked	95 g	23	819	9.8	145.8	0

20 . **spinach, cooked**: -significant source of n3
- raw and cooked are separated because of differences in portion weights (see weights listed per MO-M in table above)

21. **sweet peppers, green and or red**: (freq of consumption = 8/200); source of vitamin C

22. **tomatoes, fresh or canned**: - includes fresh or canned stewed or plum tomatoes; does not include spaghetti sauce or sauce used for lasagne - high frequency of consumption

23. **winter squash, baked or boiled**: includes dark yellow winter squash ie butternut,

acorn, hubbard, pumpkin; is significant source of n3-fatty acids - is significant source of n3-fatty acids. Does not include spaghetti squash, summer squash or sweet potatoes because of differences in kcal, vitamins A and C

	n3	n6	kcal	tdf	vit A (IU)	vit C	frequency of consumption
spaghetti squash	*0.1*	*0*	*29*	*1.08*	*110*	*3.5*	*0*
butternut	0	0	40	1.68	7001	15.1	0
acorn	0	0	56	1.93	428	10.8	1/200

24. **potatoes (boiled or baked, mashed, plain)**: freq of consumption high; similar nutrient profiles; source of kcal, vitamin C, fibre

25. **potatoes, scalloped, mashed with milk and fat, potato salad with mayo type dressing**: grouped because of similar nutrient profiles

	n3	n6	kcal	tdf	vit C	frequency of consumption
scalloped	0.1	0.11	86	0.29	10.6	10/200
mashed (+fat +milk)	0.1	1.15	106	2	40	0
potato salad	0.37	3.35	143	1.5	10	8/200

26. **potatoes, oven baked french fries**: distinguished from deep fried because of differences in nutrient profiles

	n3	n6	kcal	tdf	vit C	frequency of consumption
f fries/oven baked	0	0.73	200	3.25	10.1	6/200
f fries/ deep fried	-	4.83	262.8	0.75	10.8	18/200

27. **potatoes, pan fried or deep fried french fries**; includes home and restaurant fried.

28. **sweet potatoes or yams:** includes boiled and baked; significantly different vitamin C and kcal content from carrots and winter squash. Was included in both the Block 95 Food Questionnaire and the Environmental Health Survey.

	n3	kcal	tot fibre	vit C	frequency of consumption
carrots	0	45	2.7	2.3	55/200
sweet potatoes	0	103	3	24.6	0
winter squash	0.17	39	1.76	9.6	1/200

29. **turnip, parsnips**: includes cooked and raw (ie vegetable platters, stir-fried, boiled, baked etc)

	kcal	tdf	vit C	vit A (IU)	n3
turnip	18	2	11.6	0	0.032
parsnips	81	3.24	13	0	0.003

-frequency of consumption of turnip by sample: 26/200
-parsnip inclusion suggested by PEI dietitians (0 consumption by sample)

30. **other including raw and cooked onions, cucumber and summer squash**
-all grouped because of similarities in nutrient profiles

	kcal	tdf	vit C	vit A (IU)	n3
onions (cooked)	44	1.7	5.2	0	0.004
cucumber (raw)	13	0.73	5.3	215	0.03
zucchini (cooked)	16	1.6	4.6	240	0.13

- cooked onions were included in Block 95 Food Questionnaire in "other vegetables" with summer squash
- high frequency of use of onions by 1995 PEI Nutrition Survey respondents
- frequency of consumption of cucumber by sample: 12/200
- zucchini included on the recommendation of PEI dietitians and nutritionists (frequency of consumption = 0)

SOUPS

Soups were categorized on basis of fat content (cream soups), nutrient profiles (ie veg soups with carrots and/or tomatoes = high in vit C) and frequency of consumption (bouillion use = 17/200)

31. **bouillion, or clear with noodles** - frequency of consumption: 17/200

32. **cream soups** frequency of consumption: 14/200

33. **vegetable soups with carrots and/or tomatoes** (frequency of consumption:13/200)

34. **lentil, pea and bean soups; or baked beans or lentils** - grouped and listed together of similar nutrient profiles; ie all are very good sources of fibre

DAIRY

Dairy products were grouped and listed according to fat content and frequency of use

35. **cheese, regular fat (more than 24% b.f.)** ie cheddar, mozzarella

36. **light cheese (10 - 24% b.f.)** ie reduced fat cheddar

37. **cottage cheese or any cheese less than 10% b.f.**

38. **ice cream (regular or rich)**

	kcal	tot fat	sfa tot	n3	n6	mono	frequency of consumption
ice cream 16%	241	16.2	9.97	0.24	0.37	4.66	6/200
ice cream 11%	201	11	6.79	0.16	0.25	3.17	15/200

39. **low fat ice cream, frozen yogurt, ice milk or sherbet, Light yogurt** (1% or less b.f.); listed together because of similarities in nutrient profiles

40. **yogourt, regular fat content, milk puddings**: listed together because of similarities in nutrient profiles

	kcal	protein	fat tot	calcium	frequency of consumption
pudding vanilla	101	3	1.7	109	1/200
yogurt plain	63	5.25	1.55	183	0
yogurt fruit	101	3.95	1.54	122	4/200

41. **sour cream regular and low fat (18% b.f., 14 % b.f.)** freq of consumption = 4/200 and 2/200

42. **whipping cream**: frequency of consumption = 0

43. **eggs, poached or hard boiled**: frequency of consumption = 10/200

44. **eggs, cooked with added fat**: frequency of consumption = 14/200

FISH

Fish queries included frequency of consumption of the listed fish prepared without added

fat, and consumption of the listed fish prepared with added fat.

45 - 58: The following fish are listed because they are important sources of n3-fatty acids: **eel, herring, lake trout, mackerel, tuna (albacore), salmon. Smelts** were recommended for inclusion by the PEI dietitians and nutritionists.

59 - 60. **All other fish**: includes other fresh and frozen fish types low in n3-fatty acid content and not already named ie cod, sole, haddock

61. **fish fillets - breaded or battered and fried**: frequency of consumption = 2/200

62 - 65. **shellfish and lobster**. Included to reflect regional eating patterns.

MEATS AND POULTRY
Although few respondents reported eating "whole portions" of red meats (ie a beef steak, pork or lamb chop) these are included because when eaten, they make a significant contribution to overall diet quality. Except where noted, items were differentiated on the basis of cooking method, fat, protein, iron, zinc and B vitamin content.

66. **beef, roast or steak, stews and other cuts**

67. **beef, ground med and regular, fried or broiled** (frequency of consumption: 11/200)

68. **beef, ground lean, fried or broiled** (frequency of consumption: 21/200)

69. **pork and ham - roasts, chops and other cuts**

70. **poultry: including chicken, turkey, duck, pheasant, goose etc, roasted, no skin eaten**

71. **poultry: as above, roasted, skin eaten** (includes chicken nuggets/fingers, oven baked)

72. **poultry including chicken, turkey, duck, pheasant, goose etc - breaded or battered and fried** frequency of consumption = 3/200; also includes home prepared fried chicken

73. **liver, all types**

74. **lamb and mutton**

75. **tacos, burritos, or fahitas with meat or beans**; included because it was listed in the Block 95 Food Questionnaire

76. **pizza with cheese, meat and/or vegetables** frequency of consumption = 10/200

PROCESSED MEATS, LUNCHEON MEATS

77. **wieners or hot dogs, or sausage**

grouped because of similarities in nutrient profiles and unit size

	tot fat	kcal	protein	n3	n6
wieners	23.4	291	12.2	0.31	1.88
Sausage	36.25	396	13.8	0.32	3.46

78. **pepperoni, salami, bologna**: listed together because of similarities in nutrient profiles and unit size; similarities in eating situations may also make it easier for respondents to recall consumption

	tot fat	kcal	protein	n3	n6
salami	33.72	407	22.58	0.28	3.27
pepperoni	43.97	497	20.97	0.41	3.74
bologna	22.4	276	12.2	0.32	1.56

79. **smoked meat, corned beef, ham slices**: listed together because of similarities in serving sizes and situations; distinguished from listing #78 (pepperoni, salami, bologna) by much lower kcal and total fat content

	total fat	kcal	protein	n3	n6
smoked meat	4.42	123	20.19	0.04	0.19
corned beef	10.58	179	18.85	0.07	0.3

80. **bacon, cooked**: listed separately because of higher fat content

PASTA, RICE

Pasta items were categorized primarily on basis of nutrient content of added sauces.

81. **pasta with creamy cheese sauce like macaroni and cheese**: includes all types of pasta with any creamy cheese sauce; differentiated from other pasta items on the basis of fat, kcal and calcium content.

82. **spaghetti, lasagne, other pasta with tomato sauce**: differentiated from other pasta items on the basis of vitamin C content; any added meat is included in "Meats and

Poultry"

83. **pasta salad, other pasta**: includes cold pasta salads and pasta with creamy (but no cheese) sauces. Differentiated on the basis of different fat types used in dressing and differences in calcium and fat content.

84. **rice or dishes made with rice**: plain rice and pasta nutrient profiles are similar, but are listed separately because they are used differently. This item includes sweet and savoury dishes in which rice is the primary ingredient including rice pudding, pilaf, casseroles, etc.

BREADS AND SWEETS

85. **pancakes or waffles**: listed separately from the rest of the items in the group because of the distinctive serving size and because they are lower in total fat and saturated fat content (see table associated with food item #89 below).

86. **crackers, soda**: listed separately from snack crackers because of significant differences in carbohydrate, total and saturated fat content.

87. **crackers, snack type:** listed separately from soda crackers and hard pretzels because of fat and kcal content; and separately from cookies because of unit size difference

	kcal	carb	total fat	saturated fat	frequency of consumption
soda crackers	434	71.5	11.8	2.106	13/200
snack crackers	502	61	25.3	4.852	8/200
cookies	496	641	25.4	8.3	54/200
pretzels	381	79.2	3.5	0.75	0

88. **cookies**: includes all types - homemade and commercially prepared

89. **cake, donuts, cake type muffins, cupcakes, pies, biscuits**: includes regular fibre and fat content; grouped because of similar fat and kcal profiles; includes home and commercial products

	kcal	carbohydrate	total fat	saturated fat
cake	347	47.3	17	3.14
donut	340	39	18.7	4.76
cake type muffin	277	48	6.5	1.3

pie	237	34	11	2.1
biscuits	354	44.6	16.3	4.32
pancakes	*194*	*36.7*	*2.5*	*0.507*

90. **muffins, high fiber** - includes bran muffins, oat bran muffins, commercial high fibre muffins

91. **bread, whole grain (including ww bagels, rolls, english muffins)** grouped because of similar nutrient profiles. Listed separately from #92 (white bread products) because of differences in fibre and nutrient content.

92. **bread, white (including white bagels, rolls and english muffins)** grouped because of similar nutrient profiles

CEREALS
Variations in fibre and added sugar content were the primary basis of differentiation within this group.

93. **fibre cereals like raisin bran, granola or shredded wheat** (includes spoon sized shredded wheat)

94. **sweetened cereals like Frosted Flakes**

95. **other cold cereals like Corn Flakes or Cheerios**

96. **cooked cereals like oatmeal, oat bran, red river cereal**

97. **breakfast or cereal bars, granola bars**

OTHER
98. **salsa, taco sauce, ketchup** -source of vitamin C; included because all are frequently consumed

99. **peanuts, peanut butter**: source of fats, especially n6-fatty acids

100. **walnuts**: significant source of n3-fatty acids

101. **jam, molasses**: source of kcal

102. **white or brown sugar**: source of kcal

103. **chocolate candy, candy bars**: source of kcal

104. **other candy or jelly**: source of kcal

105. **potato chips, tortilla chips, cheesies, cheese puffs, popcorn- oil popped**: grouped because of similarities in eating situations and nutrient profiles (see table below)

106. **hard pretzels** - separate listing because of differences in kcal, total fat and sfa

	kcal	CHO	total fat	saturated fat	frequency of consumption
tortilla chips, low fat	445	71.6	15.2	2.91	0
tortilla chips, reg	498	62.4	25.6	4.9	1/200
potato chips, low fat	471	66.9	20.8	4.16	0
potato chips, reg	558	51	38.4	9.45	5/200
cheesies	554	53.8	34.4	6.59	8/200
popcorn, oil popped	500	57.2	28.1	4.89	6/200
hard pretzels	*381*	*79.2*	*3.5*	*0.75*	*0*

BEVERAGES

107. **pineapple juice, cranberry cocktail**: grouped because of similar nutrient profiles

	kcal	vitamin C	carbohydrate
cranberry cocktail	57	22.46	14.4
pineapple juice	56	33.12	13.78

108. **apple, orange, grapefruit juices**: grouped because of similar nutrient profiles

	kcal	vitamin C	carbohydrate
apple juice 0960160	47	41	11.68
orange juice 0932150	45	38.9	10.78
grapefruit juice 0931260	41	33.7	9.73

109. **tomato or vegetable juices, or cocktails**: grouped because of similar kcal and carbohydrate content, and similarities in consumption situations

	kcal	vit C	CHO
vegetable juice cocktail 1135780	19	27.7	4.55
tomato juice canned 1135400	17	8	4.23

110. **fruit flavoured beverages containing added vit C**: high frequency of consumption - contribute vitamin C

111. **regular soft drinks - not diet**: contribute kcal

Alcoholic beverages were listed separately because of differences in usual serving sizes and the resulting alcoholic content.

112. **beer**: alcohol consumption is an established risk factor for breast cancer

113. **wine or wine coolers**: alcohol consumption is an established risk factor for breast cancer

114. **liquor**: alcohol consumption is an established risk factor for breast cancer

MILK as beverage
115 - 126 - all types listed

MILK on cereals
127 - 140 - as above, but also includes some creams since they are also used on cereals by PEI women
MILK in tea and coffee
141 - 156 - as above

SALAD DRESSINGS
all mayonnaise types categorized separately on basis of kcal, total fat and monounsaturated fat content

157. **salad dressings, reg fat content**

158. **mayonnaise type salad dressing, regular**

159. **mayonnaise type salad dressing, low fat**

	kcal	total fat	saturated fat	monounsaturated fat
Mayonnaise >65% 450250	732	80.4	3.52	44.62
Mayonnaise type salad drsg, reg	495	48.9	3.52	27.14
Mayonnaise type salad drsg, low fat	288.62	25.51	1.34	14.77

160. **mayonnaise >65% including tartar sauce**

FATS AND SPREADS

Fats and spreads used on bread and rolls were differentiated based on saturated, monounsaturated and type of polyunsaturated fat content.

161. **butter on bread or rolls**

162. **20/80 spread on bread or rolls**

163. **50/50 spread on bread or rolls**

164. **lard, bacon or pork fat on bread or rolls**

165 - 184. **margarine on bread or rolls**: margarine types were first classified by tub or stick, then grouped by similarities within nutrient profiles within major ingredient type. See Tables I, II and III following for nutrient profiles of tub and stick margarines and oils

TUB type margarines ; listed included the following:

unspecified vegetable oils- includes Chef Master made with unspecified vegetable oils
soy- Monarch - includes Chef Master (soy), Lactantia (soy) and generic (soy)
soy - Blue Bonnet
Soy- Lactantia, low Energy
soy - other (specify)
canola - Country Crock - includes Baxter's (canola) and Parkay Gold (canola)
canola - West
canola, and canola + corn - others
canola and soy - includes Imperial and Parkay
canola and linola - includes Becel low Energy, Becel regular and Fleischmann's (corn, canola and unspecified vegetable oils)
olive oil - includes all brands made with olive oil
other tub margarine (please specify)

STICK type margarines included the following:
unspecified vegetable oils - Baxter's
unspecified vegetable oils - Chef Master
unspecified vegetable oils - other including generic and West
soy + canola - Blue Bonnet and Parkay
canola + soy - Imperial
corn + canola - Fleischmann's
other stick margarine (please specify)
did not use tub or stick margarine on bread or rolls (please check)

Fats and spreads on vegetables (see explanation for fats and spread on breads and rolls for basis of differentiation)

185. **butter on vegetables**

186. **20/80 spread on vegetables**

187. **50/50 spread on vegetables**

188. **lard, bacon or pork fat on bread or rolls**

189 - 205 - **margarine on vegetables** (differentiation as per margarine type used on breads and rolls)

If you ate home prepared fried or stir-fried foods at least once per month in the past year, what was the main kind of fat or oil *usually* used? mark the one or two used most often.
208 - 237: list of fat types as above, plus the following:

Oils
corn
canola
olive
other (please specify)
don't know
Other fats
lard, bacon/animal fat
shortening
butter
20/80 spread
50/50 spread
do not know
did not eat home prepared fried or stir-fried foods (please check)

If you ate home prepared deep-fat-fried foods at least once per month in the past year, what was the main kind of fat or oil *usually* used? Mark the one or two used most often.
238 - 267: list as above

If you ate home prepared baked products at least once per month in the last year, what kinds of fat or oil did you *usually* use in baking? Mark the one or two used most often.
268 - 297: list as above

TABLE I.
Nutrient profile of tub margarines

TUB	n3-fa	n6-fa	trans-fa	mono	n3:n6	frequency of consumption
Unspec Veg Oils:						
Chef Master	4.4	10.8	14.16	51.79	1:2.45	3/200
(generic)	4.3	13.69	19.51	47.04	1:3.18	7/200
Soy						
Monarch	4.23	28.55	32.71	29.32	1:6.75	0
Monarch	4.54	28.63	12.54	28.63	1:6.31	0
Chef Master	3.92	25.17	14.08	32.4	1:6.42	0
Blue Bonnet	5.77	12.39	10.16	48.72	1:2.15	0
Lactantia	3.92	25.47	13.01	31.48	1:6.5	0
generic	3.9	26.55	14.41	31.24	1:6.81	4/200
Lactantia low E	1.87	12.28	6.27	15.17	1:6.57	1/200
Canola						
West	1.54	9.62	28.48	55.8	1:6.24	1/200
Country Crock	4.77	17.85	16.47	41.87	1:3.74	1/200
Baxter's	3.3	10.6	14.7	49.79	1:3.2	17/200
Country Crock low E	2.29	8.61	7.94	20.18	1:3.76	11/200
Canola + Soy						
Imperial	5.92	12.24	8.08	48.79	1:2.07	4/200
Parkay	5.23	13.54	10.39	46.87	1:2.59	10/200
Canola + Linola						
Becel low E	2.38	12.54	0.41	16.36	1:5.27	9/200
Becel	4.93	26.01	0.85	33.94	1:5.28	55/200
Fleischmann's	4.7	19.78	0.693	36.94	1:4.21	4/200
Corn + Canola						
Parkay Gold	3.77	18.7	11.31	43.71	1:4.96	0

TABLE II.
Nutrient profiles of stick margarines

STICK	n3-fa	n6-fa	trans-fa	mono	n3:n6	frequency of consumption
soy + canola						
Blue Bonnet	0.85	7.77	32.17	55.26	1:9.14	7/200
Parkay	1.62	13.08	25.7	47.64	1:8.07	31/200
canola + soy						
Imperial	1	7.7	31.94	55.33	1:7.7	33/200
unspec veg oils						
Baxter's	1.62	5.39	25.86	52.18	1:3.33	3/200
generic	1.04	6.89	26.54	52.49	1:6.62	14/200
West	1.3	7.47	31.09	55.1	1:5.75	0
Chef Master	0.46	5.77	28.55	56.1	1:12.54	0
Corn + canola						
Fleischmann's	4.08	9.16	?	56.87	1:2.24	0

TABLE III.
Nutrient profiles of oils

	n3-fa	n6-fa	mono	n3:n6	frequency of consumption
canola	9.3	20.3	56.1	1:2.18	19/200
corn	0	58	24.2	0	1/200
soy	6.8	51	23.3	1:7.5	0
sunflower (linoleic > 60%)	0.2	39.8	45.4	1:199	0
sunflower (linoleic <60%)	0	65.7	19.5	0	0
peanut	0	32	46.2	0	0
olive	0.6	7.9	58.9	1:13.17	2/200

7.3 Interviewer guide to the Food Frequency Questionnaire

1. How to Proceed and Record

The "Food Frequency Questionnaire" contains four parts. Part I is concerned with the frequency of consumption of certain foods that are important to health; Part II focuses on the use of fats and oils with homemade foods; Parts III and deal with the frequency of consumption of supplements and prescription drugs. Parts II, III and IV are colour-coded so that you can easily flip to them when you finish the preceding section.

PART I: Frequency of consumption of specific foods

In this section each respondent is asked to recall how frequently in the last year (or year prior to diagnosis of breast cancer) they ate any of the foods listed. Each listed food actually incorporates a number of similar foods (for which the interviewer must probe) that are of interest. It is this extended list that must be asked about, and kept in mind when completing Part I on the "Food Frequency Questionnaire". See Section 2, Part I for guidelines on probes to be used for each of the foods listed on this part of the "Food Frequency Questionnaire".

Accuracy is required for foods eaten often and in large quantities. Don't spend much time probing small quantities of foods or foods eaten infrequently.

Explain the nature of this part of the questionnaire using a format such as:

"This part of the survey is a list of foods that we are interested in knowing whether you ate the food or not over the last year (or year prior to diagnosis of breast cancer). If you did eat them we would like to know how often you ate them and how much you usually ate at any one time. We are interested only in whether you have eaten them at least once per month in the last year ***(or year prior to diagnosis)***. So, if you have not eaten those foods at least once per month since *(give the appropriate date)* they are not important to this survey."

GENERAL NOTE ABOUT LEFTOVERS:

Beef or pork roasts, turkeys, cakes, pies and other sizeable dishes often last more than a day in a small household. Be sure to phrase your question on how many different times the interviewee ate the food and not just how many times the food (roast, pie, etc.) was available. Roasts eaten the next day as sandwiches or in casseroles need to be accounted for into the final frequency.

Ask about each food, including all its individual probes, in turn. For each food that the respondent has eaten, ask how often it was eaten. Give them a little time to sort this out before recording. Ask them to express their intake in the number of times a day, a week

or a month it was eaten, whichever is easiest for them. Every line should have an entry; '0' is entered under MONTH if the food is eaten less frequently than once per month.

On the form, next to the "Comments/Calculations" column, is a specified portion-size or model that corresponds to each food in the list. Have the appropriate model on display and ask the respondent to use this to estimate, in a general way, their usual serving size. Only the model appropriate to the food item in question should be displayed.

Record the person's serving size and frequency of each food in the Comments Column until all major probes are investigated. Then multiply or add together these numbers and enter the result for this food under the Frequency Column, 'day', 'week' or 'month' as appropriate. If a respondent tells you they had, for example, 2-3 of a particular food, record the larger amount which in this case would be 3. No fractions should be entered in this column.

Use the "Comments/Calculations" column to report your calculations. This information is important for data checking.

For some food categories, one entry either under "Day", "Week" or "Month" will be all that is necessary. It is permissable, however, to enter numbers in more than one column if this is easier and accurate. If the frequency of intake per month exceeds 99, then record the amount under the Weekly Column (100 ÷ 4 = 25).

A person may eat 1 MO-L of pan-fried potatoes 4 times each week and 2 MO-L of french fried potatoes twice a month. The entry could be made in either of the following ways:

FOOD	FREQUENCY			PORTION-SIZE OR MODEL	COMMENTS/ CALCULATIONS
	DAY	WEEK	MONTH		
French Fried or Pan-fried Potatoes		4	4 or 20	MO-L	4 x 1 = 4/wk 2 x 2 = 4/mo 4 x 4 = 16/mo 2 x 2 = 4/mo

Guidelines on How and When rounding up or rounding down

Servings that are smaller than 1/2 model size need not be considered if they are seldom eaten. If small amounts are eaten often, eg. every day or several times a week, add half-portions together to record as a single portion (for example, two half portions per week would give one portion per week). Keep in mind that PART I of the Food Frequency Questionnaire deals with the frequency of foods consumed **at least once per month**. If consumed <1 per month, record "0". Do **not** record fractions or percentages. After calculations, round all such figures up (if one-half or greater; eg. 6.5 will become 7) or down (if less than one-half; eg. 6.4 will become 6).

Make these calculations as simple as possible. Remember we want to get the overview of whether this person consumes a lot of these foods or not. Don't agonize over small amounts. The following three examples will help you set up a pattern of questioning:

Example 1:

Interviewer: "Do you eat broccoli?"

Interviewee: "Yes."

Interviewer: "How often in the last year have you eaten broccoli? Answer according to number of times a day, a week or for the whole month ... whichever is the easiest."

Interviewee: "I usually eat it 3 times a month."

Interviewer: "Using this model as a guide how much did you usually eat each time?"

Interviewee: "Twice that much."

The entries made would be as follows:

FOOD	FREQUENCY			PORTION-SIZE OR MODEL	COMMENTS /CALCULATIONS
	DAY	WEEK	MONTH		
Broccoli			6 OR 6	MO-M	3 x 2 = 6 3 x 2 MO-M

Both of these recording methods in the Comments/Calculations column are correct. Note if you record a portion which is different than the portion-size pre-printed on the "Food Frequency Questionnaire", the entry under Comments/Calculations must indicate the portion size eaten by the participant. Using another example, if the portion size is MO-M and the individual had 3 per week, it would be recorded as 3 under the Week Column. In the Comments/Calculations column, it can be recorded as 3 x 1 or 3 x 1 MO-M; both would give 3 per week. As well, use the abbreviations `D' for day, `W' for week and `M' for month in the `Comments/Calculations' column to help you keep track of frequencies of all the foods that must be considered under each main item. These notations will be particularly helpful when you have to calculate before making a final entry and when reviewing your forms for accuracy.

Example 2:

Interviewer:

"Did you eat any poultry ... chicken, turkey, duck, pheasant or goose in the last year ... at home, at a restaurant or from take-outs?"

Interviewee:

"Yes, often."

Interviewer:

"Let's deal with fried poultry first. How often in the last year did you have pan-fried or deep-fat fried poultry, with or without breading or batter? Answer according to day, week or month."

Interviewee:

"I usually have deep-fried chicken about twice a month but I eat KFC about once a week."

Interviewer:

"Using this model as a guide, how many pieces did you eat each time you had fried chicken?"

Interviewee:

"At home, I eat two pieces this model size, but at KFC I eat five pieces like the model."

Interviewer:

"How often in the last year have you eaten poultry (chicken, duck, turkey) without skin cooked in other ways - roasted, broiled, stewed, barbecued or in a casserole?"

Interviewee:

" Chicken casserole probably twice last month."

Interviewer:

"How much did you eat each time?"

Interviewee:

"In a casserole probably half that much."

Interviewer:

"How often in the last year have you eaten poultry (chicken, duck, turkey) with skin cooked in other ways - roasted, broiled, stewed, barbecued or in a casserole?"

Interviewee:

"I usually eat roast chicken once a month."

Interviewer:

"How much did you eat each time?"

Interviewee:

"When I had roasted chicken, probably about four times this size."

Record as you go along. The record for poultry would look like this:

FOOD	FREQUENCY			PORTION-SIZE OR MODEL	COMMENTS/ CALCULATIONS
	DAY	WEEK	MONTH		
Poultry - breaded or battered and fried		5	4	PC-S	FR. 2M x 2 = 4 1W x 5 = 5
Poultry, no skin, cooked other ways			1	PC-S	C. 2M x 1/2 = 1 Total: 1
Poultry, with skin, cooked other ways			4	PC-S	R. 1M x 4 = 4

Example 3:

Interviewer: "How often have you eaten eggs in the last year?"

Interviewee: "I have a fried egg every morning for breakfast."

Interviewer: "Did you have eggs served in any other dishes, such as sandwiches, salads, omelets, etc.?"

Interviewee: "I usually have a Western sandwich with one egg twice a week and I eat an omelet a couple of times a month."

Interviewer: "How many eggs would you have in the omelet?"

Interviewee: "Well, it's for supper, so my share is probably two."

The record for egg or egg dishes would look like this:

FOOD	FREQUENCY			PORTION-SIZE OR MODEL	COMMENTS/ CALCULATIONS
	DAY	WEEK	MONTH		
Eggs, poached or hard boiled			0	1 LARGE EGG	
Eggs, cooked with added fat	1	2	4	1 LARGE EGG	FR: 1D SAN: 2W x 1 = 2 OM: 2M x 2 = 4

NOTE: A food eaten every working day or school day is probably 5/W (not 1/D or 7/W). For such frequencies, record under Comments/Calculations column "every working day" or "every school day" rather than "every day".

TIPS FOR THE INTERVIEWERS

Here is a script suggested by one of the interviewers of the previous provincial nutrition survey. It seemed to help the interviewee to focus on foods consumed during the past year.

Script of the interviewer:

"I am going to ask you how often and how much you have of certain foods. I want you to think back to the foods that you have eaten over the past year...that is from May 1997, to today."

"In the last year, did you eat broccoli?"
"Did you have it at least once per month in the last year?"
"Did you have this amount (show the pre-selected model)?"
"More or less? How much more or less?"

The interviewer repeated this series of questions for Questions 01 to 07. She found that the repetitiveness helped the respondent to focus on the information we want. It takes a

few minutes at the beginning, but the rest of the questionnaire is completed quickly and accurately once the respondent understands what we need from her.

The interviewer also realized that asking questions on each food item for those questions with multiple foods in a category helped the respondent to focus on one food at the time, resulting in more accurate answers without overloading the respondent. For example, Question 09 - ask the frequency of consumption of cauliflower, then brussels sprouts, then broccoli. Once you have asked all the different foods within a category, you can then total them together.

REMEMBER: EVERY QUESTION OF THE FOOD FREQUENCY QUESTIONNAIRE MUST HAVE AN ENTRY; '0' IS ENTERED UNDER THE 'MONTH' COLUMN IF THE FOOD HAS NOT BEEN EATEN AT LEAST ONCE PER MONTH IN THE PAST YEAR. DO NOT LEAVE IT BLANK.

Section 2: PROBES FOR FOOD CATEGORIES ON THE FREQUENCY

Part I:

For each food identified on the "Food Frequency Form", question about the usual consumption, over the past year. It is important to be very familiar with the types of foods listed under each item below to ensure accuracy in recording.

FRUITS

#01. **BANANAS** - fresh. Reference size 8.5" x 1.5" diameter

#02. **ORANGES, GRAPEFRUIT** - fresh or canned segments. 1 unit = 1 med orange (all types) or 1/2 of one medium sized grapefruit.
Reference sizes: med orange: BAL
med grapefruit: 4" diameter

#03. **APPLES, PEARS** - fresh and canned. Includes fruit with and without skin, and applesauce.
Reference sizes: med apple = BAL

#04. **BLUEBERRIES, CRANBERRIES** - fresh, frozen or canned. Includes fruit made into sauce.

#05. **STRAWBERRIES** - includes fresh or frozen, whole, sliced or in a sauce, sweetened or unsweetened

#06. **RHUBARB, COOKED** - fresh or frozen rhubarb, sugar added

#07. **KIWIFRUIT** - 1 medium

#08. **CANTALOUPE**
EQUIVALENCE: 1/4 med cantaloupe (5" diameter) = 1 MO-M

#09. **PINEAPPLE** - includes fresh or canned; if canned, packed in water or syrup

#10. **OTHER FRUITS INCLUDING GRAPES, PLUMS**

VEGETABLES

#11. **BRUSSELS SPROUTS, BROCCOLI** -Raw or cooked (as in fresh vegetable platter, salads, stir fry, etc).

#12. **CABBAGE** - cooked (boiled, in stir-fries, in cabbage rolls etc)

#13. **SNAP BEANS** - green or yellow, fresh, frozen or canned

#14. **CORN** - fresh, frozen or canned

#15. **PEAS, GREEN** - fresh, frozen or canned

#16. **CARROTS OR MIXED VEGETABLES CONTAINING CARROTS** - carrots cooked or raw; mixed vegetables fresh, frozen or canned

#17. **COLESLAW** - home or commercially prepared

#18. **LETTUCE, all kinds**- includes lettuce used in salads, on sandwiches etc

#19. **SPINACH** - raw

#20. **SPINACH**- cooked

#21. **SWEET PEPPERS** - includes sweet peppers of all colours, cooked and fresh ie in salads and cooked dishes.
Size of 1 reference unit: 4" high x 3" diameter

#22. **TOMATOES** - includes fresh and canned tomatoes, whole or stewed; does not include sauce used for spaghetti or lasagne

#23. **WINTER SQUASH** - refers to dark yellow squash eg. Acorn, Butternut, Hubbard **AND** Pumpkin.
NOTE: Crookneck, Spaghetti, Scallop, Zucchini and sweet potato are NOT included.

#24. **POTATOES (MASHED, BOILED OR BAKED - no fat added)** - includes cooked in microwave, in the oven, on BBQ; with or without skin

#25. **POTATOES: SCALLOPED OR MASHED WITH MILK AND FAT, OR POTATO SALAD WITH MAYONNAISE TYPE DRESSING** - includes home and restaurant prepared, and take outs; also includes potatoes cooked in casseroles and stews.

#26. **POTATOES - OVEN BAKED FRENCH FRIES** - includes frozen commercial heated in the oven, homemade oven baked

#27. **POTATOES - PAN FRIED OR DEEP FRIED FRENCH FRIES** - includes home and restaurant fried; also includes commercially seasoned french fries and hash browns - home or restaurant fried.

#28. **SWEET POTATOES OR YAMS** - includes baked and boiled

#29. **TURNIP, PARSNIPS** - includes raw and cooked (ie vegetable platters, stir-fried, boiled, baked etc.)

#30. **OTHER VEGETABLES INCLUDING RAW AND COOKED ONIONS, CUCUMBER AND SUMMER SQUASH** - includes raw and cooked onions of all types, cucumber and summer squash including zucchini, scallop, crookneck and spaghetti squash

SOUPS

#31. **BOUILLION, OR CLEAR SOUP WITH NOODLES** - includes canned, homemade or restaurant prepared clear soups such as chicken noodle or ramen type soups

#32. **CREAM SOUPS** - includes canned, homemade or restaurant prepared cream based soups such as cream of mushroom, cream of celery, or chowders

#33. **VEGETABLE SOUPS WITH CARROTS AND/OR TOMATOES** - includes canned, homemade or restaurant prepared vegetable soups that have added carrots or tomatoes, or have tomato base

#34. **LENTIL, PEA AND BEAN SOUPS; OR BAKED BEANS OR LENTILS** - includes all dishes made primarily with beans or lentils

DAIRY

#35. **CHEESE, regular fat (more than 24% B.F.)**: includes full fat cheeses such as Blue, Brick, Brie, Colby, Cheddar, Edam, Fontina, Gouda, Gruyere, Limburger, Monterey, Mozzarella, Muenster, Parmesan, Provolone, Swiss, regular fat Cheez Whiz, regular cream cheese etc.

- Cheese on pasta dishes, on vegetables, on meats (cheeseburgers), in omelets, etc. (4 TBL grated cheese is equivalent to one slice).

EQUIVALENCE: 1 slice => 1 MO-S

#36. **LIGHT CHEESE (10 - 24% B.F.)**: includes cheeses such as Mozzarella (made with partly skimmed milk), processed cheese food, processed cheese spreads such as light Cheese Whiz, light cream cheese, Feta, regular Quark (10% B.F.), etc.

Cheese spreads including light Cheese Whiz, light cream cheese used on sandwiches etc. (2 TBL is equivalent to one slice).

Note: Questions #35 and #36:
The portion sizes listed on the food frequency (1 SLICE, 1/3 PC-S, 2 TBL) are interchangeable (ie. the three portion sizes apply to both #35 and #36 cheeses). The reference weights for commercial cheese slices are 31 g for a thick slice and 21 g for a thin slice.

- Minigo is recorded under #36; due to its 7% B.F. content, it is considered as a light cheese. Be aware that many consumers think of it as a yogourt because it is cultured like a yogurt and sold in the yogurt section, you may have to probe specifically for Minigo.

#37. COTTAGE CHEESE OR ANY CHEESE LESS THAN 10% B.F.: Any cottage cheese (2%, 1%, dried), ricotta made with partly skimmed milk, light Quark (0.4% B.F.), any low-fat cheeses (eg. processed skim milk cheeses 7% B.F. or 1% B.F. ultra light).

#38. **ICE CREAM (REGULAR OR RICH)** - probe for regular and rich (eg. Haagen-Daas) ice creams. An ice cream bar or slice of ice cream cake is considered equivalent to 1/2 cup.

#39. **LOW FAT ICE CREAM FROZEN YOGURT, ICE MILK OR SHERBET, LIGHT YOGURT (1% OR LESS b.f.)** - Plain, fruit in the bottom, swiss style (stirred).
EQUIVALENCE (#34, #35): 125 G or 175 G individual yogurts - 1/2 cup
500 G container = ~ 4 portions @ 1/2 cup
- probe for any low fat ice cream (less than 10% b.f.)any frozen yogurt, any ice milk (eg Dairy Queen brand) and any sherbet

#40. **YOGURT (reg fat content) and milk puddings** - plain, fruit in the bottom, swiss style (stirred).
Also includes milk based puddings - instant and cooked

#41. **SOUR CREAM (REGULAR or LOW FAT)**

#42. **WHIPPING CREAM**, whipped

#43. **EGGS, POACHED OR HARD COOKED** - includes eggs or egg dishes cooked with no added fat

#44. **EGGS, COOKED WITH ADDED FAT** - includes omelets, quiches, egg or Western sandwiches, eggnogs, custard, souffles, etc. **Use of eggs whites only** are EXCLUDED, only count whole eggs or egg yolks.

FISH

#45 **SMELTS** - #60 **ALL OTHER FISH**
For all named fish types:
the first query includes fish (fresh, frozen or canned) cooked and eaten **without** added fat - ie baked, broiled, steamed, BBQ, poached, canned (as in sandwiches, chowders, casseroles) etc. Consider the amount of fish used in sandwiches as 1/2 PCS. Fish canned in water, and not eaten with salad dressing or mayonnaise type dressing should be included here.

the second query includes fish (fresh, frozen or canned) cooked with added fat - ie pan fried, baked with added fat. Fish canned in oil, or fish canned in water and eaten with added fat (ie salad dressing or mayonnaise type dressing) should be included here. It **excludes** deep fried fish.

#51. **LAKE TROUT** - does not include rainbow trout

#59, 60. **ALL OTHER FISH** - includes all other fresh and frozen fish types not already named ie cod, sole, haddock, etc.

#61. **FISH FILLETS - DEEP FAT-FRIED** - includes all types of fish (does not include shellfish or lobster) - home prepared, fast food or restaurant prepared

#62. **SHELLFISH** - includes shrimp, crab, mussels, clams and oysters

#63. **SHELLFISH -with added fat or fried**: includes deep-fat fried, pan-fried in fat, either with or without breading,
crumbs or batter. Includes any commercially breaded shellfish.

#64. **LOBSTER: steamed/broiled:** includes steamed, boiled, broiled or barbecued; canned, frozen or fresh

A 3/4-1 lb lobster contains 1/2 cup or 72.5 g (2.6. W-OZ).

#65. **LOBSTER with added fat:** includes deep fat fried, pan-fried in fat, either with or without breading, crumbs or batter. Sandwiches with mayonnaise are included here.

MEATS AND POULTRY

#66. **BEEF AND VEAL**: All beef and veal - fresh, frozen, canned. No game meat or organ meats should be included.

- STEAKS, ROASTS, STEW, RIBS, OTHER CUTS: Cooked any way - pan-fried, broiled, oven roasted, pot roasted, stewed, barbecued, in sandwiches, etc. **Wild game** (ie. venison) is NOT considered beef.

#67. **GROUND BEEF, MEDIUM AND REGULAR** - Includes hamburgers and cheeseburgers made at home, pan-fried, broiled or barbecued, and from fast food outlets. All hamburger patties will be assumed to be of an average size (weight: 60 - 85 g or 2-3 ounces), unless specified otherwise.
Also includes all dishes which contain medium or regular fat ground beef ie. in spaghetti sauce or lasagne, meat loaf, meat balls, Salisbury steaks, Sloppy Joes, Shepherd's pies, soup, hamburgers or cheeseburgers.

#68. **GROUND BEEF, LEAN** Includes hamburgers and cheeseburgers made at home, pan-fried, broiled or barbecued, and from fast food outlets. All hamburger patties will be assumed to be of an average size (weight: 60 - 85 g or 2-3 ounces), unless specified otherwise.
Also includes all dishes which contain lean ground beef ie. in spaghetti sauce or lasagne, meat loaf, meat balls, Salisbury steaks, Sloppy Joes, Shepherd's pies, soup, hamburgers or cheeseburgers.

#69. **PORK AND HAM:** Fresh, frozen, cured, canned or smoked:
- ROASTS, CHOPS, SPARE-RIBS AND GROUND PORK: cooked or served in any way in sandwiches, casseroles, etc.

Important: Sliced deli ham IS NOT included. It is included in Luncheon Meats Q# 79.

#70. **POULTRY: ROASTED NO SKIN** Chicken, turkey, duck, pheasant, goose, etc.: includes: Roasted, baked, broiled, boiled, stewed, barbecued, in sandwiches, etc.

#71. **POULTRY: ROASTED WITH SKIN** Chicken, turkey, duck, pheasant, goose,

etc.: includes: Roasted, baked, broiled, boiled, stewed, barbecued, in sandwiches, etc.

#72. **POULTRY**: Chicken, turkey, duck, pheasant, goose, etc.: - breaded or battered and fried includes: Deep-fat fried, pan-fried, either with or without breading, crumbs or batter.

For questions #70, 71 and 72:

EQUIVALENCE: 3 wings with skin => 1 PC-S
5 wings without skin => 1 PC-S
1 drumstick or 1 thigh => 1/2 PC-S
1 full leg (1 drumstick + 1 thigh)=> 1 PC-S

Equivalent parts of turkey should be recorded as double serving. (eg. turkey leg is twice the size of a chicken leg).

#73. **LIVER, ALL TYPES**
All types of livers (beef, pork, veal, lamb, chicken). Cooked any way - pan-fried, deep-fat fried, broiled, braised, stewed, etc.

#74. **LAMB AND MUTTON**: Fresh or frozen
- ROASTS, CHOPS, STEW AND OTHER CUTS - cooked any way

#75. **TACOS, BURRITOS OR FAJITAS** - with meat or beans
Reference size 1 unit: 6" long

#76. **PIZZA** All pizzas - home-made, frozen, take-out, deli, etc.
Record by number of slices regardless of the type of topping used.
EQUIVALENCE: 1 slice = 1/4 of 8" pizza
= 1/8 of 12" pizza
= 1/2 mini pizza

PROCESSED MEATS, LUNCHEON MEATS

#77. **WIENERS, HOT DOGS , SAUSAGE** - includes all types of weiners and hot dogs, and all fresh sausages (regular fat and low fat) such as link (large and small), country, farmer's, Polish, breakfast, homemade etc. whether beef, pork, turkey or mixed meat.

Note: vegetable weiners are not included.

EQUIVALENCE: 1 unit = 5"length

#78. **PEPPERONI, SALAMI, BOLOGNA** - all packaged and deli types; includes low-sodium and low-fat products; includes pepperoni and salami used in submarine

sandwiches
EQUIVALENCE: 1 slice bologna 4" diameter = 4 slices 1" diameter pepperoni or salami
#79. **SMOKED MEAT, CORNED BEEF, HAM SLICES**

EQUIVALENCE FOR Q #78 AND 79:
- The portion size listed on the food frequency is "1 SLICE". A "SLIVER" thickness for meat shavings is equivalent to 1/2 commercial slice of luncheon meat.

- If the respondent knows the total weight eaten in a time frame (e.g. ate 1 lb salami per week) but cannot precisely tell you the number of slices, write down the details under the "Comments/calculations" column and leave the frequency column blank. The weight will be converted to slices by the data entry people. This also applies to cheese e.g. ate 500g/week.

#80. **BACON**: Side, back or peameal. Also include turkey bacon and any low-sodium or low-fat bacon.

PASTA AND RICE

#81. **PASTA with creamy cheese sauces like macaroni and cheese-** includes all types of pasta ie
elbows, noodles, spaghetti etc. with any creamy cheese sauce. For example, home prepared or commercial macaroni and cheese, fettucini alfredo etc. Includes commercial sauces (packaged/dehydrated and prepared, or bottled) and homemade.

#82. **SPAGHETTI, LASAGNE, OTHER PASTA WITH TOMATO SAUCE** - includes pasta and tomato sauce only. Includes commercial sauces (packaged/dehydrated and prepared, or bottled) and homemade.

Note: Any added meat should be included in Meats and Poultry section.

#83. **PASTA SALAD, OTHER PASTA** - includes other pasta dishes such as cold pasta salads tossed with oil and vinegar dressing etc. Also includes pasta with non-tomato and non-cheese containing sauces.

#84. **RICE** - includes all types of rice and dishes made primarily with rice such as puddings, pilaf, casseroles

BREADS AND SWEETS

#85. **PANCAKES OR WAFFLES** - includes homemade and commercial; all types

#86. **CRACKERS, SODA** - includes all types of soda crackers and Melba toast

#87. **SNACK CRACKERS** - includes all types except soda/saltine crackers and Melba Toast.
eg. Ritz, whole wheat cracker, cream/table water, flavoured crackers, plain munch, Tater Crisps), salted and unsalted. If the person gives the amount eaten in terms of a box, record in the `Comments/Calculations' column the brand, type and weight if known (eg. CHRISTIE Wheat Thins 300 g box/Month) and leave the `Frequency' columns blank.

#88. **COOKIES** - includes all types, commercial and homemade
Reference: 1 unit = 2" diameter
EQUIVALENCE: 1 2-layer (or "filled") cookie = 2 units

#89. **CAKE, DONUTS, CAKE TYPE MUFFINS, PIES, BISCUITS** - includes homemade and commercial; lowfat and regular. Also includes all types of squares and dessert bars.

Does not include granola or cereal bars.

EQUIVALENCE: 1 UNIT = WE-XS cake
= WE-XS pie
= 3.5" x 2.5" donut
= 3.5" x 3" muffin
= 1.5" x 2.5" biscuit

#90. **MUFFINS - HIGH FIBRE** - includes homemade and commercial high fibre muffins such as bran muffins
Reference size: 3.5" x 3"

#91. **BREAD, WHOLE GRAIN** - includes whole wheat bread, bagels, rolls and English muffins; bought in bakeries, commercial or homemade. Includes multigrain, cracker wheat, and any of the named bread products made with more than 50% whole wheat flour.

EQUIVALENCE: 1 slice bread = 1/2 bagel or 1 dinner roll or 1/2 English muffin

#92. **BREAD, WHITE** - includes white bread, bagels, rolls and English muffins; commercial, bought in bakeries or homemade

EQUIVALENCE: 1 slice bread = 1/2 bagel or 1 dinner roll or 1/2 English muffin

CEREALS

#93. **FIBRE CEREALS** - includes raisin bran, granola, shredded wheat or spoon size

shredded wheat

#94. **SWEETENED CEREALS** - includes cereals such as frosted flakes, captain crunch

#95. **OTHER COLD CEREALS** - includes other cereals such as cheerios, corn flakes, rice krispies ie cereals that are neither high fibre or high fat

#96. **COOKED CEREALS** - includes oatmeal, oat bran, red river cereal, cream of wheat

#97. **BREAKFAST OR CEREAL BARS, GRANOLA BARS** - all types

OTHER FOODS

#98. **SALSA, TACO SAUCE, KETCHUP** - includes homemade or commercial

#99. **PEANUTS, PEANUT BUTTER**

#100. **WALNUTS**

#101. **JAM, MOLASSES**

#102. **SUGAR - WHITE OR BROWN** - probe for use in tea and coffee, on breakfast cereals etc

#103. **CHOCOLATE CANDY OR CANDY BARS**

#104. **OTHER CANDY OR JELLY** - includes candy other than chocolate ie peppermints, butterscotch candies, jelly beans etc.

#105. **POTATO OR TORTILLA CHIPS, CHEESIES, POPCORN** - includes cheesies, cheese puffs, potato chips (reg and low fat/baked), tortilla chips (reg and low fat/baked) and oil-popped popcorn, popcorn with added fat and microwave popcorn. This does not include air-popped popcorn.

Any type of potato chips or tortilla chips (eg. ruffles, regular, sticks, blue corn chips, etc.), any flavour (eg. barbecue, sour cream and onions, vinegar, etc.), unsalted chips, etc.

EQUIVALENCE: A 55 g bag of potato chips => 2 BO-L
A 70 g bag of potato chips => 2.5 BO-L
A 200 g bag of potato chips => 5 BO-L
A 400 g bag of tortilla chips => 10 BO-L

#106. **PRETZELS** - includes hard pretzels only

BEVERAGES

#107. **PINEAPPLE JUICE, CRANBERRY COCKTAIL** - includes all types of cranberry juices and cocktails. Does not include crystal lite types.

#108. **APPLE, ORANGE AND GRAPEFRUIT JUICES**

#109. **TOMATO OR VEGETABLE JUICES OR COCKTAILS**

#110. **FRUIT FLAVOURED BEVERAGES CONTAINING ADDED VITAMIN C** - includes all beverages and drinks containing added vitamin C such as Kool-Aid, Hi-C etc. Does not include "crystal lite" types.

#111. **REGULAR SOFT DRINKS** - does not include diet drinks.

#112. **BEER** - includes commercial, home-brewed, regular or light
- dealcoholized beer is NOT included

#113. **WINE** - includes red, white, rose, homemade or bought

EQUIVALENCE: 4 F-OZ => 125 mL
750 mL => 7 servings of 4 F-OZ
1 litre => 9 servings of 4 F-OZ

A wine cooler is equivalent to 1 serving of wine.

#114. **LIQUOR/SPIRITS**
A spirit cooler is equivalent to 1 1/2 serving of spirit.

SERIES OF QUESTIONS ABOUT MILK CONSUMPTION

#115. **MILK AS A BEVERAGE**:
NOTE: DO NOT READ THE LIST TO THE RESPONDENT
Ask whether she drank milk at least once per month over the last year... either plain or to make a flavoured beverage such as chocolate milk (cocoa, syrup, powder), milk shake, milk flavoured with Postum, hot cocoa, hot chocolate or cafe au lait. Record the type of milk she drank (it could be more than one type), the frequency of use and the amount taken at any one time. Probe for commercial chocolate milk, buttermilk, milkshakes, acidophilus milk and Lactaid milk. Record these under the appropriate type (whole, 2%, 1%, etc).

If triple milk was used, ask the respondent if it was used undiluted or diluted. If the triple

milk was diluted, ask if it was diluted according to directions, that is to say, using a ratio 2:1. If it was more diluted, please indicate the dilution factor at Question #122.

If evaporated milk was used, ask the percentage of fat it contained (if unknown we will assume whole evaporated milk) and then ask if it was taken undiluted or diluted; enter the frequency on the appropriate line.

If the respondent did not drink cow's milk, please record the type of milk used (eg. soya milk, goat milk, rice milk, etc.) at Question #123, there is no need to record the frequency of consumption for these types of milk.

If the respondent did not drink milk at least once per month over the past year, please check Question #124.

#125. **MILK ON CEREALS**:
NOTE: DO NOT READ THE LIST TO THE RESPONDENT
Next present the question about milk or cream **on cereals** (either ready-to-serve or cooked cereals) or cooked with cereals. Did the respondent eat cereal at least once per month over the last year? How often in a day, a week or month has she used milk or cream on (or in) cereal? What kind of milk/cream was it ... whole, 2%, 1%, skim, triple milk, cream, evaporated milk? Ask the respondent to use the GL-S (equivalent to 1/2 CUP, 4 F-OZ) or the measuring cup (1/2 full is 4 F-OZ) to indicate how much she used at any one time (1/2 cup is about minimal, 3/4 cup an ample amount and 1 cup allows dry cereal to float).

If triple milk was used, ask the respondent if it was used undiluted or diluted. If the triple milk was diluted, ask if it was diluted according to directions, that is to say, using a ratio 2:1. If it was more diluted, please indicate the dilution factor at Question # 134.

If evaporated milk was used, ask the percentage of fat it contained (if unknown we will assume whole evaporated milk) and then ask if it was taken undiluted or diluted; enter the frequency on the appropriate line.

If the respondent did not use cow's milk on cereals, please record the type of milk used (eg. soya milk, goat milk, rice milk, etc.) at Question #139, there is no need to record the frequency of consumption for these types of milk.

If the respondent did not eat cereals at least once per month over the past year, please check Question #140.

MILK IN TEA OR COFFEE:
NOTE: DO NOT READ THE LIST TO THE RESPONDENT
For the question concerned with the consumption of milk or cream in **tea and coffee**, ask the respondent if she drank tea or coffee at least once per month in the last year? what

kind of milk was used (whole, 2%, 1%, skim, dry skim milk powder, Triple milk, cream or evaporated milk)? Powdered coffee whiteners are recorded as a check mark at the bottom of the page (Q #155). Some people may consume several types of milk with coffee and tea throughout the year. If so, record the frequency of all types used on the appropriate lines. Use the TBL model as a reference serving size (it is the amount of a restaurant milker or creamer) for the amount taken at any one time. If the respondent consumed more than one creamer, enter the multiples of this amount and the frequency of the use of this amount under 'DAY' (for many people it may be several times a day), 'WEEK' or 'MONTH'.

If triple milk was used, ask the respondent if it was used undiluted or diluted. If the triple milk was diluted, ask if it was diluted according to directions, that is to say, using a ratio 2:1. If it was diluted differently, please indicate the dilution factor at Question #150, space has been provided to record the dilution factor.

If evaporated milk was used, ask the percentage of fat it contained (if unknown we will assume whole evaporated milk) and then ask if it was taken undiluted or diluted; enter the frequency on the appropriate line.

If the respondent did not use cow's milk, please record the type of milk used (eg. soya milk, goat milk, rice milk, etc.) at Question #153, there is no need to record the frequency of consumption for these types of milk.
If the respondent did not use milk or cream, in other words the person drank black tea or black coffee, please check Question #154. If the respondent did not drink tea or coffee, please check Question #156.

SALAD DRESSINGS

#157. **SALAD DRESSINGS, REGULAR FAT CONTENT** - includes French, Caesar, Italian, Ranch, Thousand Island, Oil and vinegar, any homemade salad dressing containing oil, etc.

#158. **MAYONNAISE TYPE SALAD DRESSING, REGULAR FAT CONTENT**

#159. **MAYONNAISE TYPE SALAD DRESSING, LOW FAT** - includes Miracle Whip reduced fat content and ultra low fat content

#160. **MAYONNAISE WITH GREATER THAN 65% FAT** - includes real mayonnaise only

FATS AND SPREADS
(DO NOT READ LIST TO RESPONDENT)
This section is divided into 2 main parts: the first queries the use of different types of fat

and fat spreads on bread and rolls, the second queries the use of different types of fat and fat spreads on vegetables.
Each part is further divided into 2 sub-sections: the first queries the use of fat types other than margarine, the second sub-section queries the use of specific types of margarines.

The first 4 questions in each part ask about the frequency of use of fats/spreads other than margarine. The last questions in each part deal with the use of different types of margarine.
DO NOT READ THE LIST OF FAT TYPES OR MARGARINES TO THE RESPONDENT

FATS AND SPREADS ON BREADS AND ROLLS: First, ask whether she ate bread or rolls at least once per month over the last year....and if so, whether she usually used any fat spread. Then query the type of fat spread usually used. Some may use several different types of fats as spreads through out the year - if so, record the frequency of all types used on the appropriate lines.

#161. **BUTTER ON BREAD OR ROLLS**

#162. **20/80 SPREAD ON BREAD OR ROLLS**

#163. **50/50 SPREAD ON BREAD OR ROLLS**

#164. **LARD, BACON OR PORK FAT ON BREAD OR ROLLS**

#165 - 184 **MARGARINE ON BREAD OR ROLLS**
IF SHE USUALLY USED MARGARINE to spread on the bread or rolls, then query the use of stick vs tub; then type or name of brand used. Prompt for the main type of margarine used. Some people may consume several types of margarine throughout the year. If so, record the frequency of all types used on the appropriate lines.

If she used a type of margarine not listed, please specify in Q#176 or #183.
If the respondent either did not consume bread or rolls, or use margarine on rolls/bread products, then check Q# 184.

FAT SPREADS ON VEGETABLES
Follow the same procedures as used in fat spreads on rolls and breads.
(DO NOT READ LIST TO RESPONDENT)

#185. **BUTTER ON VEGETABLES**

#186. **20/80 SPREAD ON VEGETABLES**

#187. **50/50 SPREAD ON VEGETABLES**

#188. **LARD, BACON OR PORK FAT ON VEGETABLES**

#189 - 207. **MARGARINE ON VEGETABLES**
(DO NOT READ LIST TO RESPONDENT)

PART II: Questions about the type(s) of fat used in the preparation of home-made foods during the past year (or year prior to diagnosis)

Questions #208 - 297:

Once you have ascertained that the respondent ate home prepared foods (pan- or stir-fried, deep-fat-fried foods, baked products) at least once per month in the past year (or year prior to diagnosis), you do not need to ask about the frequency of use of each individual fat source.

Questions in this section relate solely to the addition of fat to foods during cooking during the last year (or year prior to diagnosis). **They refer only to homemade foods eaten at least once per month in the last year**. If the food was not eaten at least this frequently, check the last statement 'Did not eat home (deep- or pan-) fried foods this past month'. If the respondent used applesauce instead of fat or oil in baking, then it is recorded as 'Did not eat home baked goods that contained fat this past year'.

Prompt for the main source of fat used for deep-frying, pan-frying and baking. If we have omitted a source of fat, please write it down.

There is no need to quantify amounts used. If two or more fats are used because the person sometimes uses one and sometimes another, place a check (√) on the line of the one that is used most frequently. If two or more are used in more or less equal proportions, place a check (√) under the 'MAIN SOURCE' column for each of the fats used. For example:

MAIN SOURCE	IF YOU ATE HOME DEEP-FAT FRIED FOODS AT LEAST ONCE PER MONTH IN THE PAST YEAR, WHAT WAS THE MAIN KIND OF FAT OR OIL *USUALLY* USED?
	TUB MARGARINES
	unspecified vegetable oils
√	soy - Monarch
	soy- Blue Bonnet
√	soy- Lactantia, low Energy
	soy - others
	....etc.....
	Did not eat home deep-fried foods this past month

In this example, since two sources of fat were checked, we will presume that the individual uses soy - Monarch and soy- others in a ratio of about 50:50. If three sources of fat were checked, then the proportion calculated would be 33:33:33.

Check (√) the answer 'Do not know' if the person doesn't know what fat was used.

IMPORTANT Check (√) the answer 'Did not eat home deep-fried foods this past month' if these foods were eaten less than once per month in the last year.

PARTS III and IV: Questions about the use of nutrient supplements and the use of prescription drugs.

Please ask the questions as worded. When possible, record the DIN number directly from the supplement or prescription container. If no DIN number is available, take down all pertinent identifying information including name as printed on the label, name of the company producing the product, strength of supplement (ie "each tablet contains 500 mg of ....."), etc.

FINALIZING THE FOOD FREQUENCY QUESTIONNAIRE

After you have completed the "Food Frequency Questionnaire", check for the number of **main dish items** consumed in a month. If this number seems low or high, probe further to clarify inconsistencies.

7.4 Portion-size models used

Term	Abbreviation
medium	med
small mound (59.1 ml)	MO-S
medium mound (118.3 ml)	MO-M
large mound (236.6 ml)	MO-L
medium bowl (236.6 ml)	BO-M
large bowl (325.3 ml)	BO-L
small piece (73.7 ml)	PC-S
large circle (81.1 sq cm)	CR-L
small glass (118.3 ml)	GL-S
medium glass (177.4 ml)	GL-M
tablespoon (15 ml)	TBL
teaspoon (5 ml)	TSP
weight ounce	oz
fluid ounce	FOZ
pound	lb
w/o	without

8. APPENDIX B

TABLE I.
Cases: nutrient intakes from food sources by age group and percentiles

	34-49 years n=12 percentiles			50-74 years n=30 percentiles			75+ years n=4 percentiles		
	25th	50th	75th	25th	50th	75th	25th	50th	75th
energy (kcal)	1613.0	1928.7	2403.4	1504.9	1812.4	2132.8	1466.0	1767.2	2168.0
protein (g)	69.8	87.5	98.3	57.4	67.0	97.9	51.5	66.4	81.0
carbohydrate (g)	183.4	225.1	300.5	183.4	225.1	279.9	204.8	237.7	265.6
total fat (g)	60.2	83.5	87.1	50.2	70.2	96.4	52.3	71.2	92.6
total sat fat (g)	18.4	28.3	32.5	16.38	20.1	28.1	15.3	24.0	36.9
total poly fat (g)	9.3	14.4	18.3	9.7	13.4	18.8	10.6	14.0	16.6
total mono fat (g)	23.6	32.5	34.7	18.5	29.5	36.6	19.7	27.7	34.1
n3 fatty acid (g)	1.0	1.8	2.2	0.9	1.5	2.3	1.3	1.8	2.0
n6 fatty acid (g)	7.6	12.1	15.0	7.7	11.0	15.7	8.7	12.0	14.2
trans fatty acid (g)	0.5	0.8	1.6	0.3	0.8	2.6	0.2	0.6	1.2
alcohol (g)	0	0.9	4.3	0	0	3.0	0	0.2	1.2
dietary fibre (g)	9.0	11.9	19.0	10.3	13.2	15.3	9.9	16.2	21.5

TABLE I (cont'd)

	34-49 years n=12 percentiles			50-74 years n=30 percentiles			75+ years n=4 percentiles		
	25th	50th	75th	25th	50th	75th	25th	50th	75th
total carotenoids (RE)	371.5	617.0	965.5	350.0	602.5	935.0	419.5	526.5	762.0
vitamin E (mg)	1.4	3.0	6.6	1.3	2.3	3.7	0.9	1.7	2.5
iron (mg)	9.8	10.6	12.7	8.0	10.0	12.5	8.7	10.4	12.4
vitamin C (mg)	76.2	117.5	219.7	78.8	116.6	192.4	116.0	122.4	141.9
zinc (mg)	9.4	11.2	13.2	7.0	8.9	12.0	7.6	9.4	10.4
vitamin B_6 (mg)	1.4	1.9	2.2	1.4	1.8	2.2	1.1	1.4	1.6
calcium (mg)	515.5	948.2	1210.3	525.8	608.7	977.4	439.5	561.4	847.1
riboflavin (mg)	1.4	2.0	2.4	1.3	1.6	2.1	1.2	1.4	1.7
thiamin (mg)	1.2	1.4	1.7	1.0	1.5	1.7	1.1	1.3	1.5
folate (μg)	167.8	213.9	284.2	175.8	200.6	256.0	209.9	222.8	261.0
niacin (NE)	30.1	35.6	39.6	26.4	31.3	40.3	22.4	29.5	34.8

TABLE II.
Controls: nutrient intakes from food sources by age group and percentiles

	34-49 years n=13 percentiles			50 - 74 years n=33 percentiles			75+ years n =4 percentiles		
	25th	50th	75th	25th	50th	75th	25th	50th	75th
energy (kcal)	1455.9	1808.7	2130.2	1630.6	1942.5	2542.2	1587.8	2438.0	2874.6
protein (g)	64.9	70.2	84.4	61.5	79.0	108.6	61.3	97.5	121.7
carbohydrate (g)	163.2	227.4	270.4	187.2	232.9	301.1	187.4	279.5	374.1
total fat (g)	53.0	61.8	84.0	59.4	75.86	95.4	66.1	89.9	109.5
total sat fat (g)	15.8	18.4	24.4	20.5	28.3	32.1	22.1	31.2	35.9
total poly fat (g)	10.2	11.4	19.9	9.1	13.1	18.1	10.5	16.1	22.3
total mono fat (g)	20.2	24.8	36.0	23.5	29.4	38.3	27.4	35.0	42.8
n3 fatty acid (g)	1.1	1.6	2.2	1.0	1.6	1.8	1.4	1.72	2.4
n6 fatty acid (g)	7.9	10.2	17.1	7.4	10.6	15.2	8.4	13.5	18.4
trans fatty acid (g)	0.1	0.5	1.5	0.4	1.0	1.51	1.9	2.7	3.9
alcohol (g)	0	0.8	3.5	0	0	1.5	0	0	1.0
dietary fibre (g)	12.6	13.4	18.7	14.3	16.7	21.6	13.4	21.6	28.9

TABLE II (cont'd)

	34-49 years			50 - 74 years			75+ years		
	percentiles			percentiles			percentiles		
	25th	50th	75th	25th	50th	75th	25th	50th	75th
total carotenoids (RE)	415.0	602.0	705.0	490.0	942.0	1486.0	1197.5	1905.0	2411.0
vitamin E (mg)	1.2	2.9	4.4	1.7	2.6	4.2	2.0	2.6	2.8
iron (mg)	8.6	9.6	12.8	9.2	11.2	14.8	8.7	12.8	19.7
vitamin C (mg)	81.7	139.2	153.9	81.7	120.4	175.9	70.3	80.4	142.1
zinc (mg)	7.8	10.1	11.5	8.8	10.9	15.1	6.5	13.0	18.0
vitamin B_6 (mg)	1.4	1.7	1.8	1.6	1.9	2.6	1.5	2.2	2.9
calcium (mg)	491.4	607.0	768.1	550.8	858.8	1266.7	554.4	1071.2	1416.1
riboflavin (mg)	1.2	1.4	1.6	1.5	1.9	2.5	1.1	2.2	3.3
thiamin (mg)	1.1	1.2	1.4	1.2	1.6	1.9	1.0	1.2	2.2
folate (µg)	190.4	231.5	248.7	189.3	222.1	285.9	160.1	245.7	312.1
niacin (NE)	27.9	32.8	39.4	25.8	35.3	45.5	26.2	38.2	48.8

TABLE III.
Cases: Comparison of macronutrient intakes from food sources to recommended intakes, by age

	34-49 years (n=25)			50-74 years (n=63)			75+ years (n=8)		
	actual intake	recommended intake	actual intake as % recommended	actual intake	recommended intake	actual intake as % recommended	actual intake	recommended intake	actual intake as % recommended
energy (kcal)	2057.4 ± 681.1	1900	108.3	1812.4 (1504.9, 2132.8)[a]	1800	100.7	1817.1 ± 419.7	1700	106.9
protein (g)	84.2 ± 25.9	51	165.1	67.0 (57.4,97.9)[a]	54	124.1	66.3 ± 18.9	55	121.1
	actual intake	recommended intake (as % of total energy)	actual intake as % recommended	actual intake	recommended intake (as % of total energy)	actual intake as % recommended	actual intake	recommended intake (as % of total energy)	actual intake as % recommended
carbohydrate (g)	252.4 ± 93.1	55	89.2	225.1 (183.4, 279.8)[a]	55	90.3	235.2 ± 36.9	55	94.1
total fat (g)	80.5 ± 29.7	30	117.4	73.7 ± 31.5	30	122.0	72.5 ± 27.6	30	119.7

[a] median intake (interquartile range); other values presented as actual mean intake ± standard deviation

TABLE IV.

Cases: Comparison of micronutrient intakes[c] from food sources to Recommended Nutrient Intakes (RNI) (1990), by age

	34-49 years (n=25)			50-74 years (n=63)			75+ years (n=8)		
	actual intake	recommended intake[c]	actual intake as % recommended[b]	actual intake	recommended intake[c]	actual intake as % recommended[b]	actual intake	recommended intake[b]	actual intake as % recommended[c]
iron (mg)	11.2 ± 3.7	13	86.2	10.0 (8.0,12.5)[a]	8	125.0	10.6 ± 2.5[a]	8	132.5
zinc (mg)	11.2 ± 3.6	9	124.4	8.9 (7.0,12.0)[a]	9	98.9	9.0 ± 1.8[a]	9	100
vitamin C (mg)	117.5 (76.2,219.7)[a]	30	391.7	116.6 (78.8,192.4)[a]	30	388.7	129.0 ± 20.5[a]	30	430
vitamin E (mg)	4.0 ± 3.1	6	66.7	2.3 (1.3,3.7)[a]	6	38.3	1.7 ± 1.0	6	28.3
vitamin A (RE)	1364.9 ± 820.8	800	170.6	1384.6 ± 763.2	800	173.1	975.5 ± 150.6	800	121.9

[a] median intake (interquartile range); all other values presented as actual mean intake ± standard deviation

[b] actual and recommended intakes are expressed in the units specified for each nutrient

TABLE V.

Controls: Comparison of macronutrient intakes from food sources to recommended intakes, by age

	34-49 years (n=25)			50-74 years (n=63)			75+ years (n=8)		
	actual intake	recommended intake	actual intake as % recommended	actual intake	recommended intake	actual intake as % recommended	actual intake	recommended intake	actual intake as % recommended
energy (kcal)	1842.7 ± 576.4	1900	97	2070.2 ± 630.5	1800	115	2231.2 ± 841.5	1700	131.2
protein (g)	73.7 ± 19.3	51	144.5	79.0 (61.5,108.6)[a]	54	146.3	91.5 ± 40.3	55	166.4
	actual intake	recommended intake (as % of total energy)	actual intake as % recommended	actual intake	recommended intake (as % of total energy)	actual intake as % recommended	actual intake	recommended intake (as % of total energy)	actual intake as % recommended
carbohydrate (g)	236.8 ± 80.8	55	93.4	259.6 ± 83.8	55	91.2	280.7 ± 121.4	55	91.4
total fat (g)	68.8 ± 27.8	30	112	78.1 ± 28.0	30	113.2	87.8 ± 33.0	30	118

[a] median intake (interquartile range); other values presented as actual mean intake ± standard deviation

TABLE VI.

Controls: Comparison of micronutrient intakes[c] from food sources to Recommended Nutrient Intakes (RNIs) (1990), by age

	34-49 years (n=25)			50-74 years (n=63)			75+ years (n=8)		
	actual intake	recommended intake[c]	actual intake as % recommended[c]	actual intake	recommended intake[c]	actual intake as % recommended[c]	actual intake	recommended intake[c]	actual intake as (% recommended[c]
iron (mg)	10.8 ± 3.1	13	83.1	12.0 ± 3.5	8	150	14.2 ± 7.9	8	177.5
zinc (mg)	10.1 ± 3.2	9	112.2	11.6 ± 4.1	9	128.9	12.3 ± 6.8	9	136.7
vitamin C (mg)	122.1 ± 47.6	30	407	120.4 (81.7,175.9)[a]	30	401.3	80.4 (70.3,142.1)[a]	30	268.0
vitamin E (mg)	2.9 (1.2,4.4)[a]	6	48.3	2.6 (1.7,4.2)[a]	6	43.3	2.4 ± 0.7	6	40
vitamin A (RE)	1169.6 ± 362.7	800	146.2	1702.6 ± 921.2	800	212.8	2562.9 ± 1230.2	800	320.4

[a] median intake (interquartile range); other values are presented as actual mean intake ± standard deviation

[b] actual and recommended intakes are expressed in the units specified for each nutrient

TABLE VII.
Cases and controls: comparison of actual mean intakes vs Dietary Reference Intakes (DRI) (1998), by age

Nutrients	Cases				Controls			
	31-50 years (n=13)		51+ years (n=33)		31-50 years (n=14)		51+ years (n=36)	
	actual intake	% DRI[b]	actual intake	% DRI[b]	actual intake	% DRI[b]	actual intake	% DRI[b]
calcium (mg)	982.4 ± 462.4	98.2	608.2 (483.4,846.2)[a]	50.7	700.0 ± 293.6	70.0	806.9 (550.2,1354.5)[a]	67.2
riboflavin (mg)	2.1 ± 0.8	233.3	1.5 (1.3,1.9)[a]	166.7	1.4 (1.2,1.7)[a]	155.6	1.9 (1.5,2.8)[a]	211.1
thiamin (mg)	1.5 ± 0.4	166.6	1.4 (1.0,1.7)[a]	155.6	1.3 ± 0.3	144.4	1.5 (1.1,1.9)[a]	166.7
niacin (NE)	35.7 ± 9.8	324.5	31.2 (26.0,35.9)[a]	283.6	34.0 ± 8.6	309.1	36.0 ± 12.0	327.3
folate (μg)	222.5 (187.7,280.4)[a]	69.5	204.1 (177.7,256.0)[a]	63.8	233.8 ± 64.8	73.0	225.2 (189.1,293.4)[a]	70.4
vitamin B_6	1.9 ± 0.6	172.7	1.6 (1.3,1.9)[a]	123.1	1.8 ± 0.4	163.6	2.1 ± 0.7	161.5

[a] median intake (interquartile range); other values presented as actual mean intake ± standard deviation
[b] calculated as % Estimated Average Requirement for all nutrients with the exception of calcium, for which % Adequate Intake was calculated

TABLE VIII.
Cases and controls: actual intakes of macronutrients as percentage of total energy, by age

	Cases			Controls		
	34-49 years	50-74 years	75+ years	34-49 years	50-74 years	75+ years
	n=12	n=30	n=4	n=13	n=33	n=4
energy (kcal)	2057.4	1812.4 (1504.9,2132.8)	1817.0	1842.7	2070.2	2231.2
protein (% energy)	16.4	14.8	14.6	16.0	15.3	16.4
carbohydrate (% energy)	49.1	49.7	51.8	51.4	50.2	50.3
total fat (% energy)	35.2	36.6	35.9	33.6	34.0	35.4
saturated fat (% energy)	11.9	10.0	12.9	10.2	11.9	11.7
polyunsaturated fat (% energy)	6.3	7.0	6.7	7.1	5.8	6.6
monounsaturated fat (% energy)	14.1	14.6	13.3	13.4	13.4	14.2
alcohol (% energy)	0.3	0	0.1	0.3	0	0

TABLE IX.
Cases and controls: percentage using nutrient supplements

	% Cases (n=50)	% Controls (n=50)
used at least 1 nutrient supplement	34	42
used at least 2 nutrient supplement	20	22
used at least 3 nutrient supplement	12	16
used at least 4 nutrient supplement	8	14
used at least 5 nutrient supplement	6	2
used at least 6 nutrient supplement	4	2
used at least 7 nutrient supplement	4	2
used at least 8 nutrient supplement	4	2
used at least 9 nutrient supplement	0	2
used 10 nutrient supplements	0	2

TABLE X.
Mean supplement intakes by cases and controls, by age[a]

Supplement	Cases *(n)*			Controls *(n)*		
	34-49 yrs	50-74 yrs	75+ yrs	34-49 yrs	50-74 yrs	75+ yrs
iron (mg)	9 *(1)*	9 *(1)*	9 *(1)*	-	64 *(1)*	-
carotenoids (RE)	2000 *(1)*	5000 *(1)*	2000 *(1)*	500 *(1)*	-	-
vitamin C (mg)	216.7 *(3)*	420.7 *(7)*	90 *(1)*	60 *(2)*	1034.2 *(6)*	250 *(1)*
vitamin A (IU)	3250 *(2)*	4125.5 *(6)*	3000 *(1)*	2500 *(2)*	3600.7 *(5)*	5000 *(1)*
vitamin E (mg)	227.5 *(2)*	446.7 *(6)*	75 *(1)*	37.5 *(2)*	734.2 *(6)*	-
vitamin D (mcg)	10 (2)	9.1 (6)	10 (1)	7.7 *(3)*	13.3 *(6)*	10 *(1)*
zinc (mg)	15 *(1)*	13.3 *(3)*	15 *(1)*	-	137.5 *(2)*	-
selenium	25 *(1)*	125 *(2)*	25 *(1)*	-	40 *(1)*	-
pantothenic acid	10 *(2)*	8 *(2)*	10 *(1)*	10 *(2)*	193 *(2)*	-

[a] Supplement intakes are presented separately in Tables X and XI to be consistent with age categories for Recommended Nutrient Intakes (Table X) and Dietary Reference Intakes (Table XI)

TABLE XI.
Mean supplement intakes by cases and controls, by age[a]

Supplement	Cases *(n)*		Controls *(n)*	
	34 - 50 yrs	**51 - 80 yrs**	**34 - 50 yrs**	**51 - 80 yrs**
magnesium (mg)	100 *(1)*	258.3 *(3)*	1156.5 *(2)*	793.7 *(3)*
folate (mcg)	200.1 *(2)*	446.6 *(5)*	400 *(2)*	1808.2 *(4)*
biotin (mcg)	30 *(1)*	101.2 *(4)*	30 *(1)*	1505 *(2)*
calcium (mg)	200 *(1)*	775 *(6)*	600 *(2)*	927.7 *(6)*
thiamin (mg)	1.5 *(2)*	12.0 *(5)*	1.5 *(2)*	19.8 *(4)*
riboflavin (mg)	1.7 *(2)*	12.7 *(5)*	1.7 *(2)*	20.6 *(4)*
niacin (NE)	20 *(2)*	31.2 *(4)*	20 *(2)*	265 *(3)*
vitamin B_6 (mg)	2.5 *(2)*	11.4 *(5)*	27 *(2)*	24 *(4)*
vitamin B_{12} (mcg)	18 *(2)*	18.2 *(5)*	6 *(2)*	86 *(3)*

[a] Supplement intakes are presented separately in Tables X and XI to be consistent with age categories for Recommended Nutrient Intakes (Table X) and Dietary Reference Intakes (Table XI)

TABLE XII.
Prescription drugs used by cases and controls

Drug	Cases (n)	Controls (n)
Accolate	0	1
Aldomet 250 mg	0	1
Alti-salbutamol inhaler	0	1
Amitriptyline 25 mg	1	0
Apo-amilzide tab (2 controls)	0	2
APO-salvent 1 puff	1	1
Arthrotec 50	0	1
Arudis 50 mg	0	1
Aspirin 5 gr	1	0
Atenolol 50mg	0	3
Ativan 1 mg	0	1
Barotec puffer	0	1
Becloforte 250 mcg	1	0
Betaloc 100 mg	1	0
Birth control pill, type unk	1	0
Cardizem 90 mg	1	0
Cimetidine 600 mg	0	1
Cimetidine 600 mg	0	1
Cimetidine 600 mg	0	1
Coumadin 2.5 mg	0	1
Didronel 200 mg	1	0
Diltiazem 60 mg	1	0
Dyazide	1	2

TABLE XII (cont'd)

Drug	Cases (n)	Controls (n)
Eltroxin 0.1 mg	2	1
Eltroxin 50 mcg	1	1
Entrophen 5 gr	0	3
Enteric-coated ASA 325 mg	3	1
Estrace 1 mg	0	2
Estraderm 50 patch	0	1
Estraderm 25 mg	0	1
Estropipate 0.75 mg	0	1
Etrafon D 25 mg	0	1
Foradil puffer	0	1
'High blood pressure medication'	1	0
HydroDiuril apohydro 25 mg	0	1
HydroDiuril 50 mg	1	0
Icaps	1	0
Imdur 60 mg	0	1
Indocid SR 75 mg	1	0
Inhibace 2.5 mg	0	1
Iopidine 0.5 % drops	1	0
Lanoxin 0.125 mg	1	1
Lanoxinil 25 mg	0	1
Lescol 20 mg	0	1
Levothyroxine sodium 50 mcg	0	1
Lithane 300 mg	1	0

TABLE XII (cont'd)

Drug	Cases (n)	Controls (n)
Lozide 2.5 mg	0	2
Losec 20 mg	0	1
Lorazepam 1 mg	0	1
Lorazepam 1.5 mg	0	1
Lovastatin 20 mg	0	2
Metformin 500 mg	0	1
Methotrexate 2.5 mg	1	1
Metoprolol 50 mg	1	1
Mevacor 20 mg	1	1
Miero K extencaps	1	0
Modulon 100 mg	1	0
Nadolol 80 mg	1	0
Naxen 375 mg	0	1
Neptazane 50 mg	1	0
Nifedipine P.A. 10 mg	1	0
Nostril nasal spray	0	1
Novamilor 50 mg	0	1
Novo-atenol 50 mg	1	0
Novohydrazide 25 mg	1	2
Novohydrazide 50 mg	0	1
Novo-medopa 250 mg	0	1
Novo-metoprol	0	1
Novonaprox 375 mg	1	0
Novopueol 200 mg	0	1
Novosalmol inhaler	0	1

TABLE XII (cont'd)

Drug	Cases (n)	Controls (n)
Novosemide	0	1
Novosumiog 20 mg	0	1
Novo-timol 0.5%	1	0
Novotriamzide 50 mg	1	0
Novoveramil SR 240 mg	0	1
Pamate 10 mg	0	1
Paxil 20 mg	0	1
Pravachol 20 mg	1	1
Prednisone 5 mg	2	1
Premarin 0.625 mg	9	9
Premarin 0.3 mg	0	1
Prepulsid 10 mg	1	0
Prometrium 100 mg	0	1
Provera 5 mg	5	6
Provera 2.5 mg	1	3
Pulmicort	1	1
Ranitidine 150 mg	2	2
Rivotril 0.5 mg	0	1
Salofalk 500 mg	1	0
Slow K	0	1
Synthroid 0.05 mg	2	0
Synthroid .075 mg	2	1
Synthroid 0.1 mg	1	5
Tegretol CR 200 mg	0	1
Theo-dur	1	0

TABLE XII (cont'd)

Drug	Cases (n)	Controls (n)
Timoptic .05	0	1
Tofranil 25 mg	1	0
Tylenol 325 mg	1	1
Ventolin	1	0
Verapamil SR 240 mg	2	0
Voltaren 50 mg	0	2
Warfilone 5 mg	0	1
Zoloft 50 mg	0	1

9. APPENDIX C

9.1 Health and Lifestyle Questionnaire

Part I. Demographic Profile

In order to compare your answers with people from similar backgrounds we would like to ask you a few questions about yourself.

☐ 1. What is the highest grade or level of education you have ever attended or ever completed?
(choose one answer only)

_a. No schooling
_b. Some Elementary
_c. Completed Elementary
_d. Some Secondary
_e. Completed Secondary
_f. Some Community College, Technical College, or Nurse's training
_g. Completed Community College, Technical College, or Nurse's training
_h. Some University (e.g. B.A., M.A., PhD) or Teachers College
_i. Completed University (e.g. B.A., M.A., PhD) or Teachers College
_j. Other education or training (Specify)_____

☐ 2. What is your marital status? ***(choose one answer only)***

_a. Single (never married)?
_b. Married (and not currently separated)?
_c. Common law?
_d. Divorced/separated?
_e. Widowed?
_f. Other? (Specify)_____

Part II Family History

It is known that some health problems run in families. We have some "family history" questions to help us to find out more about this. If you are adopted, or if your parents remarried, it would be better to know about your biological family (i.e. blood relations) for both your parents and your brothers and sisters.

☐ 3. Is your mother still alive? ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

_a. Yes ***(skip to question # 5)***
_b. No
_c. Don't know ***(skip to question # 6)***

☐ 4. **IF NO**, what was the primary cause of her death? ***(choose one answer only)***

_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____

Yes = 1; No = 0; Don't know = -1; Refusal = 9

_d. Other (please specify)_____
_e. Don't know

___(yrs) 5. What is her present age (or the age at which she died)? ***(years)***

☐ 6. Is your father still alive? ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
_a. Yes ***(skip to question # 8)***
_b. No
_c. Don't know ***(skip to question # 9)***

☐ 7. **IF NO**, what was the primary cause of his death? ***(choose one answer only)***
_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____
_d. Other (please specify)_____
_e. Don't know

___(yrs) 8. What is his present age (or the age at which he died)? ***(years)***

____# 9. How many brothers do you have (including those who may have died)?

____# 10. How many sisters do you have (including those who may have died)?

Could you please tell me some details about your siblings (brothers and sisters). We would like to know either their present age, or if they have died, the age at which they died. We'll begin with your oldest brother or sister.

☐ 11. First brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. Brother
☐ _b. Sister
☐ _c. Half brother/sister
___(yrs) d. Present age, or age at which they died ***(years)***

☐ 12. **If they have died,** what was the primary cause of death? ***(choose one answer only)***
_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____
_d. Other (please specify)_____
_e. Don't know

☐ 13. Second brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. Brother
☐ _b. Sister
☐ _c. Half brother/sister
___(yrs) d. Present age, or age at which they died ***(years)***

☐ 14. **If they have died,** what was the primary cause of death? ***(choose one answer only)***

_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____
_d. Other (please specify)_____
_e. Don't know

15. Third brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Brother
☐ _b. Sister
☐ _c. Half brother/sister
___(yrs) d. Present age, or age at which they died ***(years)***

☐ 16. **If they have died,** what was the primary cause of death? ***(choose one answer only)***

_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____
_d. Other (please specify)_____
_e. Don't know

☐ 17. Fourth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Brother
☐ _b. Sister
☐ _c. Half brother/sister
___(yrs) d. Present age, or age at which they died ***(years)***

☐ 18. **If they have died,** what was the primary cause of death? ***(choose one answer only)***

_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____
_d. Other (please specify)_____
_e. Don't know

☐ 19. Fifth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Brother
☐ _b. Sister
☐ _c. Half brother/sister
___(yrs) d. Present age, or age at which they died ***(years)***

☐ 20. **If they have died,** what was the primary cause of death? ***(choose one answer only)***

_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____
_____
_d. Other (please specify)_____
_e. Don't know

☐ 21. Sixth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. Brother
☐ _b. Sister
☐ _c. Half brother/sister
___(yrs) d. Present age, or age at which they died ***(years)***

☐ 22. **If they have died,** what was the primary cause of death? ***(choose one answer only)***

_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____
_____
_d. Other (please specify)_____
_e. Don't know

☐ 23. Seventh brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. Brother
☐ _b. Sister
☐ _c. Half brother/sister
___(yrs) d. Present age, or age at which they died ***(years)***

☐ 24. **If they have died,** what was the cause of death? ***(choose one answer only)***

_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____
_____
_d. Other (please specify)_____
_e. Don't know

☐ 25. Eighth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. Brother
☐ _b. Sister
☐ _c. Half brother/sister
___(yrs) d. Present age, or age at which they died ***(years)***

☐ 26. **If they have died,** what was the primary cause of death? ***(choose one answer only)***

_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____
_d. Other (please specify)_____
_e. Don't know

☐ 27. Ninth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. Brother
☐ _b. Sister
☐ _c. Half brother/sister
___(yrs) d. Present age, or age at which they died ***(years)***

☐ 28. **If they have died,** what was the primary cause of death? ***(choose one answer only)***

_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____
_d. Other (please specify)_____
_e. Don't know

☐ 29. Tenth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. Brother
☐ _b. Sister
☐ _c. Half brother/sister
___(yrs) d. Present age, or age at which they died ***(years)***

☐ 30. **If they have died,** what was the primary cause of death? ***(choose one answer only)***

_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____
_d. Other (please specify)_____
_e. Don't know

☐ 31. Eleventh brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. Brother
☐ _b. Sister
☐ _c. Half brother/sister
___(yrs) d. Present age, or age at which they died ***(years)***

☐ 32. **If they have died,** what was the primary cause of death? ***(choose one answer only)***

_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____
_d. Other (please specify)_____
_e. Don't know

☐ 33. Twelfth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. Brother
☐ _b. Sister
☐ _c. Half brother/sister
___(yrs) d. Present age, or age at which they died ***(years)***

☐ 34. **If they have died,** what was the primary cause of death? ***(choose one answer only)***

_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____
_d. Other (please specify)_____
_e. Don't know

☐ 35. Thirteenth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. Brother
☐ _b. Sister
☐ _c. Half brother/sister
___(yrs) d. Present age, or age at which they died ***(years)***

☐ 36. **If they have died,** what was the primary cause of death? ***(choose one answer only)***

_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____
_d. Other (please specify)_____
_e. Don't know

☐ 37. Fourteenth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. Brother
☐ _b. Sister
☐ _c. Half brother/sister
___(yrs) d. Present age, or age at which they died ***(years)***

Identifier # ☐☐☐☐

☐ 38. **If they have died,** what was the primary cause of death? ***(choose one answer only)***

_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____
_d. Other (please specify)_____
_e. Don't know

☐ 39. Fifteenth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. Brother
☐ _b. Sister
☐ _c. Half brother/sister
___(yrs) d. Present age, or age at which they died ***(years)***

☐ 40. **If they have died,** what was the primary cause of death? ***(choose one answer only)***

_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____
_d. Other (please specify)_____
_e. Don't know

☐ 41. Sixteenth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. Brother
☐ _b. Sister
☐ _c. Half brother/sister
___(yrs) d. Present age, or age at which they died ***(years)***

☐ 42. **If they have died,** what was the primary cause of death? ***(choose one answer only)***

_a. Heart disease
_b. Stroke
_c. Cancer (please describe part of body where it started)
_____
_d. Other (please specify)_____
_e. Don't know

The next few questions are about specific health conditions that your mother, father or siblings (brothers and sisters) may have had. We'll begin with your mother and father.

43. Has your mother had any of the following conditions?
(Yes = 1; No = 0; Don't know = -1; Refusal = 9)

☐ _a. Heart attack
____yrs _b. **If YES**, how old was she when she had her first heart attack?

☐ _c. Stroke
_____yrs _d. **If YES**, how old was she when she had her first stroke?

☐ _e. Diabetes
_____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
_____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
_____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____

☐ _l. Cancer ***(second episode)***
_____yrs _m. **IF YES**, at what age?
☐ _n. describe part of body where cancer started_____

☐ _o. None of above

44. Has your father had any of the following conditions?
(Yes = 1; No = 0; Don't know = -1; Refusal = 9)

☐ _a. Heart attack
____yrs _b. **If YES**, how old was he when he had his first heart attack?

☐ _c. Stroke
_____yrs _d. **If YES**, how old was he when he had his first stroke?

☐ _e. Diabetes
_____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
_____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
_____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____

☐ _l. Cancer ***(second episode)***
_____yrs _m. **IF YES**, at what age?
☐ _n. describe part of body where cancer started_____

☐ _o. None of above

Could you please give me the same information about your siblings (your brothers and sisters)?

☐ 45. First brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. Heart attack
____yrs _b. **If YES**, how old were they when they had their first heart attack?

☐ _c. Stroke
_____yrs _d. **If YES**, how old were they when they had their first stroke?

☐ _e. Diabetes
_____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
_____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
_____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____

☐ _l. Cancer ***(second episode)***
_____yrs _m. **IF YES**, at what age?
☐ _n. describe part of body where cancer started_____

☐ _o. None of above

☐ 46. Second brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Heart attack
____yrs _b. **If YES**, how old were they when they had their first heart attack?

☐ _c. Stroke
_____yrs _d. **If YES**, how old were they when they had their first stroke?

☐ _e. Diabetes
_____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
_____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
_____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____
☐ _l. Cancer ***(second episode)***
_____yrs _m. **IF YES**, at what age?
☐ _n. describe part of body where cancer started_____

☐ _o. None of above

☐ 47. Third brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Heart attack
____yrs _b. **If YES**, how old were they when they had their first heart attack?

☐ _c. Stroke
_____yrs _d. **If YES**, how old were they when they had their first stroke?

☐ _e. Diabetes
_____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
_____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
_____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____

☐ _l. Cancer ***(second episode)***
_____yrs _m. **IF YES**, at what age?
☐ _n. describe part of body where cancer started_____

☐ _o. None of above

☐ 48. Fourth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Heart attack
____yrs _b. **If YES**, how old were they when they had their first heart attack?

☐ _c. Stroke
_____yrs _d. **If YES**, how old were they when they had their first stroke?

☐ _e. Diabetes
_____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
_____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
_____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____

☐ _l. Cancer ***(second episode)***
_____yrs _m. **IF YES**, at what age?
☐ _n. describe part of body where cancer started_____

☐ _o. None of above

☐ 49. Fifth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Heart attack
____yrs _b. **If YES**, how old were they when they had their first heart attack?

☐ _c. Stroke
____yrs _d. **If YES**, how old were they when they had their first stroke?

☐ _e. Diabetes
____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____

☐ _l. Cancer ***(second episode)***
____yrs _m. **IF YES**, at what age?
☐ _n. describe part of body where cancer started_____

☐ _o. None of above

☐ 50. Sixth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Heart attack
____yrs _b. **If YES**, how old were they when they had their first heart attack?

☐ _c. Stroke
____yrs _d. **If YES**, how old were they when they had their first stroke?

☐ _e. Diabetes
____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____

☐ _l. Cancer ***(second episode)***
____yrs _m. **IF YES**, at what age?
☐ _n. describe part of body where cancer started_____

☐ _o. None of above

☐ 51. Seventh brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Heart attack
____yrs _b. **If YES**, how old were they when they had their first heart attack?

☐ _c. Stroke
_____yrs _d. **If YES**, how old were they when they had their first stroke?

☐ _e. Diabetes
_____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
_____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
_____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____

☐ _l. Cancer ***(second episode)***
_____yrs _m. **IF YES**, at what age?
☐ _n. describe part of body where cancer started_____

☐ _o. None of above

☐ 52. Eighth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Heart attack
____yrs _b. **If YES**, how old were they when they had their first heart attack?

☐ _c. Stroke
_____yrs _d. **If YES**, how old were they when they had their first stroke?

☐ _e. Diabetes
_____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
_____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
_____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____

☐ _l. Cancer ***(second episode)***
_____yrs _m. **IF YES**, at what age?
☐ _n. describe part of body where cancer started_____

☐ _o. None of above

☐ 53. Ninth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Heart attack
____yrs _b. **If YES**, how old were they when they had their first heart attack?

☐ _c. Stroke
_____yrs _d. **If YES**, how old were they when they had their first stroke?

☐ _e. Diabetes
_____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
_____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
_____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____

☐ _l. Cancer ***(second episode)***
_____yrs _m. **IF YES**, at what age?
☐ _n. describe part of body where cancer started_____

☐ _o. None of above

☐ 54. Tenth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Heart attack
____yrs _b. **If YES**, how old were they when they had their first heart attack?

☐ _c. Stroke
_____yrs _d. **If YES**, how old were they when they had their first stroke?

☐ _e. Diabetes
_____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
_____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
_____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____

☐ _l. Cancer ***(second episode)***
_____yrs _m. **IF YES**, at what age?
☐ _n. describe part of body where cancer started_____
☐ _o. None of above

☐ 55. Eleventh brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Heart attack

____yrs _b. **If YES**, how old were they when they had their first heart attack?

☐ _c. Stroke
_____yrs _d. **If YES**, how old were they when they had their first stroke?

☐ _e. Diabetes
_____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
_____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
_____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____

☐ _l. Cancer ***(second episode)***
_____yrs _m. **IF YES**, at what age?
☐ _n. describe part of body where cancer started_____

☐ _o. None of above

☐ 56. Twelfth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Heart attack
____yrs _b. **If YES**, how old were they when they had their first heart attack?

☐ _c. Stroke
_____yrs _d. **If YES**, how old were they when they had their first stroke?

☐ _e. Diabetes
_____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
_____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
_____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____

☐ _l. Cancer ***(second episode)***
_____yrs _m. **IF YES**, at what age?
☐ _n. describe part of body where cancer started_____

☐ _o. None of above

☐ 57. Thirteenth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Heart attack
_____yrs _b. **If YES**, how old were they when they had their first heart attack?

☐ _c. Stroke
_____yrs _d. **If YES**, how old were they when they had their first stroke?

☐ _e. Diabetes
_____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
_____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
_____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____

☐ _l. Cancer ***(second episode)***
_____yrs _m. **IF YES**, at what age?
☐ _n. describe part of body where cancer started_____

☐ _o. None of above

☐ 58. Fourteenth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Heart attack
_____yrs _b. **If YES**, how old were they when they had their first heart attack?

☐ _c. Stroke
_____yrs _d. **If YES**, how old were they when they had their first stroke?

☐ _e. Diabetes
_____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
_____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
_____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____

☐ _l. Cancer ***(second episode)***
_____yrs _m. **IF YES**, at what age?
☐ _n. describe part of body where cancer started_____

☐ _o. None of above

☐ 59. Fifteenth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Heart attack
_____yrs _b. **If YES**, how old were they when they had their first heart attack?

☐ _c. Stroke
_____yrs _d. **If YES**, how old were they when they had their first stroke?

☐ _e. Diabetes
_____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
_____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
_____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____

☐ _l. Cancer ***(second episode)***
_____yrs _m. **IF YES**, at what age?
☐ _n. describe part of body where cancer started_____

☐ _o. None of above

☐ 60. Sixteenth brother or sister ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

☐ _a. Heart attack
_____yrs _b. **If YES**, how old were they when they had their first heart attack?

☐ _c. Stroke
_____yrs _d. **If YES**, how old were they when they had their first stroke?

☐ _e. Diabetes
_____yrs _f. **If YES**, at what age?

☐ _g. Osteoporosis
_____yrs _h. **If YES**, at what age?

☐ _i. Cancer ***(first episode)***
_____yrs _j. **If YES**, at what age?
☐ _k. describe part of body where cancer started_____

☐ _l. Cancer ***(second episode)***

_____yrs _m. **IF YES**, at what age?

☐ _n. describe part of body where cancer started_____

☐ _o. None of above

Part III. Physical Activity

The next few questions relate to your usual level of physical activity.

61. In a typical week during the past 12 months ***(or 12 months prior to diagnosis)***, how many **hours** did you spend on each of the following activities ***(Put "0" if none.)***

____(hrs) _a. Walking, including walking to work, shopping and leisure

____(hrs) _b. Cycling, including cycling to work and during leisure time

____(hrs) _c. Gardening

____(hrs) _d. Housework such as cleaning, washing, cooking, child care

____(hrs) _e. "Do it Yourself" home maintenance and repairs

____(hrs) _f. Other physical exercise such as aerobics, swimming, jogging

☐ 62. Did you usually practise any of these activities vigorously enough to cause sweating or a faster heartbeat? ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

_a. Yes
_b. No ***(skip to question # 64)***
_c. Don't know ***(skip to question # 64)***

____(hrs) 63. If **YES**, for how many **hours per week** in total did you practise such vigorous physical activity?

____(floors) 64. In a typical day during the past 12 months ***(or 12 months prior to diagnosis)***, how many **floors of stairs** (approx 10 steps) did you climb up? ***(Put "0" if none.)***

☐ 65. We would like to know the type and amount of physical activity involved in your usual daily activities or work habits. Which of the following best describes your situation?
(choose one answer only)

_a. Sedentary occupation. You spend most of your time sitting (such as in an office)

or

_b. Standing occupation. You spend most of your time standing or walking. However, your work does not require intense physical effort (e.g. sales clerk, school teacher, hairdresser, guard etc.)

or

_c. Physical work. This involves some physical effort including handling of heavy objects and use of tools (e.g. plumber, cleaner, nurse, sports instructor, electrician, carpenter, etc.)

or

_d. Heavy manual work. This involves very vigorous physical activity including handling of very heavy objects (eg. bricklayer, construction worker, etc.)

Part IV Personal Health History and Lifestyle Habits

The following questions are about your lifestyle habits and personal health history.

☐ 66. Have you smoked 100 or more cigarettes in your life?
(Yes = 1; No = 0; Don't know = -1; Refusal = 9)
_a. yes
_b. no ***(skip to question # 70)***

☐ 67. During the past 30 days, on how many days did you smoke at least one cigarette?
(choose one answer only)
_a. 0 days ***(skip to question #69)***
_b. 1 or 2 days
_c. 3 to 5 days
_d. 6 to 9 days
_e. 10 to 19 days
_f. 20 to 29 days
_g. all 30 days

☐ 68. On the days that you smoked, how many cigarettes did you usually smoke?
(choose one answer only)
_a. 5 or less cigarettes ***(skip to question #70)***
_b. 6 to 10 cigarettes ***(skip to question #70)***
_c. 11 to 15 cigarettes ***(skip to question #70)***
_d. 16 to 20 cigarettes ***(skip to question #70)***
_e. 21 to 25 cigarettes ***(skip to question #70)***
_f. more than 25 cigarettes ***(skip to question #70)***

69. How old were you when you stopped smoking? ***(years)***
____(yrs) _a. (*age in years*)
☐ _b. Don't know

70. How old were you when you had your first menstrual period?
(choose one answer only)
____(yrs) _a. (*age in years*)
☐ _b. Don't know
☐ _c. Never had a menstrual period

71. ***Interviewer: for the following question, please note the respondent's year of birth and use the appropriate wording***

☐ **for those respondents born in 1958 or earlier:**

When you were in your mid-thirties how many days were there between the start of one menstrual period and the start of the next? Ignore times when you were pregnant, breastfeeding or taking an oral contraceptive ("the pill").

OR

☐ **for those respondents born between 1959 - 1980:**

How long are your menstrual periods? That is, usually, how many days are there between the start of one menstrual period and the start of the next? Ignore times when you were pregnant, breastfeeding or taking an oral contraceptive ("the pill").

(choose one answer only)

_a. Usually 24 days or less
_b. Usually 25 to 26 days
_c. Usually 27 - 29 days
_d. Usually 30 - 31 days
_e. Usually 32 or more days
_f. Irregular
_g. No menstrual cycles ***(skip to question #73)***
_h. Used the pill continuously
_i. Don't know

☐ 72. Are you still menstruating? That is to say, have you had at least 1 menstrual cycle during the past 12 months? ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***

_a. Yes ***(skip to question #74)***
_b. No
_c. Don't know ***(skip to question #74)***

73. How old were you when you stopped having your periods? ***(years)***

____(yrs) _a. (*age in years*) ***(skip to question #75)***
☐ _b. Don't know

☐ 74. How many periods have you had in the last 12 months? ***(choose one answer only)***

_a. 1 to 3
_b. 4 to 5
_c. 6 to 9
_d. 10 or more

75. What was the date of the start of your last "natural" menstrual period? That is, the date of the start of your last menstrual period prior to beginning any Hormone Replacement Therapy treatment, if applicable.

_____ _a. (date: day/month/year)
☐ _b. Don't know

☐ 76. Have you ever used oral contraceptives or "the pill"?
(Yes = 1; No = 0; Don't know = -1; Refusal = 9)
_a. Yes
_b. No ***(skip to question # 82)***
_c. Don't know ***(skip to question # 82)***

77. How old were you when you first used the pill?***(years)***
____(yrs) _a. (*age in years*)
☐ _b. Don't know

78. For how long altogether did you use the pill?
____ _a. ☐ years ☐ months ***(tick appropriate units; write # of months or years on line)***
☐ _b. Don't know

☐ 79. Are you currently on the "pill"?
(Yes = 1; No = 0; Don't know = -1; Refusal = 9)
_a. Yes
_b. No

☐ 80. What brand name contraceptive pill did you last use?_____

81. If you are not currently on the pill, how old were you when you last used it?
____(yrs) _a. (*age in years*)
☐ _b. Don't know

☐ 82. Have you ever received any Hormone Replacement Therapy (HRT)?
(Yes = 1; No = 0; Don't know = -1; Refusal = 9)
_a. Yes
_b. No ***(skip to question # 88)***
_c. Don't know ***(skip to question # 88)***

☐ 83. Are you currently taking this treatment?
(Yes = 1; No = 0; Don't know = -1; Refusal = 9)
_a. Yes
_b. No
_c. Don't know

84. How old were you when you started this treatment? ***(years)***

____(yrs) _a. (*age in years*)
☐ _b. Don't know

85. For how long have you taken this treatment?
_____ _a. ☐ years ☐ months ***(tick appropriate units; write # of months or years on line)***
☐ _b. Don't know

86. What brand name did you last use? _____

87. In what form did you take Hormone Replacement Therapy?
(mark all that apply; Yes = 1; No = 0; Don't know = -1; Refusal = 9)

☐ _a. By mouth (pill form)
☐ _b. By injection
☐ _c. By implantation under the skin
☐ _d. By cream (vaginal or skin)
☐ _e. By adhesive pads on the skin

☐ 88. Have you had a hysterectomy (womb removed)?
(Yes = 1; No = 0; Don't know = -1; Refusal = 9)
_a. Yes
_b. No ***(skip to question #91)***
_c. Don't know ***(skip to question #91)***

89. How old were you when you had the hysterectomy? ***(years)***
____(yrs) _a. *(age in years)*
☐ _b. Don't know

90. Why did you have a hysterectomy?
(mark all that apply; Yes = 1; No = 0; Don't know = -1; Refusal = 9)

☐ _a. Complications of pregnancy
☐ _b. Fibroid or cyst
☐ _c. Cancer
☐ _d. Contraception
☐ _e. Endometriosis
☐ _f. Prolapsed uterus/urine incontinence
☐ _g. Abnormal bleeding not due to any of above
☐ _h. Don't know
☐ _i. None of these

☐ 91. Have you had an operation to remove one or both ovaries?
(Yes = 1; No = 0; Don't know = -1; Refusal = 9)
_a. Yes
_b. No ***(skip to question #94)***
_c. Don't know ***(skip to question #94)***

92. How old were you when you had the operation to remove one or both ovaries?
____(yrs) _a. *(age in years)*
☐ _b. Don't know

☐ 93. Were one or both ovaries removed? ***(choose one answer only)***
_a. One
_b. Both
_c. Don't know

☐ 94. Have you ever had benign breast disease?
(Yes = 1; No = 0; Don't know = -1; Refusal = 9)
_a. Yes
_b. No ***(skip to question #96)***
_c. Don't know ***(skip to question #96)***

95. What type(s) of benign breast disease have you had?
(mark all that apply; Yes = 1; No = 0; Don't know = -1; Refusal = 9)

☐ _a. Cyst
☐ _b. Mastitis
☐ _c. Benign lump (not cancer)
☐ _d. Other, *please specify*_____

The next few questions are about your childbearing history

☐ 96. Have you ever been pregnant? ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
_a. Yes
_b. No ***(skip to question #139)***
_c. Don't know ***(skip to question #138)***

☐ 97. Have you had any children? ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
_a. Yes
_b. No ***(skip to question #135)***

____(yrs) 98. How old were you when your <u>first</u> child was born? ***(years)***

Please tell me some details about when each of your children was born, beginning with your oldest child.

☐ 99. <u>First child</u> ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. male
☐ _b. female
_____ _c. year of birth

☐ 100. Was this child breastfed? ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
_a. Yes
_b. No ***(skip to question #102)***
_c. Don't know ***(skip to question #102)***

☐ 101. For how many weeks was this child breastfed? ***(choose one answer only)***
_a. 1 week or less
_b. more than 1 week, less than 3 weeks
_c. 3 weeks or more, but less than 6 weeks
_d. 6 weeks or more, but less than 12 weeks
_e. 12 weeks or more, but less than 24 weeks
_f. 24 weeks or longer
_g. Don't know

☐ 102. <u>Second child</u> ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. male
☐ _b. female
_____ _c. year of birth

☐ 103. Was this child breastfed? ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
_a. Yes
_b. No ***(skip to question #105)***
_c. Don't know ***(skip to question #105)***

☐ 104. For how many weeks was this child breastfed? ***(choose one answer only)***
_a. 1 week or less
_b. more than 1 week, less than 3 weeks
_c. 3 weeks or more, but less than 6 weeks
_d. 6 weeks or more, but less than 12 weeks
_e. 12 weeks or more, but less than 24 weeks
_f. 24 weeks or longer
_g. Don't know

☐ 105. Third child ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. male
☐ _b. female
____ _c. year of birth

☐ 106. Was this child breastfed? ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
_a. Yes
_b. No ***(skip to question #108)***
_c. Don't know ***(skip to question #108)***

☐ 107. For how many weeks was this child breastfed? ***(choose one answer only)***
_a. 1 week or less
_b. more than 1 week, less than 3 weeks
_c. 3 weeks or more, but less than 6 weeks
_d. 6 weeks or more, but less than 12 weeks
_e. 12 weeks or more, but less than 24 weeks
_f. 24 weeks or longer
_g. Don't know

☐ 108. Fourth child ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. male
☐ _b. female
____ _c. year of birth

☐ 109. Was this child breastfed? ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
_a. Yes
_b. No ***(skip to question #111)***
_c. Don't know ***(skip to question #111)***

☐ 110. For how many weeks was this child breastfed? ***(choose one answer only)***
_a. 1 week or less
_b. more than 1 week, less than 3 weeks
_c. 3 weeks or more, but less than 6 weeks
_d. 6 weeks or more, but less than 12 weeks
_e. 12 weeks or more, but less than 24 weeks
_f. 24 weeks or longer
_g. Don't know

☐ 111. Fifth child ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. male
☐ _b. female
____ _c. year of birth

☐ 112. Was this child breastfed? ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
_a. Yes
_b. No ***(skip to question #114)***
_c. Don't know ***(skip to question #114)***

☐ 113. For how many weeks was this child breastfed? ***(choose one answer only)***
_a. 1 week or less
_b. more than 1 week, less than 3 weeks
_c. 3 weeks or more, but less than 6 weeks
_d. 6 weeks or more, but less than 12 weeks
_e. 12 weeks or more, but less than 24 weeks
_f. 24 weeks or longer
_g. Don't know

☐ 114. Sixth child ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. male
☐ _b. female
____ _c. year of birth

☐ 115. Was this child breastfed? ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
_a. Yes
_b. No ***(skip to question #117)***
_c. Don't know ***(skip to question #117)***

☐ 116. For how many weeks was this child breastfed? ***(choose one answer only)***
_a. 1 week or less
_b. more than 1 week, less than 3 weeks
_c. 3 weeks or more, but less than 6 weeks
_d. 6 weeks or more, but less than 12 weeks
_e. 12 weeks or more, but less than 24 weeks
_f. 24 weeks or longer
_g. Don't know

☐ 117. Seventh child *(Yes = 1; No = 0; Don't know = -1; Refusal = 9)*
☐ _a. male
☐ _b. female
____ _c. year of birth

☐ 118. Was this child breastfed? *(Yes = 1; No = 0; Don't know = -1; Refusal = 9)*
_a. Yes
_b. No *(skip to question #120)*
_c. Don't know *(skip to question #120)*

☐ 119. For how many weeks was this child breastfed? *(choose one answer only)*
_a. 1 week or less
_b. more than 1 week, less than 3 weeks
_c. 3 weeks or more, but less than 6 weeks
_d. 6 weeks or more, but less than 12 weeks
_e. 12 weeks or more, but less than 24 weeks
_f. 24 weeks or longer
_g. Don't know

☐ 120. Eighth child *(Yes = 1; No = 0; Don't know = -1; Refusal = 9)*
☐ _a. male
☐ _b. female
____ _c. year of birth

☐ 121. Was this child breastfed? *(Yes = 1; No = 0; Don't know = -1; Refusal = 9)*
_a. Yes
_b. No *(skip to question #123)*
_c. Don't know *(skip to question #123)*

☐ 122. For how many weeks was this child breastfed? *(choose one answer only)*
_a. 1 week or less
_b. more than 1 week, less than 3 weeks
_c. 3 weeks or more, but less than 6 weeks
_d. 6 weeks or more, but less than 12 weeks
_e. 12 weeks or more, but less than 24 weeks
_f. 24 weeks or longer
_g. Don't know

☐ 123. Ninth child *(Yes = 1; No = 0; Don't know = -1; Refusal = 9)*
☐ _a. male
☐ _b. female
____ _c. year of birth

☐ 124. Was this child breastfed? *(Yes = 1; No = 0; Don't know = -1; Refusal = 9)*
_a. Yes
_b. No *(skip to question #126)*
_c. Don't know *(skip to question #126)*

☐ 125. For how many weeks was this child breastfed? ***(choose one answer only)***
_a. 1 week or less
_b. more than 1 week, less than 3 weeks
_c. 3 weeks or more, but less than 6 weeks
_d. 6 weeks or more, but less than 12 weeks
_e. 12 weeks or more, but less than 24 weeks
_f. 24 weeks or longer
_g. Don't know

☐ 126. Tenth child ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. male
☐ _b. female
____ _c. year of birth

☐ 127. Was this child breastfed? ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
_a. Yes
_b. No ***(skip to question #129)***
_c. Don't know ***(skip to question #129)***

☐ 128. For how many weeks was this child breastfed? ***(choose one answer only)***
_a. 1 week or less
_b. more than 1 week, less than 3 weeks
_c. 3 weeks or more, but less than 6 weeks
_d. 6 weeks or more, but less than 12 weeks
_e. 12 weeks or more, but less than 24 weeks
_f. 24 weeks or longer
_g. Don't know

☐ 129. Eleventh child ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. male
☐ _b. female
____ _c. year of birth

☐ 130. Was this child breastfed? ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
_a. Yes
_b. No ***(skip to question #132)***
_c. Don't know ***(skip to question #132)***

☐ 131. For how many weeks was this child breastfed? ***(choose one answer only)***
_a. 1 week or less
_b. more than 1 week, less than 3 weeks
_c. 3 weeks or more, but less than 6 weeks
_d. 6 weeks or more, but less than 12 weeks
_e. 12 weeks or more, but less than 24 weeks
_f. 24 weeks or longer
_g. Don't know

☐ 132. Twelfth child ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
☐ _a. male
☐ _b. female
____ _c. year of birth

☐ 133. Was this child breastfed? ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
_a. Yes
_b. No ***(skip to question #135)***
_c. Don't know ***(skip to question #135)***

☐ 134. For how many weeks was this child breastfed? ***(choose one answer only)***
_a. 1 week or less
_b. more than 1 week, less than 3 weeks
_c. 3 weeks or more, but less than 6 weeks
_d. 6 weeks or more, but less than 12 weeks
_e. 12 weeks or more, but less than 24 weeks
_f. 24 weeks or longer
_g. Don't know

☐ 135. Have any of your pregnancies resulted in stillbirth?
(Yes = 1; No = 0; Don't know = -1; Refusal = 9)
_a. Yes
_b. No ***(skip to question # 137)***
_c. Don't know ***(skip to question # 137)***

136. Would you please tell me the year (or years) when you had a stillbirth?
____ _a. First stillbirth ***(year)***
____ _b. Second stillbirth ***(year)***
____ _c. Third stillbirth ***(year)***
☐ _d. Don't know

☐ 137. Have you had any miscarriages? ***(Yes = 1; No = 0; Don't know = -1; Refusal = 9)***
_a. Yes
_b. No ***(skip to question # 139)***
_c. Don't know ***(skip to question # 139)***

138. Would you please tell me the year (or years) when you had a miscarriage?
____ _a. First miscarriage ***(year)***
____ _b. Second miscarriage ***(year)***
____ _c. Third miscarriage ***(year)***
☐ _d. Don't know

Identifier #☐☐☐☐

The next questions are about your food habits.

☐ 139. Have you changed your eating habits in the past 2 years?
(Yes = 1; No = 0; Don't know = -1; Refusal = 9)
_a. Yes
_b. No ***(skip to question #143)***
_c. Don't know ***(skip to question #143)***

140. Please tell me why you have changed your eating habits in the past 2 years.
(mark all that apply; Yes = 1; No = 0; Don't know = -1; Refusal = 9)
☐ _a. To reduce overweight/obesity
☐ _b. To reduce stomach problems, e.g. ulcer or gastritis
☐ _c. To manage diabetes
☐ _d. To manage bowel problems, e.g. irritable bowel or diverticulitis
☐ _e. To reduce high blood cholesterol
☐ _f. To reduce high blood pressure
☐ _g. Concern over a family history of illness, *please specify*_____
_____
☐ _h. To manage allergies, e.g. skin rash
☐ _i. Concern over eating a healthy diet
☐ _j. Other *(give details)*_____

☐ 141. Are you currently following a special diet prescribed by a doctor or dietitian?
(Yes = 1; No = 0; Don't know = -1; Refusal = 9)
_a. Yes
_b. No ***(skip to question #143)***
_c. Don't know ***(skip to question #143)***

142. We are interested in any special diets you are following which were prescribed by a doctor or dietitian. Are you following a ....
(mark all that apply; Yes = 1; No = 0; Don't know = -1; Refusal = 9)
☐ _a. Low fat/ low saturated fat diet
☐ _b. Low salt diet
☐ _c. Weight reduction diet
☐ _d. Diabetic diet
☐ _e. High fibre diet
☐ _f. Vegetarian (Lacto-ovo) diet
☐ _g. Vegetarian (Vegan) diet
☐ _h. Diet to manage allergies
☐ _i. Other *(give details)*_____

____ 143. What is the MOST you have ever weighed as an adult (excluding pregnancy)?
_a. ☐ lbs ☐ kg
☐ _b. Don't know

____ 144. What is the LEAST you have ever weighed as an adult?
_a. ☐lbs ☐ kg
☐ _b. Don't know

☐ 145. Again excluding pregnancy, have you LOST 15 pounds or more in the last 5 years? ie. do you weigh 15 pounds less this month than you did in June 1993?
(Yes = 1; No = 0; Don't know = -1; Refusal = 9)
a. Yes
b. No ***(skip to question #147)***
c. Don't know ***(skip to question #147)***

146. Why did this weight loss occur?
(mark all that apply; Yes = 1; No = 0; Don't know = -1; Refusal = 9)
☐ _a. Diet
☐ _b. Exercise
☐ _c. Illness
☐ _d. Other, *please specify*_____
☐ _e. Don't know

☐ 147. Again excluding pregnancy, have you GAINED 15 or more pounds in the last 5 years? ie. do you weigh 15 pounds more this month than you did in June 1993?
(Yes = 1; No = 0; Don't know = -1; Refusal = 9)
_a. Yes
_b. No ***(skip to question #149)***
_c. Don't know ***(skip to question #149)***

148. Why did this weight gain occur?
(mark all that apply; Yes = 1; No = 0; Don't know = -1; Refusal = 9)
☐ _a. Diet
☐ _b. Exercise
☐ _c. Illness
☐ _d. Other, *please specify*_____
☐ _e. Don't know

Anthropometric Measures

149. **Height:** _____ ☐cm or ☐inches

150. Weight used for calibration
☐☐☐.☐ Kg

Weight on scale of calibration weight
☐☐☐.☐ Kg

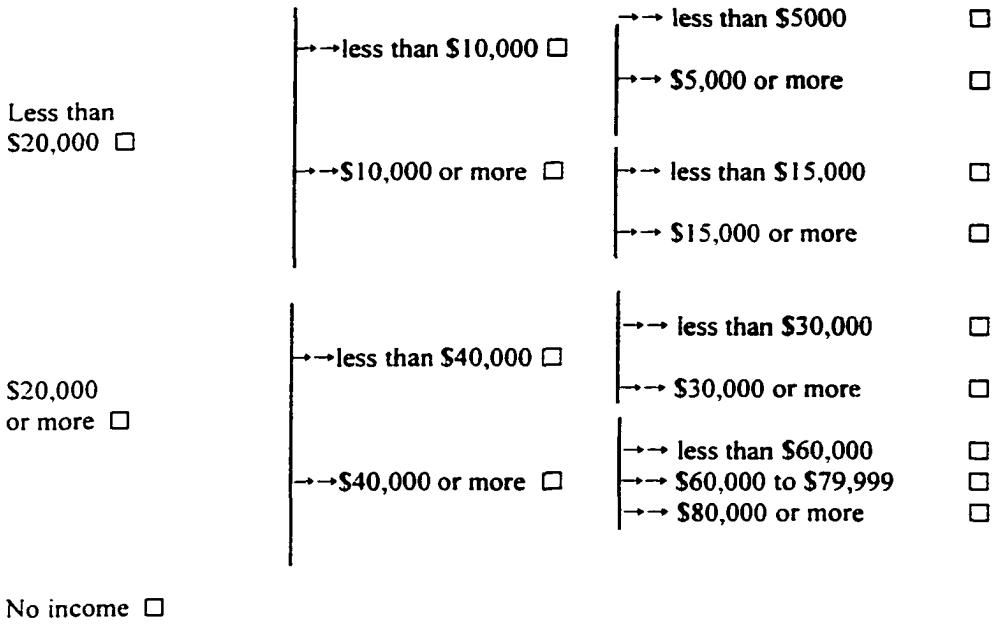
151. **Weight:** _____ ☐kg or ☐pounds

Measured ☐
Self-reported ☐....Reason_____
Refusal ☐

152. **Waist:** _____ cm		_____ cm	Refusal ☐
153. **Hips:** _____ cm		_____ cm	Refusal ☐

☐ 154. How would you best describe your race or colour? ***(choose one answer only)***
_a. White
_b. Black
_c. Aboriginal peoples of North America
_d. Other, *please specify*_____

155. What is your best estimate of the total income of all household members from all sources in 1997 before taxes and deductions? Was the total household income.....



9.2 Health and lifestyle variables

Variable	Variable unit or description (-1 = don't know; 9 = refusal)
Demographics	
schooling	1=no schooling 2=some Elementary 3=completed Elementary 4=some Secondary 5=completed Secondary 6=some Community College, Technical College or Nurse's Training 7=completed Community College, Technical College or Nurse's Training 8=some University or Teacher's College 9=completed University (eg B.A., M.A., PhD) or Teacher's College
marital status	1=single (never married) 2=married (and not currently separated) 3=common law 4=divorced/separated 5=widowed
age	years
Anthropometrics	
height	cm

Variable	Variable unit or description (-1 = don't know; 9 = refusal)
weight	kg
waist measurements	cm
hip measurements	cm
Family history (mother, father, siblings #1-16):	
age (or age at death)	years
primary cause of death (if any)	1=heart disease; 0=no; 1=yes 2=stroke; 0=no; 1=yes 3=cancer (specify part of body where it started); location coded 4-29 by name 4=other (specify); coded 31-64 by name 5=don't know
health conditions experienced (and age in years at time of onset)	1=heart attack; 0=no; 1=yes 2=stroke; 0=no; 1=yes 3=diabetes; 0=no; 1=yes 4=osteoporosis; 0=no; 1=yes 5=cancer (first episode); location coded 4-29 by name 6=cancer (second episode); location coded 4-29 by name 7=none of the above

Variable	Variable unit or description (-1 = don't know; 9 = refusal)
Physical Activity	
usual physical activity in hours/week	1= hrs/week walking 2=hrs/week cycling 3=hrs/week gardening 4=hrs/week housework 5=hrs/week "do it yourself" home maintenance and repairs 6=hrs/week physical exercise such as aerobics, swimming, jogging
ever engage in vigorous activity	sufficient to cause sweating or a faster heartbeat; 0=no; 1=yes
hours/week spent in vigorous activity	hours per week
stair flights climbed per day	10 steps = 1 flight
usual daily activities or work habits	1=sedentary 2=standing 3=physical work 4=heavy manual work
Personal Health History and Lifestyle Habits	
100 or more cigarettes smoked	0=no; 1=yes

Variable	Variable unit or description (-1 = don't know; 9 = refusal)
# days (in the past 30 days) that at least 1 cigarette was smoked	1=0 days 2=1 or 2 days 3=3-5 days 4=6-9 days 5=10-19 days 6=20-29 days 7=all 30 days
# cigarettes usually smoked per day	1=5 or less 2=6-10 3=11-15 4=16-20 5=21-25 6=more than 25
age at smoking cessation	years
age at menarche	years; 0=never had menstrual period
usual menstrual cycle length	1=24 days or less 2=25-26 days 3=27-29 days 4=30-31 days 5=32 or more days 6=irregular 7=used pill continuously 0=no menstrual cycles

Variable	Variable unit or description (-1 = don't know; 9 = refusal)
currently menstruating	at least 1 menstrual cycle during past 12 months 0= no; 1= yes
age at menopause	years
# menstrual periods in past 12 months	1=1-3 2=4-5 3=6-9 4=10 or more
date of start of last natural menstrual period	prior to beginning any Hormone Replacement Therapy; dd/mm/yy
Oral Contraception (OC) use	0= no; 1= yes
age at first OC use	years
length of time OC used	years
currently using OC	0= no; 1= yes
OC brand last used	coded 1-6 by name
age at last OC use	years
Hormone Replacement Therapy (HRT) use	0= no; 1= yes
currently using HRT	0= no; 1= yes
age at first HRT use	years

Variable	Variable unit or description (-1 = don't know; 9 = refusal)
length of time HRT used	years
brand name of HRT last used	coded 1-6 by name
form(s) of HRT ever used	1=by mouth 2=by injection 3=by implantation under skin 4=by cream 5=by adhesive pads on skin
hysterectomy	0= no; 1= yes
age at hysterectomy	years
reason(s) for hysterectomy	1=complications of pregnancy 2=fibroid or cyest 3=cancer 4=contraception 5=endometriosis 6=prolapsed uterus/urine incontinence 7=abnormal bleeding not due to above
oophorectomy	0= no; 1= yes
age at oophorectomy	years

Variable	Variable unit or description (-1 = don't know; 9 = refusal)
# ovaries removed	0=none 1=one 2=both
ever had benign breast disease	0= no; 1= yes
type(s) benign breast disease experienced	1=cyst 2=mastitis 3=benign lump
ever pregnant	0= no; 1= yes
ever had any children	0= no; 1= yes
age at first birth	years
Details about all children (for 1-12 children)	
gender	male: 0= no; 1= yes female: 0= no; 1= yes
year of birth	year
breastfed	0= no; 1= yes

Variable	Variable unit or description (-1 = don't know; 9 = refusal)
duration of breastfeeding in weeks	1=1 or less 2=more than 1, less than 3 3=6 or more, but less than 12 4=12 or more, but less than 24 5=24 or longer
stillbirth(s)	0= no; 1= yes
year(s) of stillbirth(s)	year(s)
miscarriage(s)	0= no; 1= yes
year(s) of miscarriage(s)	year(s)
Eating habits and weight	
change in eating habits in last 2 years	0= no; 1= yes
reason(s) for change in eating habits	1=to reduce overweight/obesity 2=to reduce stomach problems 3=to manage diabetes 4=to manage bowel problems 5=to reduce high blood cholesterol 6=to reduce high blood pressure 7=concern over family history of illness (specify) 8=to manage allergies 9=concern over eating healthy diet 10=other (specify); coded 1-9 by name

Variable	Variable unit or description (-1 = don't know; 9 = refusal)
special diet prescribed by doctor or dietitian	0= no; 1= yes
special diet(s) being followed currently	1=low fat/low saturated fat diet 2=low salt diet 3=weight reduction diet 4=diabetic diet 5=high fibre diet 6=vegetarian (Lacto-ovo) diet 7=vegetarian (Vegan) diet 8=diet to manage allergies 9=other (specify); coded 1-3 by name
maximum adult weight (excluding pregnancy)	kg
minimum adult weight	kg
weight loss	loss of 15 lb (6.8 kg) or more when compared to weight of 5 years ago; 0= no; 1= yes
reason(s) for weight loss	1=diet 2=exercise 3=illness 4=other (specify); coded 1-2 by name
weight gain	gain of 15 lb (6.8 kg) or more when compared to weight of 5 years ago; 0= no; 1= yes

Variable	Variable unit or description (-1 = don't know; 9 = refusal)
reason(s) for weight gain	1=diet 2=exercise 3=illness 4=other (specify); coded 4-8 by name
race or colour	1= white 2=black 3=aboriginal peoples of North America 4=other (specify)
income	total income of all household members from all sources in 1997 before taxes and deductions; coded 1-16 by income level

9.3 Interviewer guide to the Health and Lifestyle Questionnaire

The "Health & Lifestyle Questionnaire" is designed to help us find out about the respondents' family and personal health history, as well as their usual lifestyle habits. The questionnaire consists of four parts. The first part (Part I) deals with the respondent's demographic profile. The second part (Part II) will provide information on their family health history. The third part (Part III) will assess the respondent's level of physical activity. Questions in Part IV are about personal lifestyle habits and the respondent's health history, including smoking behaviours, reproductive history, weight gain or loss and anthropometric measures.

The questionnaire has been colour-coded to allow you, as an interviewer, to follow some of the specified skip patterns more easily. For example, questions #11 - 42 ask for health information on all of the respondent's brothers and sisters. Space has been allowed for 16 siblings. If the respondent has fewer than 16 siblings, then you should complete all appropriate questions (see page 2, Part II. Family History; **Q # 3 - 42** for specific directions), and skip to the next colour section where question # 43 begins.

Please note: Much of the information asked for is of a very sensitive nature; so ask the questions in a neutral manner and remind the respondent that all of her answers will be kept confidential. Assure the respondent that having her answer is important to the survey.

HOW TO ADMINISTER THE QUESTIONNAIRE

Read the opening statement for each part of the questionnaire in turn. Read each question to the respondent **exactly as worded** and record the responses given. Your cues and skip patterns are in ***BOLD ITALIC LETTERS*** and should not be read. Since some questions use different types of response categories, read the instructions for each carefully.

Some questions (ie question **#71**) have different wording depending on whether the respondent is a case or a control. Be sure to use the appropriate wording!

STEPS TO COLLECTING INFORMATION

1) Read each question to the respondent, and note any special interviewer instructions carefully.

2) While the majority of questions require only a single answer, there are a few questions that require multiple answers. Read each question carefully: directions for answers are included at the end of the question in bold italics.

3) During the interview:
i) Make a tick beside the appropriate letter on the line provided as the respondent provides the answers to questions during the interview;
ii) Complete those questions requiring age (ie # 43: age at illness), date (ie #99: year of birth) and specific information on the line provided in the left margin (ie #140: "please specify concern over family history of illness").

4) After the interview is completed but before leaving the respondent's home, check the questionnaire carefully to make sure that you have asked all of the appropriate questions and follow the skip patterns correctly.

5) Later, after the interview, complete the coding boxes associated with each question. Note that the following notation should be used for questions requiring Yes/No answers:
use the number **"1"** to indicate **"YES"**;
use the number **"0"** to indicate **"NO"**;
use the number **"-1"** to indicate a **"DON'T KNOW"**
and the number "**9**" to indicate a "**REFUSAL**"

This "legend" is repeated in the interviewer directions after all questions where this notation should be used.
While we have included the option of "refusal" to answer, do not offer this as an option to the respondents. Many of the questions are personal and sensitive in nature, but it is very important that we get the answers.

6) Before passing the questionnaires in, re-check to make sure that all coding and questions are answered.

Part I Demographic Profile

Q #1: Education: The highest level reached should be recorded and not every stage up to this point. Some probing may be required for this question since a distinction is required between 'some' and 'completing' an education level. 'Elementary' is defined as up to and including grade six. Once a level is suggested by an individual, probe to ascertain whether the next higher level is appropriate, e.g. for a student who has completed one year of university, tick beside response h. 'Some University'. If the person has a Bachelor degree or higher degree (Masters or Ph.D.), then tick beside response i. 'Completed university'.

Response j. 'Other education or training' is to be used for recording education or training completed in another country or any other that does not fit into any of the other categories.

Q #2: Marital Status. Note that 'living common law' is coded the same as 'married'.

Part II. Family History

Q #3 - 42: These questions pertain to the family health history. Please note that we need to know about the biological family (ie blood relations) if possible. Ask the questions as worded. Note the question layout and follow indicated "skip to" patterns. The even numbered questions in this series (questions #11 - 42) ask about the cause of death of the sibling. Please note that we are only interested in the primary cause of death; tick one answer only. In the case of cancer, please ask the respondent to specify or describe the part of the body where the cancer started.
If the cause of death is attributed to something not on the list, please tick part "d. Other", and specify the cause.
If the cause of death is unknown, tick part "e. Don't know".

Q #3 - 8: ask about the health of the respondent's parents. If the respondent cannot remember the exact age of a parent (or the exact age at which the parent died), probe to see if they can remember the age (or age at death) within a decade. For example, "I really don't remember how old my mother was when she died, but I know she was in her 80"s". In this case, you would simply write "80's" on the appropriate line.

Q #9-10: ask about the number of brothers and sisters.

Q #11-42: ask about the health of the respondent's siblings.

Please note the first box beside each odd numbered question from question 11 - 41: this box is to be used to indicate whether or not there is a sibling.
Use parts a and b of these same questions to indicate whether the sibling is a brother or sister.
Use part c of these questions to indicate the blood relationship of the sibling: is the sibling a half brother /sister, or a full brother/ sister?
Part d asks for the current age of the sibling, or the age at which they died.
If the respondent cannot remember the exact age of their sibling, or the age at which they died, try to have them remember the age within a decade (see above for parents).
ie. question #11:

☐ 11. First brother or sister (Yes = 1; No = 0; Don't know = -1; Refusal = 9)

☐ _a. Brother

☐ _b. Sister

☐ _c. Half brother/sister

_____(yrs) _d. Present age, or age at which they died

During the interview:
If the respondent has a first sibling, put a "**1**" in the box beside the question number 11.
If that sibling is a sister, make a tick beside "b. Sister".
If that sibling is a full sister, put a line through "c. Half brother/sister".
Lastly, complete the age of the sister; either the current age, or the age at which she died.

After the interview is completed, complete the boxes as follows:
write "**0**" in the box beside "a. Brother";
write "**1**" in the box beside "b. Sister"; and
write "**0**" in the box beside "c. Half brother/sister".

If the respondent had only 2 siblings, then "**0**" should be written in the box beside the question number 15. This would indicate that the respondent has only 2 siblings. Continue on to question # 43. After the interview is completed, write "**0**" in the first box of the remaining odd numbered questions in this series of questions ie in questions # 17, 19, 21, 23, 25,..... 41.

There is space provided for 16 siblings; if the respondent has fewer than 16 siblings, complete the questions for the given number of siblings, then skip to the next series of questions. The questionnaire is colour-coded to ease identification of question series.

Q #43 - 60: These questions pertain to specific health conditions of family members. Each part of every question must be asked. Note that for parts 'a' (heart attack) and 'c' (stroke) we are interested in the age at the time of the first episode. For the remaining health conditions (diabetes, osteoporosis and cancer) fill in the initial age at diagnosis. Again, there is space provided for 16 siblings. Follow the same procedure as above if there are fewer than 16 siblings.

Part III. Physical Activity

Q #61 - 65: All questions relate to the respondent's **usual** level of activity during the specified time period. All of these questions relate to a specific time frame that will vary according to whether the individual has been diagnosed with breast cancer or not. The time frame for controls is the past 12 months prior to the interview date (ie May 1997 - April 1998); for cases, you should ask about the period 12 months prior to diagnosis of cancer (ie if diagnosis was made in Sept 1998 the time period of interest is Oct 1997 to Sept 1998).

Part IV Personal Health History and Lifestyle Habits

Q #66 -69 Smoking: The next four questions are about cigarette smoking.

Q #66: If the respondent has not smoked 100 or more cigarettes (answers "No" to Q66), skip questions 67 and 68 and go directly to Q70. If the respondent doesn't know whether or not they have smoked 100 or more cigarettes, continue on to question #67.

Q #67: Note that if the respondent has not smoked at least one cigarette in the past 30 days (ie they choose option "a. 0 days"), skip to question # 69.

Q #68: Ask the question as posed. If the respondent usually smokes every day, ask them to tell you how many cigarettes they smoke per day.

If the respondent refuses to answer any of the questions on smoking, write "Refused" clearly in the right margin opposite the question refused.

Q #69: This question should only be asked of those respondents who have smoked at least 100 or more cigarettes in their lives, but have not smoked at least one cigarette in the past 30 days (ie they have said "yes" to question #66, and have chosen "a. 0 days" as their response to question # 67). If the respondent cannot remember how old she was when she stopped smoking, make a tick on the answer line beside "b. Don't know", and put a "-1" (ie. the coding equivalent of " Don't know") in the box beside.

Q #70 begins the series of questions on menstrual cycles. It's very important to get the age at which the respondent had her first menstrual period. This will give us information on her hormonal exposure. An exact age is best, but if she can't give you that, try to get an age +/- 1 years. If this option is used, the age should be noted as age +/- 1 years on the answer line (ie 12 +/- 1 year).
Note that if the respondent has absolutely no recollection of her age at the time of her first menstrual period, you should tick option "b", and write "-1" (ie the coding equivalent of "Don't know") in the box beside. **This option should only be used as a last resort.**

Q #71: Please note the respondent's year of birth and use the appropriate wording for this question. The answer options are the same regardless of which wording is used. Tick the response given by the respondent. After the completion of the interview, write in the letter of the response in the correct box.

Q #73: This question will only be completed by those respondents who are not currently menstruating. As with question # 70, it is important to get the exact age, if possible. If the respondent cannot remember her exact age, follow the procedures outlined for question #70.

Q #75: This information will validate information given in Q #74. Note that the question is asking for the date of the last "natural" menstrual period. For those respondents who are on Hormone Replacement Therapy (HRT), we would like to know

the date of their last period before beginning HRT. This question is similar in intent to question # 70 and 73 - it will give us information on the individual's hormonal exposure through the years. If the respondent answered question #73, you may use that information to help probe for the date required for this question.

It's very important to get at least the **year** of the last natural menstrual period. Probing for things such as her age at last natural period may help her to remember.

As with the age at first menstruation, if the respondent cannot remember her exact age at her last natural period, then try to get the year +/- 1 year. If this option is used, it should be noted in a similar fashion to that used in question # 70 (ie 1989 +/- 1 year).

If the respondent has absolutely no recollection of the date or her age at the time of her last natural menstrual period, you should tick option "b", and write "-1" (ie the coding equivalent of "Don't know") in the box beside. **This option should only be used as a last resort.**

Q #78: Note that you should tick which units you are using to report the time frame; then fill in the actual number on the line beside the question.

Q #80: If the respondent cannot remember the brand name of the last contraceptive pills that she used, write in "don't know" on the answer line.

Q #81: If the respondent cannot remember how old she was when she last used the "pill", then tick on the answer line beside "b. Don't know" and write "-1" (for "Don't know") in the box beside the question.

Q #86: If the respondent cannot remember the brand name of the HRT treatment last used, write in "don't know" on the answer line.

Q #89: As with questions # 70, 73 and 75, this information is very important. Some gentle probing may help the respondent to remember. An exact age is the best, but if that is impossible, try to get an age within +/- 1 yr.
If this option is used, it should be noted in a similar fashion to that used in questions # 70 and 75
(ie 49 +/- 1 year).

If the respondent has absolutely no recollection of her age at the time of her hysterectomy, you should tick option "b", and write "-1" (ie the coding equivalent of "Don't know") in the box beside. **This option should only be used as a last resort.**

Q #94, 95: If the respondent is unsure of what "benign breast disease" means, or is having difficulty remembering, you may use the named types of benign breast disease in question # 95 to clarify and aid recall.

Q #96 - 140: These questions ask for details of the respondent's reproductive history. Questions #96 and 97 begin the series by asking if the respondent has ever been pregnant, or had children. If the respondent has never been pregnant, skip to question #139. If she has been pregnant, but has never had any children, skip to question # 135.

There are spaces provided for 12 children. If the respondent has had fewer than 12 children, follow the same procedure as was used for siblings in questions 11-42 (ie put "**0**" in the first box beside the question number to indicate "no more children"). Skip to question # 135.

For example:
If the respondent had 8 children, complete questions # 99 - 122.
Write "**0**" in the first box beside question #123, and continue on to question 135.

Q #97: "Children" in this question include all live births, as well as full-term still-born children.

Q #98: It is very important to get the age when the respondent's first child was born. This will give us information on her hormonal exposure. An exact age is best, but if she can't give you that, try to get an age +/- 1 years. If this option is used, the age should be noted as age +/- 1 years on the answer line (ie 12 +/- 1 year).
Note that if the respondent has absolutely no recollection of her age at the time of the birth of her first child, you should tick option "b", and write "-1" (ie the coding equivalent of "Don't know") in the box beside. **This option should only be used as a last resort.**

Q #99 - 133: Begin with the oldest child and progress to the youngest; this may help with memory recall.

Q #100 and 101: This includes all breastfeeding, even if it is only on an occasional basis.

Q #135 - 138: These questions ask for details of stillbirths and miscarriages. This is an extremely sensitive area for most individuals. Reassure the respondent again, if necessary, that her answers are important and will be held in strict confidence.

Diet History

Q #139 - 142: The next four questions are about the respondent's food habits. They are designed to provide some information as to whether the respondent has changed their diet in the last 2 years, and if so, for what reason.

Q #140: This question includes all changes in eating habits, whether prescribed or self imposed.

Q #142: This question pertains only to diets prescribed by a physician or dietitian.

Q #143-148: These questions are designed to provide some information on maximum and minimum adult weights, weight loss or gain, and reasons for weight loss or gain.

Q #145 and 147: Please be sure and read the entire question including the example given (change the date as necessary), to the respondent. These questions are intended to compare the current weight of the respondent against their weight 5 years ago.
For example, question # 145 asks about whether the respondent has lost 15 or more pounds in the past 5 years. Ask the respondent to think about how much she weighed 5 years ago (ie June 1993), compare that weight to her current weight and make a decision: does she weigh 15 pounds less today than she did in June 1993?
These questions are not concerned with cyclical fluctuations in weight. They are intended to assess the absolute difference in weight (ie. no change, loss or gain), between 1993 and 1998.

Q #145: Again excluding pregnancy, have you LOST 15 pounds or more in the last 5 years? ie. do you weigh 15 pounds less this month than you did in June 1993?
If the respondent weighed 140 lbs in June 1993, do they weigh 125 pounds or less today?

Q #147: Again excluding pregnancy, have you GAINED 15 or more pounds in the last 5 years? ie do you weigh 15 pounds more this month than you did in June 1993? If the respondent weighed 140 pounds in June 1993, do they weigh 155 pounds or more today?

Q #146 and 148: These questions query the reason(s) for the weight loss or gain. Read the list to the respondent. Use the Yes/No coding, and mark all reasons that apply. If a reason other than those listed is given by the respondent, please tick "Other", and write the reason in beside.

At the end of this section, thank the subject and indicate that you just have a few short questions left.

The first four questions of the **NON-RESPONSE QUESTIONNAIRE** should be completed now. These questions are designed to assess any significant differences

between survey participants and non-participants.

The Anthropometric Measures, ethnicity and income questions are the last sections of the survey to be administered by the interviewer. Although last, these are by no means the least important. Without this information, inferences to the public at large or specific age groups cannot be drawn.

Anthropometric Measures:

Q #149, 150: Weight and Height.

Q #152, 153: Waist-Hip Circumferences. Remember to do a third measurement if the two measurements are different by 0.4 cm or more. If the third measurement is out by 0.4 cm or more, then a fourth measurement is required.

See Section 2. Measuring Weight and Height (following) for specific guidelines on how to take these measures.

Q #154. Ethnicity: Ask the question as worded. If the respondent chooses "d. Other", please be sure to write in the appropriate race or colour on the line beside this option.

Q #155: Income: This question asks about the total income of all members of the household. from all sources before deductions. The advantage of this format is that it does not require the respondent to report their exact income, but to gradually indicate the range that their income falls into.

Start by asking whether their total income was greater or less than 20,000.00. Check the appropriate box then probe for more specific information. For example, if the respondent answers 'less than 10,000", probe for whether their income was less than or greater than 5,000. When the respondent has identified the most specific estimate of the income category (e.g.14- '30,000 or more', check that box. Then draw a line through other responses which are lower (e.g. 02-20,000 or more and 07- less than 40,000). This will allow the highest level to be easily coded.

If the respondent is reluctant to answer, assure her/him that the information is confidential and will be used to described groups in the sample. No names will be used in the analysis. If possible, try to get the first or second level answer.

If the respondent had no income in 1997, check "no income".

Although questions on income are sometimes sensitive, this question is very important. It is asked because differences in income often indicate differences in the ability to obtain a healthy diet needed to prevent diseases, as well as to obtain adequate health care. It will

also allow us to relate income to other health variables and the utilization of health services, etc.

If the respondent refuses to provide income information, record clearly on bottom right of the page 'Respondent refused to answer'.

If the individual has lived in more than one household in the last year (1997), indicate the income for the household in which the individual has spent the most time in 1997.

Section 2. Measuring Weight and Height

Height, weight, waist and girth measurements are to be taken on each individual. These data will be used in two ways:

1) to calculate the average nutrient requirements for groups of people in the survey defined, for example, by age, Body Mass Index (BMI) and Waist to Hip Ratio (WHR). The WHR is one of the simplest indices of body fat distribution for the general population. WHR is calculated during data processing by the formula: WAIST (ABDOMINAL) GIRTH (cm)/HIP (GLUTEAL) GIRTH (cm). BMI is calculated during data processing by the formula: BMI = Weight (kilograms/Height^2 (meters).

2) to identify individuals and groups at risk of certain diseases associated with body composition using BMI and WHR. BMI is an indicator of weight for height. High indices, over 27, are associated with an increased incidence of hypertension, hyperlipidemia, coronary heart disease and other health problems. Values below 20 may be associated with other health problems. WHR is used as an indicator for body fat distribution. WHRs in excess of 0.8 for women are associated with an increased risk of CVD. A high WHR has been demonstrated to be an independent risk factor for acute myocardial infarction, angina pectoris, stroke and obesity mortality.

Survey interviewers are to measure weight and height with strict adherence to the following methods:

1. Weight and height measurements should be performed, if at all possible, in a room WITHOUT FLOOR CARPETING, eg. kitchen, bathroom, or other room with tile, wood or other hard surface flooring and preferably without a baseboard. The back of a door may be suitable.

2. If you are unable to obtain weight or height measurements, (eg. a person in a wheel chair or with curvature of the spine or unwilling for some other reason), self reported height and weight may be recorded. Check off the self-reported box. Record self-reported weights and heights in unit of measure as reported by the individual. If the individual refuses to be measured or give a self-reported weight or height, check off the refusal box.

MEASURING WEIGHT

Equipment: Weigh Scale

Procedure: 1) Calibrate the scale weekly against the scale located in the survey office.

2) Zero the scale before each measurement.

3) Have the person remove shoes and any heavy clothing: suede jackets, heavy sweaters etc. and also heavy items like keys, change, wallets etc. from pockets.

4) Have the person step on the scale and remain there until the arrow on the dial readout stops fluctuating.

5) Read aloud and record the weight in kilograms (kg) to the nearest 0.5 kg.
e.g.
☐☐☐.☐

MEASURING HEIGHT

Equipment: Measuring tape with lock and stainless steel footplate, set square, headboard, pads of POST-IT notes.

Procedure:

1) Have person remove shoes, slippers etc.

2) Place a POST-IT note vertically on the wall at a level appropriate for marking the participant's height. (You may have to stand on a stool or chair to position the person's head. Have one ready if the person is taller than you are).

3 The participant stands erect, arms crossed in front of their chest, feet together, the heels, back and the back of the head against the wall, with the head centered at the POST-IT note.

4) The longer arm of the set square is placed on the head, depressing the hair to make firm contact, the shorter arm pointing upward, flat against the POST-IT note and wall. The participant is then instructed to look straight ahead, stand as tall as possible and take a deep breath while the measurement is taken. Check to ensure that the person's heels remain in contact with the floor. Have the person step away. A mark is made at the level of the lower border of the square on the POST-IT note.

5) Pull out the tape vertically, hold the leader against the floor with your foot and the tape butt against the wall, stretching it a little past the mark on the POST-IT note and lock it. If you are measuring persons taller than yourself, ask them to hold the leader with their foot while you take a reading standing on the stool or chair.

6) Read the tape in centimeters (cm) with the mark lined up at eye level.

The distance from the floor to the mark is recorded to the nearest 0.1 cm
e.g.

WAIST-HIP CIRCUMFERENCE

Equipment: Lufkin Executive Diameter Tape

Procedure: 1) If the participant is wearing a belt or heavy clothing, ask them if they could remove the belt and/or lift up their shirt/sweater. **You should not do this for them.** If they are wearing heavy sweatpants or jeans, you may want to ask them to roll down the waistband to facilitate the waist measurement. **Use your best judgement**.

2) The participant stands erect in a relaxed manner, arms crossed in front of their chest.

3) Measurements are made from the client's right hand side. The interviewer kneels, in order to be at eye level with the measuring tape. Always hold the tape in the left hand.

4) Hold the tape between thumbs and index fingers with the second fingers stabilizing and leveling the tape. A cross handed technique (right hand under the left) is used to bring the zero line of the tape in line with the waist measurement.

5) Ensure the tape is properly located in the horizontal plane in accordance with the instructions listed below.

6) Apply tension to the tape sufficient to maintain its position but not to cause indentation of the skin surface. If you are measuring over clothing you need to apply slightly more tension to allow for the thickness of the clothing. The measure should be taken at the end of

normal expiration.

7) All measurements are recorded to the nearest 0.1 cm

e.g.

8) Take measurements twice. If there is a difference of more than 0.4 cm between these measurements, take a 3rd measurement. In extreme situations a fourth measurement may be taken. The two closest measures will be selected when the forms are reviewed by the facilitator.

9) Check off the refused box if the person refuses to be measured.

Waist Girth

Position the tape horizontally at the point of noticeable waist narrowing. The tape is then placed in the recording position and the measurement is made at the end of a normal expiration. In some participants, an indeterminate waist can be approximated by taking the girth between the ribs and the iliac crest. Ask the participant to put their hands on their ileac crest (hipbone) and take the waist measurement just above this point.

Hip Girth

Position the tape around the hips at the level of the greatest gluteal protuberance and the symphysis pubis.

SCALE CALIBRATION PROTOCOL

Pre-Calibration

The scales have been calibrated by the manufacturer and checked at the survey office. Transport the scale in the original box. Handle the scales very carefully and always weigh on a flat surface such as kitchen or bathroom floor (tiled floors can be a problem as the tiles may not be flat). It is assumed that the survey scale is accurate upon purchase.

Weekly Calibration

During the survey, the scale should be calibrated every week using a known weight of 20 kg.

The scale should be calibrated as follows:

1. First Time Calibration

   a. A known weight of 20kg will be established by the survey manager by filling a container with water until it weighs 20kg.

   b. Weigh the calibration weight on your scale and determine the difference (if any). For example, 20 kg on the office scale may weight 21 kg on your scale. Record this difference and file in your manual for future use as necessary.

2. Weekly Calibration

   a. Weigh the calibration weight on your office scale during your weekly meeting. Record this under "Weight on scale of Calibration weight" in Q #150 each week. The known weight taken the 1st day is also recorded in Q #150 under "Weight used for Calibration."

Weight used for Calibration ☐☐☐.☐ kg

Weight on scale of Calibration Weight ☐☐☐.☐ kg

   b. Record the weight of the respondent as shown on the scale. You do not have to do any calculations.

3. Calibration Changes

If the known weight starts to decrease dramatically or consistently (e.g. water loss from container), it may be due to a loss of water from the known weight or there may be a

problem with the calibration of your office scale. Check the known weight as follows:

Fluctuation in the Known Weight:

a. Weigh the known weight on your scale. It may weigh 19 kg instead of 21 kg, reflecting a dramatic change over a couple of days.

b. Weigh the known weight on the office scale. It may weigh 18 kg. Remember that the first time it weighed 20 kg on the facilitator's scale, thus there has been a 2 kg loss from the known weight. Add water (or weight) to the known weight to bring it back up to 20 kg.

Loss of Calibration in the office scale:

c. If the known weight on the office scale showed 20 kg as it did the first time, it means that your survey scale is losing it's calibration. The known weight actually does still weigh 20 kg and not the 19 kg it shows on your survey scale.

Continue to record the known weight as 20 kg, but now record the Weight of the Calibration Weight" as 19 kg for that week.

There are several variations of the above example but realize that the quality of the scale and the care in handling will influence whether any of these scenarios arise. Ideally, there will be little change in the scale's calibration over the survey season.

Zeroing the Scale

The scale has already been calibrated. To zero the scale, press your weight with your hands on scale while the scale is on a table or step on the scale when it is on the floor. Step off. Zero the scale using black button at bottom end of scale. Repeat this process, then take the weight. The scales should not need to be adjusted frequently.

Calculation of the Correction Factor

This is for your information only. Correction Factors will be calculated by office staff. Correction factors are determined in the following manner:

$$CF = \frac{X}{22}$$ where '22' is the 'known weight' and 'X' is the difference between the known weight and the scale reading.

Examples:

Day 1: The scale weighs the 22 kg of known weight at 22 kg, therefore a 70 kg person would weigh 70 kg. No correction factor is needed on this day.

Day 2: The scale weighs 22 kg of known weight at 23.5 kg, therefore a correction factor is needed.

$$CF = \frac{22-23.5}{22.68} = \frac{-1.5}{22} = -0.068$$

An observed weight of 65 kg would be 61 Kg.

65 x (-0.068) = -4.43
65 + (-4.43) = 60.57

Day 3: The scale weighs 22 kg of known weight at 21 kg, therefore a correction factor is needed.

$$CF = \frac{22-21}{22} = \frac{1}{22} = 0.045$$

An observed weight of 82 kg would be 86 kg.

82 x 0.074 = 3.73
82 + 3.73 = 85.7

These examples demonstrate how even small changes in how heavy or light the scale weighs can effect the overall weight of a respondent and in turn the accuracy of the data. Ensure the calibration is done weekly.

10. APPENDIX D

10.1 Multivariate model diagnostics

Model # 1: carot2 (carotenoids/total energy), hvigor (hrs/wk vigorous physical exercise), kcal (total energy); age ≥ 50, excludes reference numbers 1257 1254 1268

Response Profile

Ordered Value	STATUS	Count
1	1	31
2	2	37

Model Fitting Information and Testing Global Null Hypothesis BETA=0

Criterion	Intercept Only	Intercept and Covariates	Chi-Square for Covariates
AIC	95.738	87.377	.
SC	97.957	96.255	.
-2 LOG L	93.738	79.377	14.361 with 3 DF (p=0.0025)
Score	.	.	13.052 with 3 DF (p=0.0045)

Analysis of Maximum Likelihood Estimates

Variable	DF	Parameter Estimate	Standard Error	Wald Chi-Square	Pr > Chi-Square	Standardized Estimate
INTERCPT	1	2.8659	1.1760	5.9391	0.0148	.
CAROT2	1	-1.9116	0.9573	3.9871	0.0458	-0.334522
HVIGOR	1	-0.2770	0.1301	4.5326	0.0333	-0.413315
KCAL	1	-0.00088	0.000477	3.4336	0.0639	-0.300054

Conditional Odds Ratios and 95% Confidence Intervals

Variable	Unit	Odds Ratio	Wald Confidence Limits Lower	Upper
CAROT2	1.0000	0.148	0.023	0.965
HVIGOR	1.0000	0.758	0.587	0.978
KCAL	1.0000	0.999	0.998	1.000

Hosmer and Lemeshow Goodness-of-Fit Test

Goodness-of-fit Statistic = 14.211 with 8 DF (p=0.0764)

Association of Predicted Probabilities and Observed Responses

Concordant = 74.2%	Somers' D = 0.486
Discordant = 25.5%	Gamma = 0.488
Tied = 0.3%	Tau-a = 0.245
(1147 pairs)	c = 0.743

Regression Diagnostics

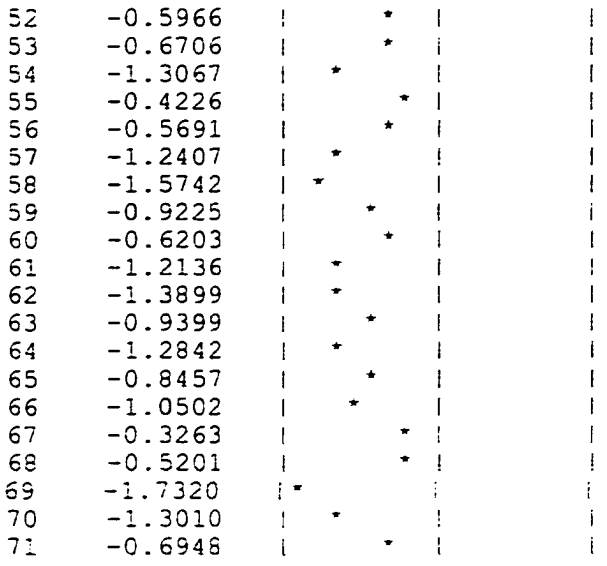
Case Number	Value	Pearson Residual (1 unit = 0.23) -8 -4 0 2 4 6 8
1	1.1415	
2	0.9383	
3	0.4502	
4	0.7831	
5	1.1664	
6	0.7040	
7	0.5311	
8	0.6762	
9	.	
10	0.6612	
11	0.8345	
12	0.7707	
13	1.3630	
14	1.2576	
15	0.9804	
16	0.5828	
17	0.7518	
18	0.5040	
19	.	
20	0.7441	
21	0.6987	
22	1.2273	
23	0.7963	
24	0.7504	
25	1.7267	
26	1.8353	
27	1.1700	
28	0.5649	
29	1.2263	
30	1.0357	
31	0.7022	
32	1.5153	
33	.	
34	1.0273	
35	-0.6378	
36	-1.4060	
37	-1.5543	
38	-0.2949	
39	-0.7060	
40	-0.5378	
41	-1.2451	
42	-1.6488	
43	-0.4727	
44	-1.1662	
45	-0.4591	
46	-0.6500	
47	-1.5323	
48	-0.3509	
49	-0.2932	
50	-0.4369	
51	-0.7021	

52	-0.4414		*	
53	-0.5021		*	
54	-1.1612	*		
55	-0.3056		*	
56	-0.4193		*	
57	-1.0766	*		
58	-1.5661	*		
59	-0.7282		*	
60	-0.4606		*	
61	-1.0432	*		
62	-1.2756	*		
63	-0.7452		*	
64	-1.1318	*		
65	-0.6556		*	
66	-0.8577	*		
67	-0.2338		*	
68	-0.3806		*	
69	-1.8657	*		
70	-1.1537	*		
71	-0.5225		*	

Regression Diagnostics

Deviance Residual

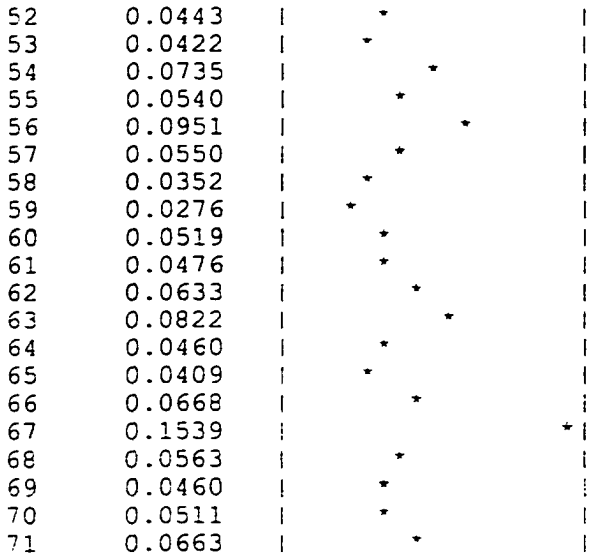
Case Number	Value	(1 unit = 0.22) -8 -4 0 2 4 6 8
1	1.2917	
2	1.1238	
3	0.6076	
4	0.9780	
5	1.3106	
6	0.8973	
7	0.7050	
8	0.8678	
9	.	
10	0.8517	
11	1.0281	
12	0.9656	
13	1.4492	
14	1.3772	
15	1.1607	
16	0.7647	
17	0.9466	
18	0.6729	
19	.	
20	0.9388	
21	0.8917	
22	1.3555	
23	0.9911	
24	0.9452	
25	1.6623	
26	1.7172	
27	1.3134	
28	0.7442	
29	1.3548	
30	1.2074	
31	0.8954	
32	1.5445	
33	.	
34	1.2004	
35	-0.8262	
36	-1.4770	
37	-1.5674	
38	-0.4084	
39	-0.8993	
40	-0.7128	
41	-1.3684	
42	-1.6207	
43	-0.6351	
44	-1.3105	
45	-0.6185	
46	-0.8396	
47	-1.5546	
48	-0.4819	
49	-0.4061	
50	-0.5911	
51	-0.8953	


52 -0.5966
53 -0.6706
54 -1.3067
55 -0.4226
56 -0.5691
57 -1.2407
58 -1.5742
59 -0.9225
60 -0.6203
61 -1.2136
62 -1.3899
63 -0.9399
64 -1.2842
65 -0.8457
66 -1.0502
67 -0.3263
68 -0.5201
69 -1.7320
70 -1.3010
71 -0.6948

Regression Diagnostics

Hat Matrix Diagonal

Case Number	Value	(1 unit = 0.01) 0 2 4 6 8 12 16
1	0.0427	
2	0.0276	
3	0.0551	
4	0.0761	
5	0.0841	
6	0.0350	
7	0.0466	
8	0.0348	
9	.	
10	0.0419	
11	0.0450	
12	0.0261	
13	0.0472	
14	0.0916	
15	0.0764	
16	0.0535	
17	0.0274	
18	0.0557	
19	.	
20	0.0282	
21	0.0350	
22	0.0557	
23	0.0361	
24	0.0268	
25	0.0354	
26	0.0910	
27	0.0473	
28	0.0434	
29	0.1258	
30	0.0205	
31	0.0334	
32	0.0694	
33	.	
34	0.0900	
35	0.0790	
36	0.0287	
37	0.0347	
38	0.1028	
39	0.0679	
40	0.0837	
41	0.0592	
42	0.0425	
43	0.0624	
44	0.0620	
45	0.1326	
46	0.0753	
47	0.0556	
48	0.0465	
49	0.0657	
50	0.1101	
51	0.0871	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54 0.0735
55 0.0540
56 0.0951
57 0.0550
58 0.0352
59 0.0276
60 0.0519
61 0.0476
62 0.0633
63 0.0822
64 0.0460
65 0.0409
66 0.0668
67 0.1539
68 0.0563
69 0.0460
70 0.0511
71 0.0663

11. APPENDIX E

11.1 Interviewer responsibilities

TRAINING PROGRAM

The interviewers are required to participate in a one day training program prior to the start of the survey. Upon completion of the training program the interviewers will:

1) Understand the rationale and purpose for the Survey of Nutrition and Health of PEI Women.

2) Know the basics of the survey methodology.

3) Understand their responsibilities during the survey.

4) Understand how to use the survey forms.

5) Be familiar with appropriate interviewing skills and techniques.

6) Demonstrate through practice interviews that the skills necessary to record complete precise and accurate data has been mastered.

In order to meet the high standards required by the survey, very few, if any mistakes, should be made completing the forms during the practice sessions. All forms from the practice sessions will be reviewed by the survey manager and the quality control supervisor. Feedback will be given to the interviewers after the practice session.

IDENTIFYING THE SAMPLE

The names and addresses of potential healthy respondents will be randomly selected by computer from the sample used by the 1995 PEI Nutrition Survey. Breast cancer patients were identified through the PEI Cancer Registry; permission to contact each patient was given by the individual's doctor.

The sample will be divided amongst the three counties. The following information will be provided for each selected respondent:

1) Reference number
2) Last name
3) Given names or initials
4) Address
5) Postal code

6) Year of birth
7) Telephone number

The study includes 2 distinct groups of women:

- those who have been diagnosed with breast cancer between June 1, 1997 - May 31, 1998 and
- healthy women matched to the breast cancer patients for age (+/- 3 years) and county of residence.

A letter has been sent to all breast cancer patients identified to date describing the study and inviting their participation. Letters will be sent to the matching healthy women to invite their participation as interviews are confirmed with the breast cancer patients. Interviewers should provide the names and reference numbers of breast cancer patients with confirmed appointments to the Survey Manager every Tuesday and Friday.

Reference and Identifier Number

This is an important component of every survey form. Each respondent (whether interviewed or not) is assigned a unique reference number. All of this reference number will be transcribed onto all survey forms and covering documentation. If by mistake, sections of one respondent's survey forms happen to get mixed together with another respondent's, then the different reference numbers would allow for early detection and separation.

The reference number also ensures that the confidentiality of the respondent is preserved.

The complete reference number consists of four digits. A basic explanation of the number is as follows:

1) the first digit indicates whether the respondent is a case (1 = breast cancer patient) or a control
(2 = healthy individual).

2) the second digit indicates in which county the respondent lives:
   1 = Prince County
   2 = Queens County
   3 = Kings County

3) the last two digits are individual identifiers.

Thus, a sample reference number will look like this:

1234: this reference number says that this individual is a breast cancer patient who lives in Queens County, with an individual identifying number of 34.

APPOINTMENTS AND DATA MANAGEMENT

The work involved in locating people by phone, in setting up appointments, in re-scheduling appointments and in record keeping is time consuming and demanding. On each workday, enough time should be allotted to contact potential respondents for the following week's interviews. For the present week, reconfirmation of the scheduled appointment should be made prior to the home visit to ensure the respondent has not forgotten and is still available. The amount of time spent calling will vary from day to day and will reflect the number of selected persons the interviewer tries to contact and the number of call-backs that need to be made to secure appointments. It should be possible to arrange 2-3 interviews a day with each interview generally taking about one and a half hours to complete, but this will vary from respondent to respondent and will depend on the travel time between respondents. Time must also be set aside to review completed surveys a second time (reviewed the first time at the interviewee's home).

Interviews are scheduled by day or evening at the convenience of the respondent and interviewer.
All respondents assigned to an interviewer must be accounted for and a detailed record kept. Use the "Record of Calls and Appointments" on the back of the "Contact Sheet" and the weekly tally sheet to assist in scheduling appointments and monitoring paper flow.

The Contact Sheet

This form provides all the information needed to begin contacting potential respondents. This sheet must be handed over to the Survey Manager along with the completed interview.

Records of Calls and Appointments Form

This form is found on the back of the Contact Sheet. All attempts made to contact the potential respondent by telephone or in person to arrange an appointment should be recorded on this form along with the date and the time called. This will ensure that all follow-up attempts are made at different times of the day and week.

Respondents are contacted by phone to make appointments for home interviews. A minimum of five attempts should be made to contact a respondent. Do not leave a message with an answering machine or with another household member as the respondent should be the first person informed about his/her requested participation in the survey. If a close family member (spouse or parent) insists on a message, leave it on behalf of yourself from UPEI without offering information about the survey. These contact attempts should be made at different times of the day (e.g. morning, afternoon and evening). After every attempt, note the reason for the "non-contact" on the "Record of Calls and Appointments Form" for that individual (no answer, phone line busy, not at

home, the telephone is not in service or the selected respondent is not available). Also note on the form the date and time for the scheduled interview appointment, or the negative outcome. If the interviewer keeps getting an answering machine, a message can be left on the third attempt, providing the first two attempts were made at different times of day. The message should ask the respondent to contact the interviewer at the health unit regarding a "Nutrition Project".

If the first call and a check of the local address cannot locate the subject (e.g. not known at this address/number), try to find out where they now reside, as many times a respondent will have relocated in the same area. Your investigative skills will be required here. A new telephone listing may be accessible through the phone company or relatives may be listed in the phone book by the same last name. If travelling in the vicinity of a potential respondent, where telephone contact has been unsuccessful, attempt to make contact to schedule an appointment. A direct visit to a potential respondent's home may secure an interview, particularly if there is no telephone in the household. If no one is home, then a business card or letter can be left. For hard-to-reach individuals unable to be contacted by telephone or home visit, a letter may be mailed to secure an interview. <u>This should only be used as a last measure.</u>

Since this form contains identifying information, it must be handed over to the Survey Manager.

Data Control Form

This form is used to track the survey package from the initial response/non-response review processes to final data entry. The form is divided into two sections: The first is to be completed by the interviewer; the second by the Quality Control Supervisor. It is not filled out until the interview is completed.

Each person the interviewer is expected to contact will be listed on the "Data Control Form". The date the person's interview is completed, the date the forms are reviewed, the date the forms are received for data entry and the date that data entry is completed are all entered onto this form by the interviewer.

The `Forms Reviewed' column is to help the interviewer keep track of the survey form review process before the package is passed on. Once forms from an interview are reviewed, the date should be entered in this column. If this column is not completed, it indicates to the interviewer that this set of forms requires review.

Selected persons who have refused to participate, were not found, not available, or who were screened out, will also be listed on the "Data Control Form". There will be not be an entry under `Date Interviewed' for these persons. The "Contact Sheet/Records of Calls

and Appointments" will still be prepared for non-respondents and forwarded along with completed survey packages. The interviewer will put the status code under the comments. This will be later verified under the comments column of the quality control supervisor's section.

The Survey Manager will file the completed interviews and accompanying papers numerically by identifier number in a locked cabinet. All survey package copies will be forwarded to UPEI at end of survey to be destroyed.

Interviewer's Progress Tally Worksheet and Summary - Weekly Progress Tally Sheets

These forms are used to track the cumulative progress of the survey by each interviewer. Both are to be completed weekly and faxed or brought to UPEI each Tuesday. This will allow the survey investigators to track the total cumulative number of respondents located and the contact outcome finalized. The original tally worksheets will be forwarded to UPEI at the end of the survey season.

Interviewer's Progress Tally Worksheet:

Each person listed on the data control form must eventually be accounted for on this sheet. Once you have either interviewed, or finished attempting to contact the respondent, enter the ID number, and the status code from the " Interview Status" form.

Summary - Weekly Progress Tally Sheets:

Use this form to summarize your weekly progress. Bring the completed form with you to the weekly meetings.

Mileage Log:

Use this form to keep track of your accumulated mileage. Please submit the completed form every 2 weeks with your invoice.

Invoices:

Please complete and submit your invoices for work done every 2 weeks.

ENCOURAGING RESPONSES AND EXPLAINING THE SURVEY

How to Proceed

The most critical step in the survey process is the initial contact made with each person selected. The usefulness of all other aspects of the survey hinges on the cooperation the interviewer can obtain at this time.

Aside from the initial letter, the first specific information a potential respondent receives about the survey comes from the interviewer when telephone contact is made. Use your charm, wit, diplomacy and the most convincing approach in presenting this information and soliciting cooperation. Be positive about the survey and confident in approaching the topic of an appointment. Make the whole endeavour sound appealing and interesting.

Proceed in a straight forward manner using the following as a general guide:

1) Introduce yourself by name and as a public health nurse, community health nutritionist or dietitian or interviewer from UPEI.

2) Ask to speak to the person selected for the survey or find out when to call again to speak to that person if they are not home. State that you will call back. As mentioned earlier, do not leave a message unless it is insisted upon and then only state that you are from the health unit and would like the respondent to return your call regarding a "Nutrition Project". If you are pressed for more information, use common sense in the information you share, as the respondent may be offended that she was not the first to receive the information on their potential participation.

3) Meeting respondents who live in apartment buildings sometimes presents a problem, since the "intercom" is a poor device by which to make first contact. If you are not able to make contact by phone, try to establish contact with the building superintendent, landlord or owner of the building. Explain the purpose of your visit, and request permission to enter the building to speak to the person selected for the survey. If building authorities are uncooperative and flatly refuse to admit you, politely withdraw and notify your quality control supervisor of the difficulties. Questions asked of neighbours should never go beyond finding out how or when you can get in contact with the respondent.

4) Once you have contacted the potential respondent, refer to the letter sent out by Joy Knight and explain that she is conducting a nutrition and health survey (or if you feel the term 'study' has a better connotation, use it) through the University of PEI, with the PEI Cancer Research Council, and that the named person has been selected to be interviewed (Note: controls have been selected at random, cancer patients were identified by the PEI Cancer Registry; permission to approach each

patient was given by their treating doctor).

5) Explain that you are calling to make an appointment to visit them at home to conduct the interview.

6) Never threaten a respondent, either directly or by implication. Reliable and complete information requires their willing cooperation. If the interview is not obtainable, check the appropriate status on the "Interview Status" form.

7) If a respondent is willing to participate in the survey, but, for whatever reasons, does not want the interview to take place in their home, make arrangements to conduct the interview at UPEI, or at another convenient location.

8) For those who agree to participate, make an appointment at a time convenient to them and you. If possible do not make an appointment more than one week in advance of the interview.
This approach should be used:

"May I please speak to potential respondent?"

"Hello, my name is interviewer. I am a public health nurse/community health nutritionist/dietitian working with UPEI. I'm calling on behalf of the Nutrition and Health of PEI Women Survey. This survey is being conducted by researchers from UPEI and the PEI Cancer Registry. The survey (or study) will be conducted in your home and will take about one and a half hours. We would appreciate your cooperation and your involvement is important to us."

When first approaching a prospective respondent, don't ask questions that can be answered "No." This can set you up for refusals. Use positive phrases. For example, instead of saying "May I make an appointment to visit you?" or "Is Friday a convenient time to do the interview?", try saying "What time on Friday is convenient for you?" or "Is 1:00 p.m. on Friday a good time or would another time that day be better?" You will undoubtedly develop your own approach as the survey progresses.

After arranging an appointment, state that you will have identification to identify yourself as an interviewer with the Nutrition Survey. A nice final touch is to say "I'm looking forward to meeting you," or "I'm looking forward to seeing you again."

10) Schedule the appointment using a daytimer or use the "Interviewer's Workplan Form" and calendar sheets.

11) Confirm the appointment the day before. Make the visit at the time arranged.

Explaining the Survey

This first contact need not be lengthy. Be prepared, however, to discuss the survey at this time if doing so will help convince the person to cooperate. For some, a few salient points will be sufficient. Others will want a full explanation of the "why?", the "what?" and the "what for?". Propose that details be given at the time of the home interview unless you feel this approach will jeopardize cooperation. Know your facts in advance. If there are questions you cannot answer, tell them that you will call them with the information if it is available.

Handle criticism with tact, giving facts that may help the person see the benefits of the undertaking. Make every effort to convince those who are sceptical and those who initially refuse, that their cooperation is very valuable to the survey and to the programs that will be developed from it.

The following concerns may have to be dealt with during the telephone contact or later at the time of the home visit. Give only that information that is asked for and that you feel will win the person's confidence. Be as brief as possible.

What is the survey about?	"The information gathered in this survey will be used to help scientists better understand the relationship between food use and health, in particular, the link between diet and breast cancer."
What will I have to do?	"Simply answer a series of questions I have about your eating practices and some general information about you. We will also ask to take your weight, height and your waist and hip measurements. It is not difficult and most people find it very interesting. We will need about one hour to complete it all."
What will be done with the information you get from me?	"First, let me assure you that all the information we receive is treated with strictest confidence. Once my visit to your home is over, the survey forms are transferred to UPEI. Only a reference number, not your name or any information that identifies you, is filed with your answers. Your information is processed in a computer with information from more than 100 other women. Tables and

	reports will never identify which data came from which people."
How can I verify that this is a valid survey?	"Please feel free to contact the primary investigators, Dr Liz Spangler at 566-0848 or Dr Jennifer Taylor at 566-0492, who will be able to verify that this is a valid survey."
How was I selected?	**Controls:** "You were randomly selected to participate in the survey. Every woman in PEI had the same chance of being selected. In all, 120 people will be surveyed". **Cases:** "You were identified as a breast cancer patient by the PEI Cancer Registry. Your doctor gave us permission to contact you. He believed that your participation would be very valuable to the success of the study."
Am I obliged to take part?	"No, but your participation is very important to the success of the study. To make this research meaningful, we need to interview women from all areas of PEI. It is important to understand what Island women eat, as well as their health and lifestyle habits."

Minimizing Refusals

When respondents refuse to participate in the survey, it is often because they do not have enough information about the survey or that the timing of the call was inconvenient. In the latter case, be sensitive to the respondent's situation and rather than risk a refusal, suggest a call-back time. The well-prepared interviewer usually succeeds in the long run in obtaining the respondent's cooperation. In some cases the respondent will be explicit in a refusal. When they say that they are just not interested, pick an issue (time, confidentiality, purpose or importance of the survey) and begin to discuss it. This usually forces the respondent to express a more specific concern, one with which you can deal directly. When all else fails, and you are faced with an adamant and vocal refusal, withdraw politely, asking for a reason for refusal.

Complete the status section of the "Interview Status" form.

THE SURVEY PROCESS

SURVEY FORMS

Questionnaire Forms- General Guidelines

A complete set of forms will be needed for each home interview. The questionnaire forms are colour-coded for easy identification. A set comprises one of each of the following:

1) Contact Sheet and Record of Calls (1 page).
2) Interview Status form (1 page).
3) Non-Response Questions Form (1 page)
4) Food Frequency Questionnaire (25 pages)
5) Health and Lifestyle Questionnaire (42 pages).

There will be extra copies of all forms to replace any originals that may become damaged in the course of an interview. Enter the respondent's ID number onto every form in the set.

Keep spare pens or pencils on hand at all times.

Write clearly. This is very important. All information recorded on the forms must be written as clearly and legibly as possible so that there can be no chance of misinterpreting the information. Each fact is later read and entered into a computer. This is tedious work...please don't make it any more difficult for the data entry clerks.

For questions that have a range of answers pre-printed on the form make a clear check mark (√) in the box or boxes provided. Complete the questionnaires in the order listed above.

The wording and logical order of the questions has been carefully thought out to maintain rapport. Follow these guidelines when asking the questions:

- Ask the questions exactly as worded on the questionnaire. Research has shown that even inadvertent or very slight word changes can easily change the response obtained.

- Ask the questions in the order presented on the questionnaire. Question sequence is planned for continuity and is arranged so that early questions will not have an

adverse effect on the respondent's answers to later questions. Follow skip patterns carefully so that unnecessary questions are not asked.

- Ask every question specified on the questionnaire. Sometimes the respondent, in answering one question, also answers another question that is asked later in the interview. Ease into this situation by saying "You've already told me something about this, but this next question asks...?" This will show that you are aware of the earlier response, and are asking for the respondent's cooperation in obtaining additional information.

- The respondent must not feel that some answers are more "acceptable" than others. In general, do not let your words or manners imply criticism, surprise, approval, agreement or disagreement with the respondent's answers.

- Ask questions in a positive manner. Some interviewer's feel uncomfortable when asking certain types of questions and adopt an apologetic attitude. For example: "You might not want to answer this question but,..." or "This question probably won't make sense to you...". Such statements invite a negative response.

- Repeat and clarify questions that are misunderstood or misinterpreted. The questions are phrased to be understood by most respondents and you will find that most people you interview understand them. Occasionally, a respondent may misunderstand or misinterpret what is asked. When this happens, repeat the question as it is written on the questionnaire. If you still do not get a response because the words and meaning of the question is not understood, you may have to probe.

Once all the forms have been filled in, check them very carefully for completeness before leaving the home so that missing information can be provided immediately by the interviewee.

The Contact Sheet

This form is the covering form that contains the detailed identifying information on the potential respondent. The purposes of this form are two-fold:

- to verify that all information received from health records is correct and complete;

- to seek more detailed information to assist in future follow-up (ie. the name, address and phone number of a relative or close friend);

The form will already contain the available information for the respondent. During initial telephone contact the interviewer may find that some part of the existing information is

incorrect. The new information can be added to the form at this time.

In seeking the address of a close relative not at the same address, be sure to reassure a respondent that this is for follow-up purposes only. Explain that many years from now they may be re-contacted for a follow-up study. This extra information ensures the probability of contacting them again in the likelihood of a change in address. A respondent may feel suspicious releasing this information despite your reassurances. Accept refusals from those who do not wish to give this information. Do not press the issue.

Interview Status

The "Interview Status" form is the information form that accompanies every survey package to its data entry destination. It is used to track respondents and incorporate necessary quality control checks.

The reference number and year of birth. Please confirm the year of birth at the interview.

The second section of the form must be completed for everyone. Remember to only accept a refusal from the respondent, not from another household member.

Definitions

Refused: Respondent chooses not to participate. Refusal must come directly from respondent.

Not resolved: Refers to a respondent who is unable to be located after exhausting all contact methods.

Not eligible: Refers to a potential respondent who is located (either directly or indirectly with the assistance of another person), but is unable to take part in the survey because he/she is out of the province or country during the survey season or has moved out of the province or country.

Screened out: Applies to all the following:

-Residence: For respondents whose principal residence has not been PEI or the Maritimes since 1993 (or earlier).

-Special Diet: For respondents who are following a medically prescribed diet for kidney disease, inflammatory bowel disease (ie Crohn's Disease or colitis) or liver disease (ie sclerosis)

-No Interpreter: For respondents who cannot speak English and for whom no interpreter is present.

-Other: For respondents who are institutionalized, have other health problems that prevent them from answering for themselves. (e.g. a stroke victim or severely ill person). Please provide the reason.

The two questions located on the top of the back side of the form are to be completed at the conclusion of the household visit, but not while still in the respondent's home. The actual date the interview was completed and whether it is reliable information or not is to be recorded. If it is not reliable, briefly explain why. The "Outcome of Interview" on the far right of this section is to be completed **by the Quality Control Supervisor.**

The "Questionnaire Assessment" is to be completed by the interviewer at the conclusion of the interview.
Space has been left for the interviewer to record any comments made by the respondent about the questionnaires.

Before forwarding the completed forms to the Quality Control Supervisor, sign off the "Interview Status" form with your initials and enter the total number of pages in the appropriate box. (This includes the "Contact Sheet/Record of Calls and Appointments" form).

CONFIDENTIALITY

Ensuring the confidentiality of information cannot be over-emphasized. Follow the general rules outlined below to ensure that every reasonable measure is taken to safeguard the confidentiality of information collected:

- place the completed set of survey forms into an envelope before leaving the respondents home.

- do not permit any unauthorized person, including members of your own family, to see the completed documents, forms or listings of selected persons.

- lock completed forms in the trunk of your car while travelling to and from appointments. Originals and photocopies of completed forms must be kept in a locked file.

- do not discuss an individual's completed questionnaire with anyone except with

your Quality Control Supervisor or survey investigators.

- on written correspondence (if required), refer to the respondent by reference number rather than by name.

- the only form that a name is on is the Contact Sheet. Make sure that NO NAME appears on all other forms.

POTENTIAL PROBLEMS

Poor appetites, slimming diets, "not feeling well" etc. are part of people's normal living and are not reasons to reschedule or screen out respondents.

Interviewing the Wrong Person and Other Scenarios

During the data collection, there may be instances where the wrong person is inadvertently interviewed. This could be due to many reasons such as:

- parent and sibling have the same names and live at the same address;

- telephone number given is for another person with the exact same name but different address (for addresses given as rural routes and P.O. Box numbers the exact location of the home is not known until contact is made).

To avoid this, careful attention must be paid to the year of birth of the respondent which is given on Contact Sheet. On contacting the potential respondent a quick verification of their mailing address and age range will validate that the correct person has been located.

If contact has been made and an interview arranged before you identify that the wrong individual has been scheduled, use your discretion to decide wether or not to proceed. Be aware that the respondent has already shown interest and a willingness to comply with the survey.

Since this individual is not the original person on the Contact Sheet, **the interview does not count**. Go back to the Contact Sheet and try to locate the original person listed.

Circumstances may arise where an interviewer believes an interview is unreliable. This may be due to many different reasons such as an interviewee under the influence of alcohol, mental health problems or perhaps there are language barriers. The interviewer will need to make a judgement call in assessing whether the information obtained is

reliable or not. A notation should be made on the "Interview Status" in the space provided for reliability of interviews. The information obtained and covering documentation should be forwarded to the facilitator, who will further clarify the reasons for unreliability and decide the classification of completed response or non-response.

Partial Response

If the participant completes most of the interview but is called away, gets bored or refuses to go on, then the interview can be considered a "Complete Response" if the Food Frequency Questionnaire and pages 1 - 40 inclusive of the Health and Lifestyle Questionnaire are completed. (The "Completed Response" will be recorded by the **Quality Control Supervisor** on the "Interview Response").

An interview that is started but interrupted by an emergency should be rescheduled at another convenient time for the respondent and you. The interviewer should enter an appropriate comment on the "Data Control Form" if a particular respondent did not complete any one, or more than one, form.

If either the Food Frequency or pages 1 - 40 of the Health and Lifestyle Questionnaire is not fully completed, then the interview is considered a "Non-response" and will be so recorded by the **Quality Control Supervisor** on the "Interview Status."

Handling Delicate Situations During the Interview

Sometimes you will encounter a situation that challenges your good judgement and tact. In most cases common sense will be your best guide.

- Avoid asking respondents to supply answers in front of others, as all information is confidential. If respondents have visitors, ask if it would be preferable for you to return later. If you are given permission to conduct the interview, tell the respondent that some of the questions may be of a personal nature. If there are not objections, proceed with the interview.

- A respondent may want to be interviewed in French. If you are not comfortable speaking French, arrange for an appropriate interviewer through your area facilitator. Interviews in languages other than English or French are possible, if an interpreter can be provided by the respondent (e.g. relative or friend). Ask for this at the time of the telephone contact. If an interpreter is used, record this fact on the "Interview Status". In those cases where there is no interpreter or bilingual interviewer, the participant will be classified as "not eligible" and the appropriate status should be checked.

- You will occasionally meet respondents who are suspicious of the survey's purpose or who are new to Canada. They may a need a careful explanation of the purpose and the

content of the survey. Sensitivity and tact will help to put such a person at ease.

- When a respondent is in obvious personal hardship such as a serious illness or bereavement, assess the situation; you may decide to continue with the interview, arrange for a convenient call-back time or terminate the interview.

- If the participants selected are not able to answer for themselves (eg. stroke victim) they are "not eligible" - check the appropriate status on the "Interview Status". Provide a reason.

- It is possible that due to unforeseen reasons, a respondent may not be at home at the time of the house visit by the interviewer. In such a situation, an attempt should be made to make another appointment by speaking with the household member present at the time of the visit or by telephoning again.

- If a respondent is known by interviewer or other health unit staff to have been charged with a crime that would challenge the safety of the interviewer, check "not eligible" with the reason provided. Call the person near the end of the survey season to advise them that although a letter was sent requesting their participation, adequate numbers have been obtained so there is no need for an interview.

Acknowledgement of Participation

Thank each respondent for their participation in the survey by emphasizing how important the information is and that their involvement will benefit many people.

All respondents will be given a "Thank You" letter signed by one of the principal investigators, a copy of Canada's Food Guide and Cancer Society fridge magnet as a small token of appreciation. In addition, healthy women will be given a copy of a brochure "Women and Cancer" produced by the Canadian Cancer Society. Breast cancer patients should also be offered a copy of the booklet "Questions and Anwers on Breast Cancer". The letter and thank you gifts should be given at the end of the interview.

SUMMARY OF SURVEY PROCESS

As an interviewer you will:

1) be assigned an interviewer number that will be entered on the "Contact Sheet"

2) contact each person on your list by telephone to set up an interview appointment according to the assigned interview day listed on the printout;

3) keep a detailed record on each respondent assigned to you.

4) ensure the reference and identifier numbers are entered on the appropriate forms.

5) make sure the food models are all accounted for and organized neatly in the kit and that you have all the equipment, forms and marker pens or pencils you will need. Contact phone numbers should be on hand (quality control supervisors, investigators, and safety contact etc.).

6) rehearse your answers to questions about the survey, handling different or difficult situations, and the interview process. Doing this before every interview usually results in less forgotten information and error and acts as a reminder to not become complacent about personal safety.

7) during the interview, fill out the following forms in the order as indicated:

   i. Contact Sheet
   ii. Interview Status
   iii. Non-Response Form
   iv. Food Frequency Questionnaire
   v. Health and Lifestyle Questionnaire
   vi. Demographic Profile

8) quickly check over all forms while still in the interviewer's home to make sure all information is gathered and recorded properly. "The Interviewer's Check List" can be used for this purpose. Errors corrected while in the interviewee's home will make the rest of the quality control procedure easier.

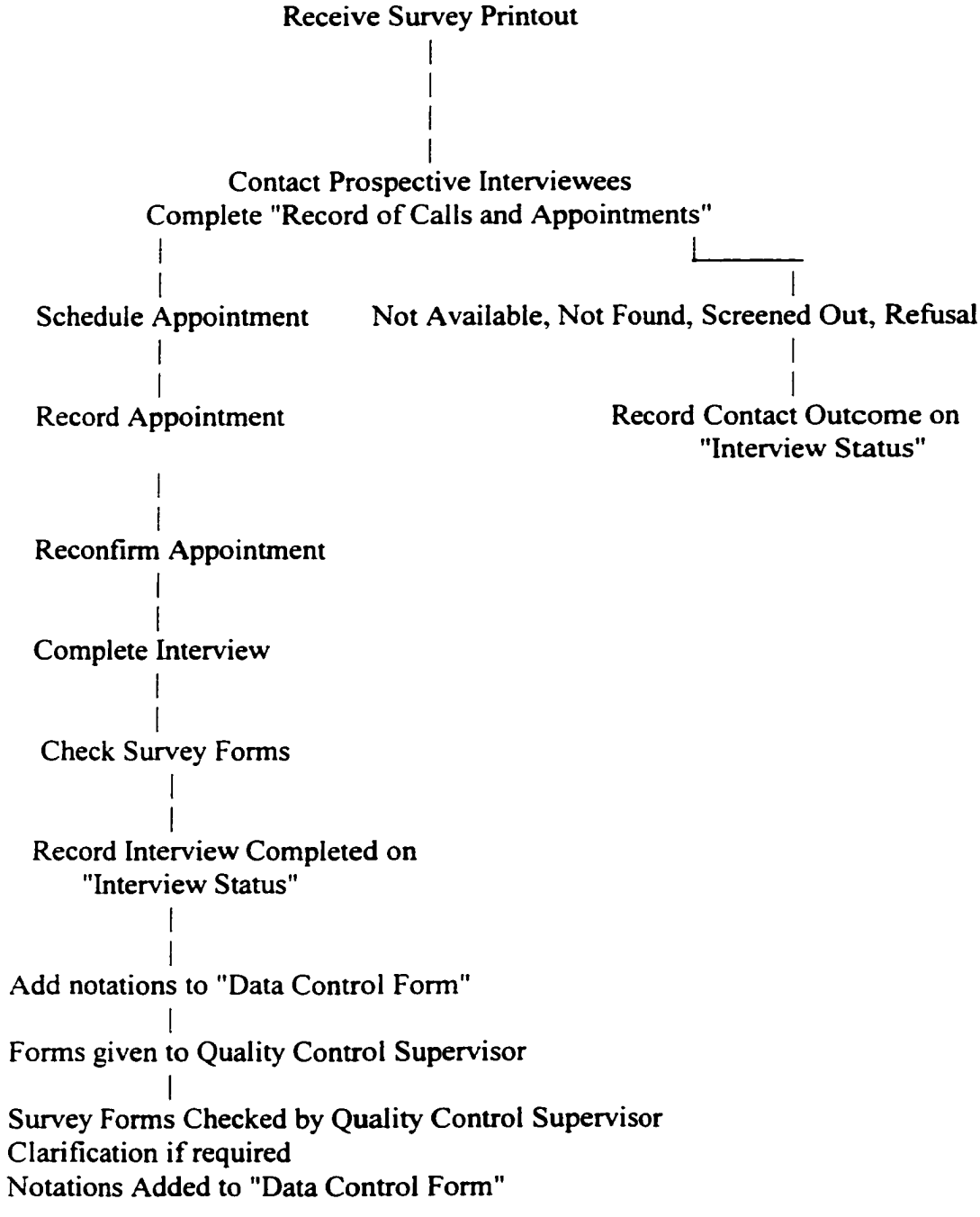
9) do a second check on all forms the same day as soon after the interview as possible to ensure they are filled out correctly. Complete the "Interview Status" form

10) Return completed survey forms to the Survey Manager, Joy Knight, at the weekly meeting.

Figure 1 outlines the survey process.

FIGURE 1

SURVEY INTERVIEW PROCESS



11.2 Contact sheet

NUTRITION AND HEALTH OF PEI WOMEN

Ref# FIELD(Mailstop) YOB:FIELD(E-Mail Type) Interviewer Initials:_____
FIELD(Name)
FIELD(Address)
FIELD(City) FIELD(ZIP Code)
FIELD(Home Phone Number)

New Name: _____

New Address: _____

_____

New Postal Code: _____

Phone Number: _____

Location / Other Comments:

_____

_____

_____

_____

_____

Please give the name of a close relative or friend whom we can contact in case we need to reach you.

Contact Name: _____

Contact Address: _____

_____

Contact Postal Code: _____

Contact Phone Number: _____

Record of Calls and Appointments

call	date	time	notes
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Acknowledgements:
PEI Nutrition Survey, 1995
Alberta Nutrition Survey, 1994
Nova Scotia Nutrition Survey, 1990
Saskatchewan Nutrition Survey, 1993

11.3 Interview status

NUTRITION AND HEALTH OF PEI WOMEN

REF #: FIELD(Mailstop)
YOB:FIELD(E-Mail Type)

☐ Interview obtained
☐ No interview obtained

Reason for no interview:

- ☐ Non Responding
  - ☐ Refusal
  - ☐ Location verified, temporary no contact
  - ☐ Language
  - ☐ Other _____
- ☐ Not Resolved
  - ☐ Letter returned, no further info
  - ☐ No answer after at least 5 phone attempts
  - ☐ Cannot locate by phone or home visit
- ☐ Not Eligible
  - ☐ Dead
  - ☐ Hospitalization/extraordinary illness
  - ☐ Living in institution
  - ☐ Moved out of province
  - ☐ Following medically prescribed diet for kidney disease, inflammatory bowel disease (ie Crohn's Disease or colitis) or liver disease (ie sclerosis)
  - ☐ Has not lived in PEI or the Maritimes for the past 5 years (ie since 1993)
  - ☐ **CASES:** diagnosis of breast cancer prior to current episode
  - ☐ **CONTROLS:** diagnosis of breast cancer in self, mother or sister
  - ☐ Other _____

Interviewer's opinion of information

☐ Reliable
☐ Unreliable: poor memory recall
☐ Unreliable: o/reasons, specify_____

Date interview completed:
☐☐ ☐☐ ☐☐ (d/m/y)

Outcome of interview:

☐ Complete response
☐ Partial response
☐ Non Response

Total # of pages in package: ☐☐

Year of birth correct at time of interview:
☐yes ☐no

Questionnaire Assessment: *(Yes = 1, No = 0, Don't know = -1)*

☐ Respondent appeared to understand all questions as posed in FFQ
☐ Respondent appeared to understand all questions as posed in H&L Questionnaire

Comments re questionnaires:

_____

_____

_____

_____

_____

_____

Interviewer initials:_____

Identifier #☐☐☐☐

11.4 Non-response questionnaire

NUTRITION AND HEALTH OF PEI WOMEN

If you face a refusal: at the first phone contact, if an eligible person refuses to participate, tell the person that you have a few short questions to ask. Remind them that these questions refer to them personally, not the household. Ask all questions below.
If the person accepts: Ask questions 1,2,3 and 4 only after completing both the Food Frequency Questionnaire and the Health and Lifestyles Questionnaires, but before doing the height and weight measurements.

☐ 1. During the past month did you eat bread?
_a. Yes
_b. No ***(go to question #3)***

☐ 2. If yes, what type of bread did you usually eat? (check only one)
DO NOT READ LIST
_a. Whole Wheat (100%, 80%, 60%)
_b. White Bread
_c. Multigrain/Cracked Wheat
_d. Rye, Pumpernickel
_e. Do Not Know
_f. Other_____

☐ 3. During the past month, did you use milk?
_a.Yes ***(go to question #4)***
_b. No ***(go to question #5)***

☐ 4. If yes, what type of milk did you usually use? (***check only one***) **DO NOT READ LIST**
_a. Whole milk
_b. 2% milk
_c. 1% milk
_d. Skim milk
_e. Powdered milk
_f. Triple milk
_g. Evaporated milk
_h. Other_____
_i. Do not know

☐ 5. During the past month, did you use any vitamin-mineral supplement?
_a. Yes
_b. No

☐ 6. Have you ever smoked cigarettes?
_a. Yes ***(go to question # 7)***
_b. No **(END)**
_c. Refused to answer **(END)**

☐ 7. At the present time do you smoke cigarettes?

_a. Yes ***(go to question #8)***
_b. No **(END)**
_c. Refused to answer **(END)**

☐ 8. Do you usually smoke cigarettes every day?
Yes ***(go to question #9)***
No **(END)**
Refused to answer **(END)**

____# 9. How many cigarettes do you smoke a day?

11.5 Introductory letter to cases

patient name
address

Dear (name):

Recent research suggests that nutrition plays an important role in everyday health. While something is known of the food use of Canadians in general, very few studies have examined the food use of women in PEI.

We are contacting patients with a recent diagnosis of breast cancer to invite their participation in an important research study investigating women's nutrition and health. Your physician, ***(name)***, gave us permission to contact you. The research is being conducted by a team including researchers from the Departments of Family and Nutritional Sciences, and Health Management, UPEI, and Dr Dagny Dryer, Director of the PEI Cancer Registry. Funding is provided by the PEI Cancer Research Council. This study will provide valuable information for the assessment of the relationship between food use and health in Island women. For that reason, your participation is very important to the success of our project.

The study will require of you an interview of approximately 1 ½ hours in your home, scheduled at your convenience. We will telephone you within the next 2 weeks to see if you would be interested in participating. You may be assured of complete confidentiality; only summary information on all participants as a group will be published. No individual information will be identifiable in any way.

The results of this research will be published and made available to interested parties. You may place a request for a summary of the results at the time of your interview.

I would be most happy to answer any questions you might have. Please write or call. The telephone number is (902) 566-0785.

Thank you in advance for your interest and co-operation.

Joy Knight, MSc Candidate
Department of Health Management
University of Prince Edward Island

11.6 Introductory letter to controls

FIELD(Name)
FIELD(Address)
FIELD(City) FIELD(ZIP Code)

DATE

Dear Ms FIELD(Last Name):

Recent research suggests that nutrition plays an important role in everyday health. While something is known of the food use of Canadians in general, very few studies have examined the food use of women in PEI.

We are contacting selected women in PEI to invite their participation in an important research study investigating women's nutrition and health. The research is being conducted by a team including researchers from the Departments of Family and Nutritional Sciences, and Health Management, UPEI, and Dr Dagny Dryer, Director of the PEI Cancer Registry. Funding is provided by the PEI Cancer Research Council. This study will provide valuable information for the assessment of the relationship between food use and health in Island women. For that reason, your participation is very important to the success of our project.

The study will require of you an interview of approximately 1 ½ hours in your home, scheduled at your convenience. We will telephone you within the next 2 weeks to see if you would be interested in participating. You may be assured of complete confidentiality; only summary information on all participants as a group will be published. No individual information will be identifiable in any way.

The results of this research will be published and made available to interested parties. You may place a request for a summary of the results at the time of your interview.

I would be most happy to answer any questions you might have. Please write or call. The telephone number is (902) 566 - 0785.

Thank you in advance for your interest and co-operation.

Joy Knight, MSc Candidate
Department of Health Management
University of Prince Edward Island

11.7 Consent form

NUTRITION AND HEALTH OF PEI WOMEN

A research study concerned with women's nutrition and health has been explained to me by the survey interviewer, Joy Knight.

I have been asked to participate in this project, and am aware that it will involve one interview of approximately 1 ½ hours during which I will be asked questions about my food use and health habits. I give permission for researchers involved in the study to access information concerning my health from the PEI Cancer Registry.

I understand that the following conditions will be adhered to at all times:

7. All personal information given by me will remain confidential.
2. A coding system will be used so that my name or other personally identifying material will not appear in the data.
3. Only summary information on all participants as a group will be published. No individual information will be identifiable in any way.
4. I do not have to answer any questions I don't want to.

I hereby agree to participate in the study.

_____ _____

Name (please print) Date DD MM YY

_____

Street Address City

_____ _____

Telephone (daytime) Telephone (evening)

_____ _____

Signature Witness

11.8 Thank you letter to cases and controls

Dear Participant,

On behalf of the team involved in the Survey of Nutrition and Health of PEI Women, I would like to thank you for your participation. Your commitment of time and willingness to provide dietary and health information to the interviewer is greatly appreciated. You have made a significant contribution to a project that is of great importance to women.

The information gathered in this survey will be used to help scientists better understand the relationship between food use and health, in particular, the link between diet and breast cancer.

During your interview, you may have discussed when the results of the survey will be available. I anticipate that summary results will be available early in 1999.

Once again, thank you very much for being part of our research study.

Sincerely,

Dr Elizabeth Spangler
Department of Health Management
Atlantic Veterinary College

on behalf of the research team:

Dr Jennifer Taylor
Department of Family & Nutritional Sciences
University of Prince Edward Island

Dr Michael Brimacombe
Department of Health Management
Atlantic Veterinary College

Dr Dagny Dryer, MD FRCPC
Director of PEI Cancer Registry

Joy Knight, MSc Candidate
Department of Health Management
Atlantic Veterinary College