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Hippocrates c. 460 - 377 B.C.

British Columbia Nutrition Survey

Report on Energy and Nutrient Intakes

March 2004

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British Columbia
Ministry of Health Services

List of Appendices

Appendix A

Sample Design Specifications

BRITISH COLUMBIA NUTRITION SURVEY

Sample Design specifications

For British Columbia Ministry of Health

France Bilocq
Statistical Consultation Group
Statistics Canada
March 1, 1999

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1. INTRODUCTION

The main objective of the British Columbia Nutrition Survey (BCNS) is to obtain information on the dietary practices of adults aged 18 to 84. The data will be collected during a face to face interview. Half of the sample will be interviewed during the Spring of 1999 and the other half in the Fall of 1999. Each season, one third of the sample will be re-interviewed in order to measure intra-personal variation of food intake.

2. TARGET POPULATION

The target population comprises all persons aged 18 to 84, living in British Columbia (BC) at the time of the survey. Persons living in institutions or on Indian Reserves are excluded. Furthermore, pregnant women, lactating women and military living on a military base will be excluded from the survey when identified by the nurses during the interview.

A set of remote areas (based on 1996 Census sub-division CSD's) were identified by the Client. These remote areas are excluded from data collection but are still part of the population under study. This will be taken into account when post-stratification will be performed. Once Indian Reserves are excluded the remote areas account for 3.8% of the population.

3. GEOGRAPHIC STRATIFICATION

The Client divided the list of in-scope CSD's in three geographic strata: Metro, Coastal and Non-Metro Interior and further divided the Metro stratum into 6 sub-strata. The geographic strata are:

* Stratum 1: Metro
  - Sub-stratum 1: Vancouver
  - Sub-stratum 2: Victoria
  - Sub-stratum 3: Nanaimo
  - Sub-stratum 4: Kamloops
  - Sub-stratum 5: Kelowna
  - Sub-stratum 6: Prince Georges

* Stratum 2: Coastal
* Stratum 3: Non-metro interior

The non-metro interior stratum was split into 10 clusters in order to reduce the cost of travel associated with data collection.

Appendix 1A provides a list of in-scope CSD's for stratum 1 (sub-strata 1 to 6), stratum 2 and stratum 3 (clusters 1 to 10).

4. THE SAMPLING DESIGN

The sample for the BC Nutrition Survey will be drawn according to a two-stage probability sample design.

1. The first stage

At the first stage, stratum 1 (sub-strata 1 to 6) and stratum 2 are chosen with certainty (probability=1).
As mentioned earlier, stratum 3 has been divided into 10 clusters. The first stage of the sampling design for stratum 3 has been performed by Statistics Canada (STC). A sample of 4 clusters has been randomly chosen with probability proportional to the population size of the clusters. The selected clusters are # 2, 4, 6 and 8 according to the numbering presented in Appendix 1A.

NOTE: For estimation purposes, there was a need to select more then two clusters. A sample of three clusters was not felt to be sufficient and a sample of five clusters seemed to fragment the overall sample too much and jeopardise the purpose of clustering: cost savings.

Appendix 1B presents a summary of Appendix 1A at the stratum/sub-stratum/cluster level and also provides the first stage sampling weights.

2. The second stage

At the second stage, the client will select, from the British Columbia Health Register (BCHR), a sample of individuals within sub-strata 1, 2, 3, 4, 5, 6, stratum 2 and clusters # 2, 4, 6 and 8 according to the selection procedure described in section 4.7.

a. The second stage sampling frame

For sub-strata 1, 2, 3, 4, 5, 6 and stratum 2, the second stage sampling frame comprises the in-scope individuals of the BCHR who are aged (or will be aged) 18 to 84 at the time of the Spring collection and lives in the CSD's identified for these areas (see Appendix 1A).

For stratum 3, the second stage sampling frame comprises the in-scope individuals of the BCHR who are aged (or will be aged) 18 to 84 at the time of the Spring collection and lives in the CSD's included in the first stage selected clusters, # 2, 4, 6 and 8 (see Appendix 1A).

b. The second stage age-sex stratification

The sub-strata 1, 2, 3, 4, 5, 6, stratum 2 and each selected cluster of stratum 3 will be stratified according to the following 14 age-sex strata:

1. 18-24 years old male
2. 25-34 years old male
3. 35-44 years old male
4. 45-54 years old male
5. 55-64 years old male
6. 64-74 years old male
7. 75-84 years old male
8. 18-24 years old female
9. 25-34 years old female
10. 35-44 years old female
11. 45-54 years old female
12. 55-64 years old female
13. 64-74 years old female
14. 75-84 years old female

3. Sample size

An effective sample size of 2,200 respondents aged 18 to 74 plus an effective sample size of 500 respondents aged 75 to 84 is expected to give a provincial estimates of a proportion of a certain characteristic precise within .02 at a 95% level of confidence. That is, the true value of a proportion is expected to belong in the interval ****** where correspond to the estimates from the survey. The expected (effective) sample size needs to be corrected to account for frame problems and non-response. In general, administrative registers suffer from some amount of "out-of-datedness", and data collection experiences with the BC Health Register showed around 20% of non-contact. Let's suppose a hit rate of 80% of the selected individuals.

An additional reduction of the original sample size will be caused by non-response (not-at-home, refusal, etc.). The Client provided the non-response factors by age group.

The next table presents the expected sample size, the expected precision and the sample size corrected for out-of-datedness and for non-response. For information, the derived non-response rate was calculated.

TABLE 1

A	B	C	D	E	F	G
Age-sex Strata	**Expected Sample Size**	**Expected Precision 95%**	**Out/date Rate**	**Non-Response Factor**	**Corrected Sample size**	**Derived Non-response Rate**
					B/(1-D)*E	
M18-24	170	.08	0,20	2,00	425	0,50
M25-34	170	.08	0,20	2,00	425	0,50
M35-44	170	.08	0,20	1,50	319	0,33
M45-54	170	.08	0,20	1,30	276	0,23
M55-64	170	.08	0,20	1,30	276	0,23
M65-74	250	.06	0,20	1,40	438	0,29
M75-84	250	.06	0,20	1,50	469	0,33
F18-24	170	.08	0,20	2,00	425	0,50
F25-34	170	.08	0,20	2,00	425	0,50
F35-44	170	.08	0,20	1,50	319	0,33
F45-54	170	.08	0,20	1,30	276	0,23
F55-64	170	.08	0,20	1,30	276	0,23
F65-74	250	.06	0,20	1,40	438	0,29
F75-84	250	.06	0,20	1,50	469	0,33
Total	2700	.02			5256	

4. Allocation

The sample was allocated to the age-sex and geographic strata according to the following steps:

a) Allocation to age-sex strata:

As viewed in Table 1, column B, a sample of 250 was allocated to ages 65-74 and 75-84 for both male and female and a sample of 170 was allocated to the remaining age-sex strata.

a) The out-of-datedness rate and the non-response factor were applied to each age-sex stratum (see column F: Corrected sample size in Table 1).

b) The allocation to metro, coastal and non-metro interior strata (strata 1,2 and 3) was done proportionally to their (population size) $^{1/3}$.

c) The allocation to sub-strata 1 to 6 was done proportionally to their (population size)$^{1/3}$

d) Finally, the sample size was allocated equally to the four selected cluster of stratum 3.

The following table provides the results (in proportion) of the allocation for the geographic strata/sub-strata/clusters.

TABLE 2: Results of the allocation (in proportion)

Strata	Sub Strata	Clusters	Allocation (proportion)	Total by strata
1	**1**	-	0,1600	0,4700
1	**2**	-	0,0800	
1	**3**	-	0,0500	
1	**4**	-	0,0600	
1	**5**	-	0,0600	
1	**6**	-	0,0600	
2	-	-	0,2400	0,2400
3	-	**2**	0,0725	0,2900
3	-	**4**	0,0725	
3	-	**6**	0,0725	
3	-	**8**	0,0725	
Total			1,0000	1,0000

Note: The allocation was performed proportionally to (population size) $^{1/3}$ instead of proportional to size or to square root of size because of the discrepancy between the population size of the strata. This method gives less importance to the largest strata and more to the smaller ones. For example stratum 1 represents 74% of the population of the 3 strata, stratum 2 represents 10% and stratum 3 represents 16%. Using allocation proportional to (population size) $^{1/3}$, 47% of the sample was allocated to the metro stratum, 24% to coastal stratum and 29 % to the non-metro interior stratum.

The results of the allocation were applied to the corrected sample size of each age-sex strata (column F in Table 1) to determine the samples size of the geographic strata. The resulting sample sizes were then rounded to the nearest higher multiple of two for the purpose of Spring/Fall collection split.

Appendix 2 provides the following six tables.

Table A: The expected sample sizes for each geographic/age-sex stratum

Table B: The expected sample sizes for Spring or Fall collection (Table A 2)

Table C: The expected sample sizes for Spring or Fall second 24-hour recall collection (Table B 3)

Table D: The corrected sample sizes for each geographic/age-sex stratum

Table E: The corrected sample sizes for Spring or Fall collection (Table D 2)

Table F: The corrected sample sizes for Spring or Fall second 24-hour recall collection (Table E 3)

5. Selection procedure

To simplify the notation, the sub-strata, stratum 2 and selected clusters will now be referred to as geographic groups. Sub-strata 1 to 6 become groups 1 to 6 respectively, strata 2 becomes group 7 and selected clusters # 2, 4, 6 and 8 become group 8, 9, 10 and 11 respectively. The Client will select from the BC Health Register, a systematic random sample of individuals within each geographic group/age-sex combination.

In order to describe the selection method let's use the following notation:

h The geographic groups, $h = 1, 2, 3, \ldots, 11$

a The age-sex stratum, $a = 1, ..., 14$

$N_{ha:}$ The number of in-scope persons available on the BC Health Register in the age-sex stratum a, in the geographic group h.

n_{ha} The number of persons to be selected on the BC Health Register in the age-sex stratum *a*, in the geographic group h (see Appendix 2, Table D).

ha: Geographic group/age-sex combination

I_{ha} The sampling interval for stratum ha: $I_{ha} = N_{ha} / n_{ha}$

$U_{ha:}$ The random start for the sample selection of individual in the geographic group/age-sex "ha": $1 < U_{ha} < I_{ha}$

The following 10 steps describes the method that will be used to select a sample of individuals in each geographic group/age-sex combination. Steps 1 to 10 are to be executed for each "ha" combination.

Appendix 3 contains a diagram that outlines the steps of the selection method.

Step 1: Generate a random number for each person

Step 2: In order to insure a good representation of each CSD and remove potential bias in the selection, the list of persons is sorted by CSD's, and by random number within CSD's.

Step 3: Select the $(U_{ha})^{th}$, $(U_{ha}+I_{ha})^{th}$, $(U_{ha}+2I_{ha})^{th}$,...,$(U_{ha}+(n_{ha}-1)I_{ha})^{th}$ persons on the list.

Lets identify the selected persons in "ha" as P_{ha1}, P_{ha2},…, $P_{ha(nha)}$

NOTE: The sample sizes obtained from the systematic sampling may differ slightly from the sample sizes in Table D (APPENDIX 2). The obtained sample sizes are noted: $n_{ha'}$.

IMPORTANT: The population size N_{ha} and the obtained sample size $n_{ha'}$ are to be stored for the calculation of the estimation weights.

Step 4: Every second person selected is *de facto* assigned to the Fall collection namely persons P_{ha2}, P_{ha4}, P_{ha6}, ... Lets rename and renumber the Fall collection persons to F_{ha1}, F_{ha2}, $F_{ha3, ...}$

The other selected persons, namely P_{ha1}, P_{ha3}, P_{ha5}, ... are assigned to the Spring collection. Lets rename and renumber the Spring collection persons to S_{ha1}, S_{ha2}, $S_{ha3, ...}$

Create a flag to identify the collection season.

NOTE: Steps 5, 6 and 7 are identical to steps 8, 9 and 10. The first three apply to the Spring collection and the last three to the Fall Collection.

Step 5: Let's assign the days of the week for the <u>first</u> 24-hour recall of the Spring collection according to the following:

S_{ha1}, S_{ha8}, S_{ha15},... to Monday, c=1
S_{ha2}, S_{ha9}, S_{ha16},... to Tuesday, c=2
S_{ha3}, S_{ha10}, S_{ha17},... to Wednesday, c=3
S_{ha4}, S_{ha11}, S_{ha18},... to Thursday, c=4
S_{ha5}, S_{ha12}, S_{ha19},... to Friday, c=5
S_{ha6}, S_{ha13}, S_{ha20},... to Saturday, c=6
S_{ha7}, S_{ha14}, S_{ha21},... to Sunday, c=7

Create a variable "c= 1, 2, … 7" to identify the day for the first 24-hour recall of the Spring collection.

Step 6: Every third person selected for the Spring collection is assigned to the <u>second</u> 24-hour recall; namely, persons S_{ha3}, S_{ha6}, S_{ha9},

Generate a new random number for each person chosen for the <u>second</u> 24-hour recall of Spring. Sort these persons according to

the new random number.

Lets rename and renumber the second 24-hour recall sample of the Spring collection SR_{ha1}, SR_{ha2}, $SR_{ha3,...}$

Create a flag to identify the participants in the second 24-hour recall.

Step 7: Lets assign the days of the week for the second 24-hour recall sample of the Spring collection according to the following:

SR_{ha1}, SR_{ha8}, SR_{ha15},... to Monday, d=1
SR_{ha2}, SR_{ha9}, SR_{ha16}... to Tuesday, d=2
SR_{ha3}, SR_{ha10}, SR_{ha17}... to Wednesday, d=3
SR_{ha4}, SR_{ha11}, SR_{ha18},... to Thursday, d=4
SR_{ha5}, SR_{ha12}, SR_{ha19},... to Friday, d=5
SR_{ha6}, SR_{ha13}, SR_{ha20},... to Saturday, d=6
SR_{ha7}, SR_{ha14}, SR_{ha21},... to Sunday, d=7

Create a variable "d= 1, 2, … 7" to identify the day for the second 24-hour recall of the Spring collection.

Step 8: Let's assign the days of the week for the first 24-hour recall of the Fall collection according to the following:

F_{ha1}, F_{ha8}, F_{ha15},... to Monday, c=1
F_{ha2}, F_{ha9}, F_{ha16},... to Tuesday, c=2
F_{ha3}, F_{ha10}, F_{ha17},... to Wednesday, c=3
F_{ha4}, F_{ha11}, F_{ha18},... to Thursday, c=4
F_{ha5}, F_{ha12}, F_{ha19},... to Friday, c=5
F_{ha6}, F_{ha13}, F_{ha20},... to Saturday, c=6
F_{ha7}, F_{ha14}, F_{ha21},... to Sunday c=7

Create a variable "c= 1, 2, … 7" to identify the day for the first 24-hour recall of the Fall collection.

Step 9: Every third person selected for the Fall collection is assigned to the second 24-hour recall; namely, persons F_{ha3}, F_{ha6}, F_{ha9},

Generate a new random number for each person chosen for the second 24-hour recall of Fall. Sort these persons according to the new random number.

Lets rename and renumber the second 24-hour recall sample of the Fall collection FR_{ha1}, FR_{ha2}, $FR_{ha3,...}$

Create a flag to identify the participants in the second 24-hour recall.

Step 10: Lets assign the days of the week for the second 24-hour recall sample of the Fall collection according to the following:

FR_{ha1}, FR_{ha8}, FR_{ha15},... to Monday, d=1
FR_{ha2}, FR_{ha9}, FR_{ha16},... to Tuesday, d=2
FR_{ha3}, FR_{ha10}, FR_{ha17},... to Wednesday, d=3
FR_{ha4}, FR_{ha11}, FR_{ha18},... to Thursday d=4
FR_{ha5}, FR_{ha12}, FR_{ha19},... to Friday, d=5
FR_{ha6}, FR_{ha13}, FR_{ha20},... to Saturday, d=6
FR_{ha7}, FR_{ha14}, FR_{ha21},... to Sunday, d=7

Create a variable "d= 1, 2, … 7" to identify the day for the second 24-hour recall of the Fall collection.

Recommendation:

The address and phone number of the individuals included in the Fall sample should be updated using the B. C. Health Register just prior to the Fall collection in order to maximise contacts.

5. OUTPUTS

1. From the selection process

The following items of information are to be computed and retained for later use (questionnaire labels, reference lists, other):

1) Sequential identifier (create one if needed)
2) Geographic group (= *h*)
3) Age-sex stratum (= *a*)
4) The flag for the Spring/Fall collection
5) The day for the first 24 hour recall (=c)
6) The flag indicating participation in second 24-hour recall
7) The day for the second 24 hour recall (=d)
8) Full name of the selected person
9) Full address of the selected person
10) Telephone number
11) Standard geographic code: Census Sub-Division (CSD).

2. For weighting and estimation process

The following information need to be stored and provided to STC and Health Canada for weighting and estimation purposes:

1) CSD number (standard geographic code)
2) Geographic group (= h)
3) Age-sex stratum (= a)
4) The BCHR population size (N_{ha}) for each geographic group/age-sex combination
5) The obtained sample sizes ($n_{ha'}$), i.e. the sample sizes resulting from the systematic sampling.

APPENDIX 1A The list of CSD's by stratum sub-stratum and cluster

Stratum	Sub-str	Cluster	CSD	NAME	Population
1	1		5909052	Abbotsford	105 403
1	1		5909056	Mission	30 519
1	1		5909054	Fraser Valley, Subd. D	356
1	1		5915022	Vancouver	514 008
1	1		5915004	Surrey	304 477
1	1		5915025	Burnaby	179 209
1	1		5915015	Richmond	148 867
1	1		5915034	Coquitlam	101 820
1	1		5915011	Delta	95 411
1	1		5915046	North Vancouver	80 418
1	1		5915001	Langley	80 179
1	1		5915075	Maple Ridge	56 173
1	1		5915029	New Westminster	49 350
1	1		5915039	Port Coquitlam	46 682
1	1		5915051	North Vancouver	41 475
1	1		5915055	West Vancouver	40 882
1	1		5915002	Langley	22 523
1	1		5915043	Port Moody	20 847
1	1		5915007	White Rock	17 210
1	1		5915070	Pitt Meadows	13 436
1	1		5915018	University Endowment Area	6 833
1	1		5915063	Greater Vancouver, Subd. A	3 066
1	1		5915065	Lions Bay	1 347
1	1		5915038	Anmore	961
1	1		5915036	Belcarra	665
1	2		5917021	Saanich	101 388
1	2		5917034	Victoria	73 504
1	2		5917030	Oak Bay	17 865
1	2		5917044	Langford	17 484
1	2		5917040	Esquimalt	16 151
1	2		5917015	Central Saanich	14 611
1	2		5917041	Colwood	13 848
1	2		5917051	Capital, Subd. C	11 432
1	2		5917010	Sidney	10 701
1	2		5917005	North Saanich	10 411
1	2		5917047	View Royal	6 441
1	2		5917042	Metchosin	4 709
1	2		5917049	Highlands	1 423
1	2		5917045	Capital, Subd. B	603

1	3		5921007	Nanaimo	70 130
1	4		5933042	Kamloops	76 394
1	4		5933040	Thompson-Nicola, Subd. B	4 668
1	5		5935010	Kelowna	89 442
1	5		5935023	Central Okanagan, Subd. B	22 901
1	6		5953023	Prince George	75 150
2			5929005	Gibsons	3 732
2			5929011	Sechelt	7 343
2			5929020	Sunshine Coast, Subd. A	13 075
2			5931006	Squamish	13 994
2			5917025	Capital, Subd. A	13 405
2			5917055	Capital, Subd. D	207
2			5919008	North Cowichan	25 305
2			5919012	Duncan	4 583
2			5919014	Cowichan Valley, Subd. B	7 376
2			5919016	Lake Cowichan	2 856
2			5919021	Ladysmith	6 456
2			5919031	Cowichan Valley, Subd. A	3 190
2			5919045	Cowichan Valley, Subd. C	14 137
2			5919047	Cowichan Valley, Subd. D	3 959
2			5921012	Nanaimo, Subd. A	14 837
2			5921018	Parksville	9 472
2			5921023	Qualicum Beach	6 728
2			5921028	Nanaimo, Subd. B	19 930
2			5923008	Port Alberni	18 468
2			5923019	Ucluelet	1 658
2			5923025	Tofino	1 170
2			5923031	Alberni-Clayoquot, Subd. A	7 904
2			5923045	Alberni-Clayoquot, Subd. B	742
2			5925005	Comox	11 069
2			5925010	Courtenay	17 335
2			5925014	Cumberland	2 548
2			5925020	Comox-Strathcona, Subd. C	23 746
2			5925025	Gold River	2 041
2			5925034	Campbell River	28 851
2			5925039	Sayward	440
2			5925044	Comox-Strathcona, Subd. B	5 469
2			5925047	Comox-Strathcona, Subd. D	205
2			5927008	Powell River	13 131
2			5927014	Powell River, Subd. A	6 207
2			5943008	Alert Bay	612
2			5943012	Port McNeill	2 925
2			5943017	Port Alice	1 331
2			5943023	Port Hardy	5 283

2			5947007	Port Edward	700
2			5947012	Prince Rupert	16 714
2			5949005	Kitimat	11 136
3		1	5901012	Fernie	4 877
3		1	5901022	Cranbrook	18 131
3		1	5901028	Kimberley	6 738
3		1	5901039	Invermere	2 687
3		1	5901040	Radium Hot Springs	530
3		1	5903004	Creston	4 816
3		1	5903008	Central Kootenay, Subd. C	8 017
3		2	5903011	Salmo	1 202
3		2	5903015	Nelson	9 585
3		2	5903019	Slocan	335
3		2	5903023	Kaslo	1 063
3		2	5903027	Silverton	241
3		2	5903032	New Denver	579
3		2	5903037	Central Kootenay, Subd. B	15 354
3		2	5903045	Castlegar	7 027
3		2	5903050	Nakusp	1 736
3		2	5903054	Central Kootenay, Subd. A	8 031
3		2	5905005	Fruitvale	2 117
3		2	5905009	Montrose	1 137
3		2	5905014	Trail	7 696
3		2	5905018	Warfield	1 788
3		2	5905023	Rossland	3 802
3		2	5905028	Kootenay Boundary, Subd. A	3 968
3		2	5905032	Grand Forks	3 994
3		2	5905037	Midway	686
3		2	5905042	Greenwood	784
3		3	5907005	Osoyoos	4 021
3		3	5907009	Keremeos	1 167
3		3	5907014	Oliver	4 285
3		3	5907020	Okanagan-Similkameen, Subd. B	9 051
3		3	5907024	Princeton	2 826
3		3	5907035	Summerland	10 584
3		3	5907041	Penticton	30 987
3		3	5907045	Okanagan-Similkameen, Subd. A	9 216
3		3	5935016	Lake Country	9 007
3		3	5935018	Peachland	4 524
3		4	5909009	Hope	6 247
3		4	5909020	Chilliwack	60 186
3		4	5909027	Harrison Hot Springs	898
3		4	5909032	Kent	4 844

3		4	5909038	Fraser Valley, Subd. B	4 191
3		4	5909058	Fraser Valley, Subd. E	3 637
3		4	5931012	Pemberton	855
3		4	5931020	Whistler	7 172
3		5	5931024	Lillooet	1 988
3		5	5933006	Merritt	7 631
3		5	5933015	Lytton	322
3		5	5933019	Ashcroft	1 858
3		5	5933024	Cache Creek	1 115
3		5	5933028	Clinton	729
3		5	5933035	Logan Lake	2 492
3		5	5933054	Chase	2 460
3		5	5933058	Thompson-Nicola, Subd. E	2 849
3		5	5933066	Thompson-Nicola, Subd. A	8 591
3		6	5937005	Lumby	1 689
3		6	5937010	Coldstream	8 975
3		6	5937014	Vernon	31 817
3		6	5937019	North Okanagan, Subd. B	11 017
3		6	5937024	Spallumcheen	5 322
3		6	5937028	Armstrong	3 906
3		6	5937033	Enderby	2 754
3		6	5939019	Revelstoke	8 047
3		6	5939032	Salmon Arm	14 664
3		6	5939041	Columbia-Shuswap, Subd. C	13 857
3		6	5939045	Sicamous	2 827
3		7	5941005	One Hundred Mile House	1 850
3		7	5941009	Williams Lake	10 472
3		7	5941011	Cariboo, Subd. B	25 167
3		7	5941013	Quesnel	8 468
3		7	5941023	Cariboo, Subd. A	16 630
3		8	5949011	Terrace	12 779
3		8	5949016	Kitimat-Stikine, Subd. C	7 818
3		8	5949022	Hazelton	347
3		8	5949024	New Hazelton	822
3		8	5949026	Kitimat-Stikine, Subd. B	2 098
3		8	5951034	Houston	3 934
3		8	5951038	Telkwa	1 194
3		8	5951043	Smithers	5 624
3		9	5951007	Vanderhoof	4 401
3		9	5951009	Fraser Lake	1 344
3		9	5951013	Fort St. James	2 046
3		9	5951022	Burns Lake	1 793
3		9	5951032	Granisle	446
3		9	5953007	Valemount	1 303

3		9	5953012	McBride	740
3		9	5953033	Mackenzie	5 997
3		10	5955005	Pouce Coupe	894
3		10	5955010	Chetwynd	2 980
3		10	5955014	Dawson Creek	11 125
3		10	5955030	Taylor	1 031
3		10	5955034	Fort St. John	15 021

APPENDIX 1B

Summary of Appendix 1A at the stratum/sub-stratum and cluster level
With corresponding population percentages
And first stage sampling weights

Stratum	Total pop	% pop Total(1)	Sub-stratum	Total pop	% pop Total(1)	Cluster	Total pop	% pop Total(1)	Groups (**)	First stage sampling weight
1	2601373	71.0	**1**	1962117	53.6				**1**	1
			2	300571	8.2				**2**	1
			3	70130	1.9				**3**	1
			4	81062	2.2				**4**	1
			5	112343	3.1				**5**	1
			6	75150	2.0				**6**	1
2	350270	9.6							**7**	1
3	571853	15.6				**1**	45796	1.3		--
						2 (*)	71125	1.9	**8**	2,0100281
						3	85668	2.3		--
						4 (*)	88030	2.4	**9**	1,6240287
						5	30035	0.8		--
						6 (*)	104875	2.9	**10**	1,3631776
						7	62587	1.7		--
						8 (*)	34616	0.9	**11**	4,1299760
						9	18070	0.5		
						10	31051	0.9		
Excluded CSD's	138463	3.8								
Total (1)	3661959									
Indian reserve	62541									
Total (2)	3724500									

(*) Clusters randomly chosen in first stage selection process of stratum 3.

(**) Refers to notation used in the selection procedure (section 4.5).

APPENDIX 2
Six tables:

Table A: The expected sample sizes for each geographic/age-sex stratum

Table B: The expected sample sizes for Spring or Fall collection (Table A 2)

Table C: The expected sample sizes for Spring or Fall REPEAT collection (Table B 3)

Table D: The corrected sample sizes for each geographic/age-sex stratum

Table E: The corrected sample sizes for Spring or Fall collection (Table D 2)

Table F: The corrected sample sizes for Spring or Fall REPEAT collection (Table E 3)

TABLE A: The expected size for each geographic/age-sex stratum

AGE-SEX STRATA

Str	Sub Str	Clus	Grp	M18-24	M25-34	M35-44	M45-54	M55-64	M65-74	M75-84	F18-24	F25-34	F35-44	F45-54	F55-64	F65-74	F75-84	Total
1	**1**		**1**	27	27	27	27	27	40	40	27	27	27	27	27	40	40	430
1	**2**		**2**	14	14	14	14	14	21	21	14	14	14	14	14	21	21	224
1	**3**		**3**	9	9	9	9	9	13	13	9	9	9	9	9	13	13	142
1	**4**		**4**	10	10	10	10	10	14	14	10	10	10	10	10	14	14	156
1	**5**		**5**	10	10	10	10	10	15	15	10	10	10	10	10	15	15	160
1	**6**		**6**	10	10	10	10	10	14	14	10	10	10	10	10	14	14	156
2			**7**	41	41	41	41	41	60	60	41	41	41	41	41	60	60	650
3		**2**	**8**	12	12	12	12	12	18	18	12	12	12	12	12	18	18	192
3		**4**	**9**	12	12	12	12	12	18	18	12	12	12	12	12	18	18	192
3		**6**	**10**	12	12	12	12	12	18	18	12	12	12	12	12	18	18	192
3		**8**	**11**	12	12	12	12	12	18	18	12	12	12	12	12	18	18	192
Total				169	169	169	169	169	249	249	169	169	169	169	169	249	249	2686

				80	80	80	80	80	117	117	80	80	80	80	80	117	117	1268
2				41	41	41	41	41	60	60	41	41	41	41	41	60	60	650
3				48	48	48	48	48	72	72	48	48	48	48	48	72	72	768
Total				169	169	169	169	169	249	249	169	169	169	169	169	249	249	2686

TABLE B: The expected sample sizes for Spring or Fall collection (Table A 2)

Numbers are rounded to the nearest integer.

AGE-SEX STRATA

	Sub str	Clus	Grp	M18-24	M25-34	M35-44	M45-54	M55-64	M65-74	M75-84	F18-24	F25-34	F35-44	F45-54	F55-64	F65-74	F75-84	Total
	1		**1**	14	14	14	14	14	20	20	14	14	14	14	14	20	20	220
1	**2**		**2**	7	7	7	7	7	11	11	7	7	7	7	7	11	11	114
1	**3**		**3**	5	5	5	5	5	7	7	5	5	5	5	5	7	7	78
1	**4**		**4**	5	5	5	5	5	7	7	5	5	5	5	5	7	7	78
1	**5**		**5**	5	5	5	5	5	8	8	5	5	5	5	5	8	8	82
1	**6**		**6**	5	5	5	5	5	7	7	5	5	5	5	5	7	7	78
2			**7**	21	21	21	21	21	30	30	21	21	21	21	21	30	30	330
3		**2**	**8**	6	6	6	6	6	9	9	6	6	6	6	6	9	9	96
3		**4**	**9**	6	6	6	6	6	9	9	6	6	6	6	6	9	9	96
3		**6**	**10**	6	6	6	6	6	9	9	6	6	6	6	6	9	9	96
3		**8**	**11**	6	6	6	6	6	9	9	6	6	6	6	6	9	9	96
Total				86	86	86	86	86	126	126	86	86	86	86	86	126	126	1364

				41	41	41	41	41	60	60	41	41	41	41	41	60	60	650
2				21	21	21	21	21	30	30	21	21	21	21	21	30	30	330
3				24	24	24	24	24	36	36	24	24	24	24	24	36	36	384
Total				86	86	86	86	86	126	126	86	86	86	86	86	126	126	1364

TABLE C: The expected sample size for Spring or Fall REPEAT collection (Table B 3)

Numbers are rounded to the nearest integer.

	Sub str	Clus	Grp	M18-24	M25-34	M35-44	M45-54	M55-64	M65-74	M75-84	F18-24	F25-34	F35-44	F45-54	F55-64	F65-74	F75-84	Total
1	**1**		**1**	5	5	5	5	5	7	7	5	5	5	5	5	7	7	78
1	**2**		**2**	2	2	2	2	2	4	4	2	2	2	2	2	4	4	36
1	**3**		**3**	2	2	2	2	2	2	2	2	2	2	2	2	2	2	28
1	**4**		**4**	2	2	2	2	2	2	2	2	2	2	2	2	2	2	28
1	**5**		**5**	2	2	2	2	2	3	3	2	2	2	2	2	3	3	32
1	**6**		**6**	2	2	2	2	2	2	2	2	2	2	2	2	2	2	28
2			**7**	7	7	7	7	7	10	10	7	7	7	7	7	10	10	110
3		**2**	**8**	2	2	2	2	2	3	3	2	2	2	2	2	3	3	32
3		**4**	**9**	2	2	2	2	2	3	3	2	2	2	2	2	3	3	32
3		**6**	**10**	2	2	2	2	2	3	3	2	2	2	2	2	3	3	32
3		**8**	**11**	2	2	2	2	2	3	3	2	2	2	2	2	3	3	32
Total				30	30	30	30	30	42	42	30	30	30	30	30	42	42	468

				15	15	15	15	15	20	20	15	15	15	15	15	20	20	230
2				7	7	7	7	7	10	10	7	7	7	7	7	10	10	110
3				8	8	8	8	8	12	12	8	8	8	8	8	12	12	128
Total				30	30	30	30	30	42	42	30	30	30	30	30	42	42	468

TABLE D: The corrected sample size for each geographic/age-sex stratum

				AGE-SEX STRATA													
Str	**Sub str**	**Clus**	**Grp**	**M18-24**	**M25-34**	**M35-44**	**M45-54**	**M55-64**	**M65-74**	**M75-84**	**F18-24**	**F25-34**	**F35-44**	**F45-54**	**F55-64**	**F65-74**	**F75-84**	**Total**
1	**1**		**1**	68	68	52	44	44	70	76	68	68	52	44	44	70	76	844
1	**2**		**2**	36	36	28	24	24	38	40	36	36	28	24	24	38	40	452
1	**3**		**3**	22	22	16	14	14	24	24	22	22	16	14	14	24	24	272
1	**4**		**4**	24	24	18	16	16	26	26	24	24	18	16	16	26	26	300
1	**5**		**5**	26	26	20	18	18	28	30	26	26	20	18	18	28	30	332
1	**6**		**6**	24	24	18	16	16	26	26	24	24	18	16	16	26	26	300
2			**7**	102	102	78	66	66	106	114	102	102	78	66	66	106	114	1268
3		**2**	**8**	32	32	24	20	20	32	34	32	32	24	20	20	32	34	388
3		**4**	**9**	32	32	24	20	20	32	34	32	32	24	20	20	32	34	388
3		**6**	**10**	32	32	24	20	20	32	34	32	32	24	20	20	32	34	388
3		**8**	**11**	32	32	24	20	20	32	34	32	32	24	20	20	32	34	388
Total				430	430	326	278	278	446	472	430	430	326	278	278	446	472	5320
				200	200	152	132	132	212	222	200	200	152	132	132	212	222	2500
2				102	102	78	66	66	106	114	102	102	78	66	66	106	114	1268
3				128	128	96	80	80	128	136	128	128	96	80	80	128	136	1552
Total				430	430	326	278	278	446	472	430	430	326	278	278	446	472	5320

TABLE E: The corrected sample sizes for Spring or Fall collection (Table D 2)

AGE-SEX STRATA

	Sub str	Clus	Grp	M18-24	M25-34	M35-44	M45-54	M55-64	M65-74	M75-84	F18-24	F25-34	F35-44	F45-54	F55-64	F65-74	F75-84	Total
1	**1**		**1**	34	34	26	22	22	35	38	34	34	26	22	22	35	38	422
1	**2**		**2**	18	18	14	12	12	19	20	18	18	14	12	12	19	20	226
1	**3**		**3**	11	11	8	7	7	12	12	11	11	8	7	7	12	12	136
1	**4**		**4**	12	12	9	8	8	13	13	12	12	9	8	8	13	13	150
1	**5**		**5**	13	13	10	9	9	14	15	13	13	10	9	9	14	15	166
1	**6**		**6**	12	12	9	8	8	13	13	12	12	9	8	8	13	13	150
2			**7**	51	51	39	33	33	53	57	51	51	39	33	33	53	57	634
3		**2**	**8**	16	16	12	10	10	16	17	16	16	12	10	10	16	17	194
3		**4**	**9**	16	16	12	10	10	16	17	16	16	12	10	10	16	17	194
3		**6**	**10**	16	16	12	10	10	16	17	16	16	12	10	10	16	17	194
3		**8**	**11**	16	16	12	10	10	16	17	16	16	12	10	10	16	17	194
Total				215	215	163	139	139	223	236	215	215	163	139	139	223	236	2660
				100	100	76	66	66	106	111	100	100	76	66	66	106	111	1250
2				51	51	39	33	33	53	57	51	51	39	33	33	53	57	634
3				64	64	48	40	40	64	68	64	64	48	40	40	64	68	776
Total				215	215	163	139	139	223	236	215	215	163	139	139	223	236	2660

TABLE F: The corrected sample size for Spring or Fall REPEAT collection (Table E 3)

Numbers are rounded to the nearest integer.

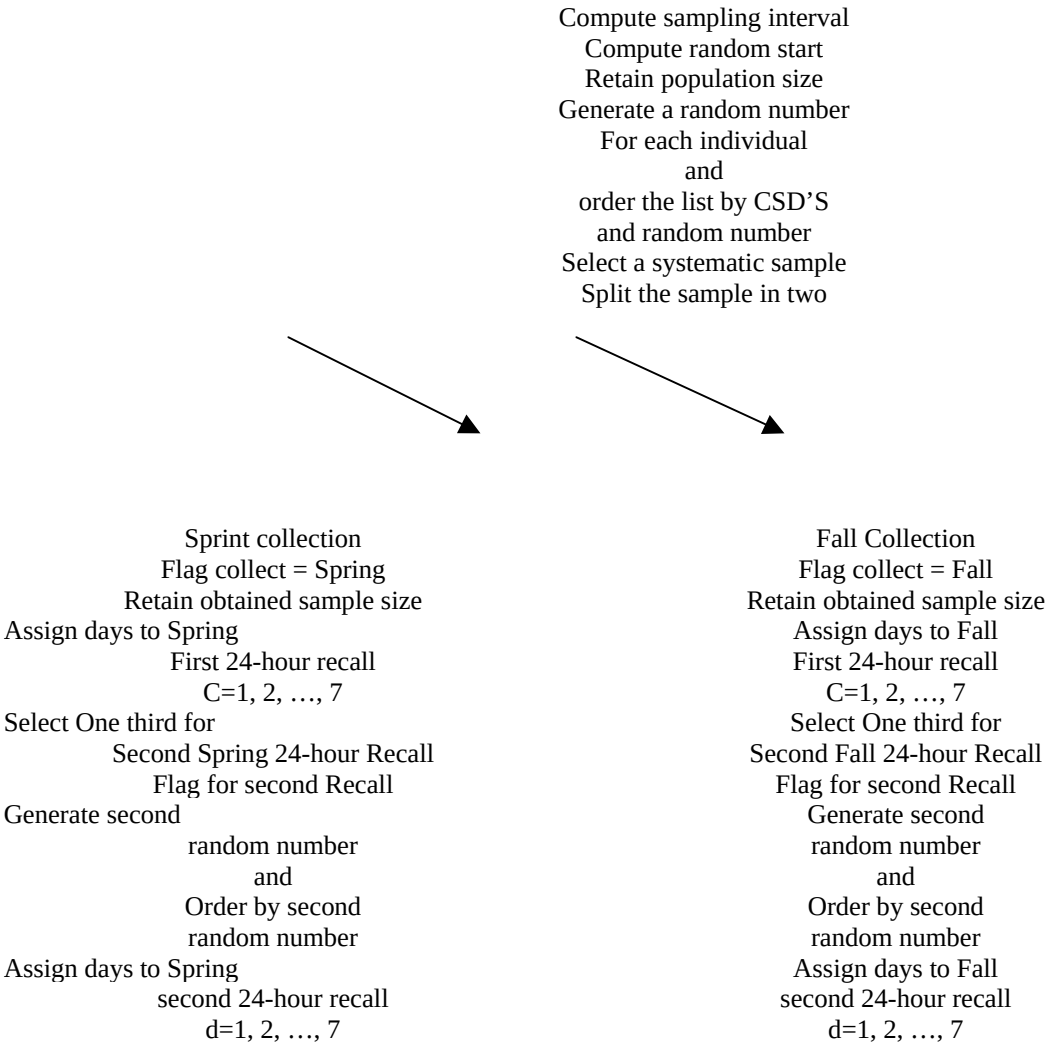
AGE-SEX STRATA

	Sub str	Clus	Grp	M18-24	M25-34	M35-44	M45-54	M55-64	M65-74	M75-84	F18-24	F25-34	F35-44	F45-54	F55-64	F65-74	F75-84	Total
1	**1**		**1**	11	11	9	7	7	12	13	11	11	9	7	7	12	13	140
1	**2**		**2**	6	6	5	4	4	6	7	6	6	5	4	4	6	7	76
1	**3**		**3**	4	4	3	2	2	4	4	4	4	3	2	2	4	4	46
1	**4**		**4**	4	4	3	3	3	4	4	4	4	3	3	3	4	4	50
1	**5**		**5**	4	4	3	3	3	5	5	4	4	3	3	3	5	5	54
1	**6**		**6**	4	4	3	3	3	4	4	4	4	3	3	3	4	4	50
2			**7**	17	17	13	11	11	18	19	17	17	13	11	11	18	19	212
3		**2**	**8**	5	5	4	3	3	5	6	5	5	4	3	3	5	6	62
3		**4**	**9**	5	5	4	3	3	5	6	5	5	4	3	3	5	6	62
3		**6**	**10**	5	5	4	3	3	5	6	5	5	4	3	3	5	6	62
3		**8**	**11**	5	5	4	3	3	5	6	5	5	4	3	3	5	6	62
Total				70	70	55	45	45	73	80	70	70	55	45	45	73	80	876

				33	33	26	22	22	35	37	33	33	26	22	22	35	37	416
2				17	17	13	11	11	18	19	17	17	13	11	11	18	19	212
3				20	20	16	12	12	20	24	20	20	16	12	12	20	24	248
Total				70	70	55	45	45	73	80	70	70	55	45	45	73	80	876

APPENDIX 3

Diagram of the sample selection procedure for a geographic group/age-sex combination.



Appendix B2

Computing Sampling Weights

Statistics Canada

British Columbia Nutrition Survey

Computing Estimation Weights

François Laflamme
Statistical Consultation Group
Statistics Canada
November 2000

1. Introduction

The British Columbia Nutrition Survey (BCNS) was conducted in 1999 along the lines of a survey design prepared by F. Bilocq[1]. The survey was relatively similar to nutrition surveys conducted in other Provinces or Territories. The main objective of the British Columbia Nutrition Survey (BCNS) was to obtain information on the dietary practices of adult aged 18 to 84. The data was collected during a face to face interview. Half of the sample was interviewed during the Spring of 1999 and the other half in the Fall of 1999. Each season, one third of the sample was re-interviewed in order to measure intra-personal variation of food intake.

2. Target population

The target population for the BCNS was the set of all residents aged 18 to 84, living in British Columbia at the time of the survey, excluding those on Indian Reserves, military camps and institutions. Furthermore, pregnant women and lactating women were excluded from the survey when identified by the nurses during the interview. A set of remote areas (based on 1996 Census sub-division CSD's) were identified by the Client. These remote areas are excluded from data collection but are still part of the population under study. This will be taken into account when post-stratification is performed. Once Indian Reserves are excluded the remote areas account for 3.8% of the population.

3. Sample Design

The design used for BCNS is a stratified multi-stage sampling design. Firstly, the three following strata were created from a list of in-scope CSD's according to the client's specifications: Metro, Coastal and Non-Metro Interior. In addition, the Metro stratum was further divided into 6 sub-strata (see Appendix I). Finally, the non-metro interior stratum was split into 10 clusters in order to reduce the cost of travel associated with data collection. To simply the notation, sub-strata, stratum 2 and clusters could be referred as geographic groups. Then, strata 1 has 6 geographic groups (sub-strata 1 to 6), strata 2 has one geographic group while strata 3 has 10 geographic groups (clusters).

At the first stage, the 7 geographic groups of stratum 1 and 2 were chosen with certainty (probability=1) while a sample of 4 geographic groups (clusters) was randomly selected in stratum 3 with probability proportional to the population size of the groups. The population of the 11 geographic groups was further stratified in 14 age-sex strata: Male/Female, 18-24/25-34/35-44/45-54/55-64/65-74/75-84.

At the second stage, the client selected from the British Columbia Health Register (BCHR), a sample of individuals within 11geographic groups according to the sample allocation to each stratum-geographic group- age- sex combination. This second stage sampling frame comprises the in-scope individuals of the BCHR who are aged (or will be aged) 18 to 84 at the time of the Spring collection and lives in the CSD's identified for these defined stratum. For more detailed information about the sample design, see Bilocq (1999).

It should be noted that while the survey was conducted in 1999, the stratification and sampling of primary units was done using 1996 data. Of course, sampling of individual respondents was

[1] Bilocq, F, "British Columbia Nutrition Survey – Sample Design Specifications", Statistics Canada, Social Survey Methods Division, March 1999

done using current information. The time lag between the base data and the field work may cause some coverage bias in the estimates (i.e. representing the 1996 population rather than that of 1999); some corrective measure should be taken at estimation.

4. Notation

The following notation will be used below

Symbol	Meaning
H	Stratum level, h=1, 2, 3
a	Geographic groups; a=1 to 6 for sub-strata 1 to 6, a=1 for stratum 2 and a= 1 to 10 for clusters of the third stratum.
i	Age sex group, i=1, 2,…, 7 for male; i=8, …, 14 for female
M_{ha}	Number of individuals in strata "h" and geographic group "a" - 1996 census
M_h	Total number of individuals in BC in strata "h" – 1996 census
m_h	Number of geographic group sampled in strata "h"
$_{ha}$	First-stage weight, list given in Appendix II
y_{haik}	Value of characteristic "Y" for individual "k" in strata "h", geographic group "a" and age-sex group "i"
N_{hai}	Number of individuals at the time of sample selection in strata "h", geographic group "a" and age-sex group "i" on BCHR at the time of sample selection
n_{hai}	Number of individuals ultimately sampled in strata "h", geographic group "a" and age-sex group "i" (i.e. all used replicates)
r_{hai}	Number of responses from age-sex "i" in strata "h" and geographic group "a"
w^*_{hai}	Unadjusted sampling weight for strata "h", geographic group "a" and age-sex group "i"
	Estimated size for age-sex group "i"
P_i	Post census estimated count for BC, age-sex group "i", for 1999 (see Appendix III)
w_{hai}	Age-sex adjusted (i.e. post-stratified) estimation weights in strata "h", geographic group "a" and age-sex group "i"

5. Computing Estimation Weights

With these notations,

$$\alpha_{ha} = \begin{cases} 1, \text{if } h = 1 \text{ or } 2 \\ \dfrac{M_h}{M_{ha} \times m_h}, \text{if } h = 3 \end{cases}$$

and

$$w^{*}_{hai} = \alpha_{ha} \times \frac{N_{hai}}{n_{hai}} \times \frac{n_{hai}}{r_{hai}}, \text{ for all h, a, i}$$

Now, one can readily obtain an estimate for the age-sex group size by computing for each age-sex group "i":

$$\hat{P}_i = \sum_{hak} w^{*}_{hai} = \sum_{ha} r_{hai} w^{*}_{hai} = \sum_{ha} \alpha_{ha} N_{hai}$$

then the age-sex adjusted (i.e. post-stratified) weights are given by:

$$w_{hai} = w^{*}_{hai} \times \frac{P_i}{\hat{P}_i}$$

An EXCEL worksheet was prepared for the purpose of computing adjusted estimation weights.

Cautionary Note on Estimating Sampling Error

Every survey estimate is accompanied by some amount of uncertainty called "sampling error". This error can be estimated directly from the sample, as long as the particularities of the survey design are dealt correctly. Given the design of BCNS (likely clustering in the data), it is not wise to use general-purpose software (Excel, SPSS…) to compute sampling errors; analysts should realise that failing to account for the design might seriously underestimate the sampling error. With a design as that of BCNS, it is often recommended to use specialised software to compute sampling errors such as SUDAAN, PC-CARP, WesVarPC, GES or JackVar.

Appendix I: Strata used in British Columbia Nutrition Survey

Stratum 1: Metro

- Sub-stratum 1: Vancouver
- Sub-stratum 2: Victoria
- Sub-stratum 3: Nanaimo
- Sub-stratum 4: Kamloops
- Sub-stratum 5: Kelowna
- Sub-stratum 6: Prince Georges

Stratum 2: Coastal

Stratum 3: Non-metro interior

The list of in-scope CSD's for stratum 1 (sub-strata 1 to 6), stratum 2 and stratum 3 (clusters 1 to 10) was provided in Bilocq[2].

[2] Bilocq, F, "British Columbia Nutrition Survey – Sample Design Specifications", Statistics Canada, Social Survey Methods Division, March 1999

APPENDIX II: First-stage weights by Stratum and Geographic Groups, British Columbia Nutrition survey.

Stratum	Sub-stratum	Cluster	Geographic Groups (**)	First stage sampling weight
1	**1**		**1**	1
	2		**2**	1
	3		**3**	1
	4		**4**	1
	5		**5**	1
	6		**6**	1
2			**1**	1
3		**2 (*)**	**2***	2,0100281
		4 (*)	**4***	1,6240287
		6 (*)	**6***	1,3631776
		8 (*)	**8***	4,1299760
Number of selected Geographic Groups			**11**	

APPENDIX III: 1999 Post Census Estimated counts, British Columbia, by Sex and Age Group.

Appendix B

24-Hour Recall Form

Identifier # __ __ __ __ __

BRITISH COLUMBIA NUTRITION SURVEY – 24 HOUR RECALL (Fall Season) FORM B

Interviewer ID __ __ Facilitator ID __ __ Start Time: __ __ : __ __ End Time: __ __ : __ __ *of Recall*

Time 00:01 23:59	Rest/ Cafe *	Meal/ Snack **	Home Prep. ***	FOOD DESCRIPTION	Salt	# of Portions	Model	Thick-ness

***Restaurant / Cafeteria**
C=cafeteria
F=fast food
R=restaurant (table service)
T=take-out outlet, deli
V=vending machine, snack bar

****Meal/Snack**
BK=breakfast
L=lunch
D=dinner
BC=brunch
S=snack

*****Homemade**
H=homemade baked products made from scratch or a mix in your own home
E=homemade baked products made from scratch or mix elsewhere than in your own home

Did you prepare most of the foods you ate yesterday? ☐Yes ☐No

For interviewers only:
In the interview, was the respondent assisted by the person who prepared the meals? ☐Yes ☐No ☐N/A
Did the respondent have prior knowledge that a 24 hour recall would be taken? ☐Yes ☐No

NUTRIENT SUPPLEMENT FORM

1. Yesterday, did you take any of the following: nutritional supplements, vitamins, minerals, or herbal, botanical or homeopathic preparations? Y / N
2. In the last month, did you take any other nutritional supplements, vitamins, minerals or herbal, botanical or homeopathic preparations? Y / N
3. Please tell me the name of all these products with their DIN (when available) that you took yesterday or during the last month. (DIN is a Drug Id. #)
4. Yesterday, at what time did you take your supplements and how many pills (or tablets, capsules, teaspoons, etc.) were taken at each time?
5. In the last month, how often was each of these supplements taken? (Number of times per day, per week or per month)
6. How many pills (or tablets, capsules, teaspoons, etc.) were usually taken on each occasion?

SUPPLEMENT NAME	DIN	YESTERDAY		DURING THE LAST MONTH			
				HOW OFTEN			HOW MUCH
		AT WHAT TIME?	#PILLS, TABS, CAPS, TSP…	DAY	WEEK	MONTH	#PILLS, TABS, CAPS, TSP…

RECIPE FORM # 1

Name of Recipe: _____

Cooking Time: _____

Temperature: _____

DESCRIPTION OF THE RECIPE AND COOKING PROCEDURES	QUANTITY

TOTAL YIELD: _____

RECIPE FORM # 2

Name of Recipe: _____

Cooking Time: _____

Temperature: _____

DESCRIPTION OF THE RECIPE AND COOKING PROCEDURES	QUANTITY

TOTAL YIELD: _____

Appendix C

Food Frequency Questionnaire

Identifier # | | | | | |

B.C. FOOD FREQUENCY QUESTIONNAIRE (Fall Session) FORM C

PART I

The next 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 month. If you did eat them, we would like to know how often you ate them and how much you ate at any one time. We are interested only in whether you have eaten them in the last month. So, if you have not eaten those foods at least once within the past month (that is before...give the date of one month ago) they are not important to this part of the survey. We will be looking at usual portions of these foods unlike the exact amounts eaten in the "yesterday" part of the survey.

"Please think about the last 4 weeks. Were they work weeks or holiday times? Did they involve a special occasion such as a wedding or party?

"Now I am going to read the list of foods"

"In the past month did you eat _____?"

IF NO, MOVE TO NEXT FOOD.
IF YES, THEN GO TO DAILY.

DAILY

"Did you eat _____ everyday in the past 4 weeks?

IF NO, MOVE TO WEEKLY
IF YES, THEN ASK "How many times a day." Using this model as a guide, would your usual serving size be the same, more, or less. How much more, how much less?"

WEEKLY

Did you eat _____ every week in the past month?

IF NO, MOVE TO MONTHLY
IF YES, THEN ASK "How many times a week?" Using this model as a guide, would your usual serving size be the same, more, or less. How much more, how much less?

MONTHLY

Then, how many times over the past month have you eaten _____? Using this model as a guide, would your usual serving size be the same, more, or less. How much more, how much less?

PLEASE NOTE - Respondents aged 75-84 (age/gender group 7 and 14) will not be asked about the portion section of the FFQ.

Identifier # | | | | | |

FOOD	FREQUENCY			PORTION SIZE		COMMENTS
	FURTHER FOOD DESCRIPTIONS	#	DAY/D WEEK/W MONTH/M	REFERENCE PORTION SIZE OR MODEL	HOW MUCH/ HOW MANY?	
HOW OFTEN DID YOU CONSUME: Vegetables and Fruits 01 Broccoli				1 MO-M		
02 Cabbage, coleslaw, sauerkraut				1 MO-M		
03 Carrots or mixed vegetables and carrots				1 MO-M		
04 Dark leafy greens – cooked				1 MO-M		
05 Dark leafy greens – raw				1 MO-M		
06 Squash (dark yellow)				1 MO-M		
07 Potatoes – French fries or panfried				1 MO-L		
08 Potatoes - baked, mashed or boiled				1 MO-L		
09-13 foods withdrawn for the fall session						

Identifier # | | | | | |

FOOD	FREQUENCY			PORTION SIZE		COMMENTS
	FURTHER FOOD DESCRIPTIONS	#	DAY/D WEEK/W MONTH/M	REFERENCE PORTION SIZE OR MODEL	HOW MUCH/ HOW MANY?	
Meat, Poultry, Fish and Alternatives 14 Poultry – fried				PC-S		
15 Poultry - cooked other ways				PC-S		
16 Beef - steaks, roasts, stews, and other cuts				PC-S		
17 Beef – hamburgers				PC-S		
18 Beef - other ground beef				PC-S		
19 Pork and Ham - roasts, chops and other cuts				PC-S		
20 Pork – bacon				1 STRIP		
21 Liver				PC-S		
22 Fish - fried (excl. shellfish)				PC-S		

Identifier # | | | | | |

FOOD	FREQUENCY			PORTION SIZE		COMMENTS
	FURTHER FOOD DESCRIPTIONS	#	DAY/D WEEK/W MONTH/M	REFERENCE PORTION SIZE OR MODEL	HOW MUCH/ HOW MANY?	
23 Fish – cooked in other ways (excl. shellfish)				PC-S		
24 Wieners or Sausages (with or without a bun)				1 UNIT		
25 Luncheon meats (cold cuts)				1 SLICE		
26 Eggs or egg dishes				1 EGG		
Milk Products 27 Cheese - regular, hard cheeses (>25 % MF)				1 SLICE or 1/3 PC-S		
28 Cheese - lower or reduced fat, part skim, processed or spreadable (10 - 24% MF)				1 SLICE or 1/3 PC-S or 2 TBL		
29 Cottage or ricotta cheeses				MO-S		
30 Yoghurt - all types				½ CUP or 175 G		
31 Ice Cream – regular or rich				½ CUP		

Identifier # | | | | | |

FOOD	FREQUENCY			PORTION SIZE		COMMENTS
	FURTHER FOOD DESCRIPTIONS	#	DAY/D WEEK/W MONTH/M	REFERENCE PORTION SIZE OR MODEL	HOW MUCH/ HOW MANY?	
32 Ice Cream - low fat, frozen yoghurt, ice milk or sherbet				½ CUP		
Grain Products 33 Cookies				1 COOKIE		
34 Crackers				1 CRACKER		
35 Donuts, cakes, pies, muffins, croissants				1 UNIT		
Other Foods 36 Potato or tortilla chips				1 BO-L		
37 Pizza				1 SLICE		
38 Rich gravy or pan drippings				1/4 CUP		
39 Cream or cheese sauce				1/4 CUP		

Identifier # | | | | | |

FOOD	FREQUENCY			PORTION SIZE		COMMENTS
	FURTHER FOOD DESCRIPTIONS	#	DAY/D WEEK/W MONTH/M	REFERENCE PORTION SIZE OR MODEL	HOW MUCH/ HOW MANY?	
Alcohol 40 Beer				1 BOTTLE		
41 Wine				4 F OZ		
42 Coolers/Ciders				1 BOTTLE		
43 Spirits				1 F OZ		
What kind of milk did you use in: (*Do not read list. See codes below*.) 44 Tea or Coffee				1 TBL		
45 On Cereal				½ CUP		
46 As a Beverage (white or chocolate)				1 CUP		

Select the types of milk consumed using the appropriate letter(s):

A Whole milk
B 2% milk
C 1% milk
D Buttermilk
E Skim milk
F Dry skim milk powder
G Cream or creamers
H Evaporated milk, regular (whole), NON diluted
I Evaporated milk, light, NON diluted
J Evaporated milk, 2%, NON diluted
K Evaporated milk, skim, NON diluted
L Evaporated milk, regular (whole), DILUTED

M Evaporated milk, light, DILUTED
N Evaporated milk, 2%, DILUTED
O Soy beverage
P Fortified soy beverage
Q Rice milk
R Fortified rice milk
S Other types of milk such as goat milk, etc. (Please specify)
T Used coffee whitener
U Did not add milk or cream to tea or coffee
V Ate cereals dry

Identifier # | | | | | |

For respondents aged 75-84 (age/sex group 7 and 14) go to PART IV, pg 11

PART II

This section deals with <u>homemade foods</u> and your use of fat over the past month. (*Do NOT read list. Check (✔) the main source(s) of fat used. If more than one source is checked, then all responses will be calculated as equal proportions*.)

IF YOU ATE HOME DEEP-FAT-FRIED FOODS AT LEAST TWICE THIS PAST MONTH, WHAT WAS THE MAIN KIND OF FAT OR OIL USED? (*Do NOT read list*.)		
47		Vegetable oil
48		Lard, bacon fat or other animal fat
49		Shortening
50		Do not know
51		Did not eat home deep-fried foods this past month
IF YOU ATE HOME-PAN FRIED FOODS AT LEAST TWICE THIS PAST MONTH, WHAT WAS THE MAIN KIND OF FAT OR OIL USED? (*Do NOT read list*.)		
52		Butter
53		Soft margarine
54		Hard margarine
55		Lard, bacon or other animal fat
56		Shortening
57		Vegetable oil
58		Pam or no oil
59		Do not know
60		Did not eat home pan-fried foods this past month
IF YOU ATE HOME-BAKED FOODS AT LEAST TWICE THIS PAST MONTH, WHAT WAS THE MAIN KIND OF FAT OR OIL USED? (*Do NOT read list*.)		
61		Butter
62		Soft margarine
63		Hard margarine
64		Shortening
65		Vegetable oil
66		Lard, bacon or other animal fat
67		Do not know
68		Did not eat home-made baked goods that contained fat this past month

Identifier # | | | | | |

WHAT WAS THE MAIN KIND OF "FAT SPREAD" YOU USED ON BREAD, BUNS, MUFFINS, ETC. THIS PAST MONTH? (*Do NOT read list*.)		
69		Butter
70		Soft margarine
71		Hard margarine
72		Low calorie margarine
73		Lard, bacon or other animal fat
74		None or none of these
75		Did not eat bread, buns, muffins, etc. this past month
WHAT WAS THE MAIN KIND OF "FAT SPREAD" YOU PUT ON POTATOES OR VEGETABLES THIS PAST MONTH? (*Do NOT read list*.)		
76		Butter
77		Soft margarine
78		Hard margarine
79		Low calorie margarine
80		Sour cream
81		Lard, bacon fat, other
82		None or none of these
83		Did not eat potatoes and vegetables this past month

Identifier # | | | | | |

PART III This section deals with your food habits during the past month.

(*Do NOT read list. Check (✔) all that apply. If the person did not eat meat or poultry or fish in Part I, then check (✔) "Did not eat meat/poultry/fish cooked by these methods this past month" below where appropriate.)*

OF THE MEAT YOU ATE LAST MONTH, WHAT WAS THE MOST COMMON METHOD OF COOKING IT? (*Do NOT read list*.)		
84		Broiled
85		Pan-fried with fat
86		Pan-fried without fat or with pan spray
87		Deep-fat fried
88		Oven-roasted (Baked)
89		Boiled
90		Microwaved
91		Barbecued
92		Steamed/Poached
93		Other method, specify:
94		Did not eat meat this past month
OF THE POULTRY YOU ATE LAST MONTH, WHAT WAS THE MOST COMMON METHOD OF COOKING IT? (*Do NOT read list*.)		
95		Broiled
96		Pan-fried with fat
97		Pan-fried without fat or with pan spray
98		Deep-fat fried
99		Oven-roasted (Baked)
100		Boiled
101		Microwaved
102		Barbecued
103		Steamed/Poached
104		Other method, specify:
105		Did not eat poultry this past month
OF THE FISH YOU ATE LAST MONTH, WHAT WAS THE MOST COMMON METHOD OF COOKING IT? (*Do NOT read list*.)		
106		Broiled
107		Pan-fried with fat
108		Pan-fried without fat or with pan spray
109		Deep-fat fried
110		Oven-roasted (Baked)
111		Boiled
112		Microwaved
113		Barbecued
114		Steamed/Poached
115		Other method, specify:
116		Did not eat fish this past month

Identifier # | | | | | |

If the person did <u>not</u> eat meat or poultry in Part I, then check (✔) "Did not eat meat/poultry this past month" below where appropriate.

OF THE MEAT YOU ATE LAST MONTH, DID YOU EAT THE VISIBLE FAT OF THE MEAT?		
117		Always
118		Sometimes
119		Never
120		Did not eat meat this past month
OF THE POULTRY YOU ATE LAST MONTH, DID YOU EAT THE SKIN OF THE POULTRY?		
121		Always
122		Sometimes
123		Never
124		Did not eat poultry this past month
IN THE PAST MONTH, WHAT WAS THE MAIN KIND OF DRESSING YOU ADDED TO YOUR SALADS? (*Do NOT read list*.)		
125		Mayonnaise
126		Mayonnaise-type and regular salad dressing
127		Low calorie and calorie-reduced salad dressing
128		Homemade oil and vinegar dressing
129		Other
130		Did not add salad dressing
131		Did not eat salad this past month

Identifier # | | | | | |

PART IV This section deals with why you choose the foods that you eat.

Next, we would like to know if you have specific reasons for choosing the foods that you eat. I have here a list of health related items which I will read out to you. Answer "yes" only to those reasons that really affect the choices you make in foods....<u>what you eat or what you don't eat</u>.
(*Read the lists. Check (✔) all that apply. Briefly probe to confirm some action is being taken. Enter a "0" if not applicable*.)

ARE YOU CHOOSING OR AVOIDING FOODS OR TYPES OF FOODS BECAUSE YOU ARE CONCERNED ABOUT: (*Read list.*)		
132		Maintaining and improving your health?
133		Heart Disease?
134		Cancer?
135		Osteoporosis (brittle bones)?
136		High blood pressure?
137		Weight gain?
138		Food Allergies or Intolerances?
139		None of the above
ARE YOU CHOOSING TO EAT FOODS OR TYPES OF FOODS BECAUSE OF: (*Read list.*)		
140		The nutrients they contain?
141		The type of fat they contain?
142		The unsaturated fat content?
143		The fibre content?
144		None of the above
ARE YOU AVOIDING FOODS OR TYPES OF FOODS BECAUSE OF: (*Read list.*)		
145		The fat content?
146		The salt content?
147		The cholesterol content?
148		The sugar content?
149		The saturated fat content?
150		None of the above

1. Do you consider yourself a vegetarian?

   ❑ Yes
   ❑ No → **go to question 2**

1a. Do you ever eat:

Dairy Products	❑ Yes	❑ No
Eggs	❑ Yes	❑ No
Fish/Seafood	❑ Yes	❑ No
Poultry	❑ Yes	❑ No
Red meat	❑ Yes	❑ No

Identifier # | | | | | |

2. I'm going to read you a list of conditions. Please indicate if you have this condition or if you have had this condition in the past. (*Read list. Check (✔) all that apply.*)

- ❑ Diabetes (*Read* **- does NOT include high blood sugars during pregnancy**)
- ❑ Heart Disease
- ❑ Stroke
- ❑ High Blood Pressure (*Read* **- does NOT include high blood pressure during pregnancy**)
- ❑ High Cholesterol
- ❑ Cancer
- ❑ Osteoporosis
- ❑ None of the above

3. Are you following any special diet?

- ❑ Yes (specify _____)
- ❑ No ➔ **go to question 4**

3a. Who prescribed this special diet?

- ❑ Doctor
- ❑ Dietitian
- ❑ Naturopath
- ❑ Chiropractor
- ❑ Self-prescribed
- ❑ Relative / Friend (not a doctor, dietitian, naturopath or chiropractor)
- ❑ Other (specify _____)
- ❑ Don't know
- ❑ Refused

4. In the past month, how many servings of fruits and vegetables did you eat on average every day? (*One serving is equal to ½ cup juice or ½ cup fresh / canned / frozen fruit and vegetable, or 1 medium whole fruit or 1 cup green salad.*)

		Record #

If the respondent has a second interview assigned, then go to FORM D (the Nutrition, Activity and Health Questionnaire), question 1. Otherwise, continue with question 5a on the next page.

Identifier # | | | | | |

5a. Have you ever seen or heard about the Canada's Food Guide to Healthy Eating? (*Show Food Guide.*)

- ❑ Yes
- ❑ No → **go to next questionnaire**

5b. Do you use it?

- ❑ Yes
- ❑ No → **go to next questionnaire**

5c. How do you use it? (*Do not read. Check (✔) all that apply.*)

- ❑ For shopping (eg. to prepare my shopping list)
- ❑ For planning/choosing meals (at home)
- ❑ For choosing foods in restaurants
- ❑ Other (specify _____)

Appendix D

Nutrition, Activity and Health Questionnaire

Identifier # | | | | | |

B.C. NUTRITION, ACTIVITY AND HEALTH QUESTIONNAIRE FORM D

In the event you find any of the questions sensitive to you, please let me know and we can move on to the next question.

The next questions are about your physical activity and weight.

1. Considering a week in the past month, how many times on the average did you do the following kinds of physical activities for more than 15 minutes during your leisure time? (*Show card with examples listed for part a, b and c. Write in each box the appropriate number of times per week.*)

   a. **STRENUOUS EXERCISE** (heart beats rapidly) such as running, jogging, hockey, football, soccer, squash, basketball, cross-country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling, singles tennis, intense weight training, high-impact aerobic exercises.

   # times per week | | |

   b. **MODERATE EXERCISE** (not exhausting) such as fast walking, baseball, doubles tennis, easy bicycling, volleyball, badminton, easy swimming, down hill skiing, popular and folk dancing, callisthenics, weight training for toning muscles, low-impact aerobic exercises, curling (sweeper).

   # times per week | | |

   c. **MILD EXERCISE** (minimal effort) such as yoga, archery, fishing from river bank, bowling, horseshoes, golf, snowmobiling, easy walking, curling (other than sweeper), gardening, housework (vacuuming, sweeping).

   # times per week | | |

2. How do you describe your work? By work we mean paid work and non-paid work such as a homemaker. Which of the following best describes how you spend most of your work time. (*Show card. Check (✓) only one. If the person is retired or unemployed, check not applicable. If a person does volunteer work for 20 hours or more per week, this can be considered unpaid work.*)

   - ❑ My work is mainly sitting. I do not walk much during work, e.g. telephone operator, computer programmer.
   - ❑ In my work I walk or move quite a lot but I do not have to lift or carry heavy things, e.g. shop assistant, light housework.
   - ❑ In my work I have to walk and carry a lot or climb staircases often or go uphill, e.g. carpentry, farm work, heavy housework.
   - ❑ My work is heavy physical labour where I usually have to carry, lift heavy things, dig or shovel, e.g. forestry work, heavy farm work, warehouse work.
   - ❑ Not applicable (ie. retired, unemployed, other (specify: _____)

Identifier # | | | | | |

3. Would you consider yourself overweight, underweight or just about right?

❑ Overweight ➔

Would you consider yourself:
❑ Very overweight
❑ Somewhat overweight
❑ A little overweight

❑ Underweight ➔

Would you consider yourself:
❑ Very underweight
❑ Somewhat underweight
❑ A little underweight

❑ Just About Right

4. Are you presently trying to change your weight?

❑ Yes ➔➔➔ Are you trying to lose or gain weight?

❑ No ➥ **go to Q 7**

❑ Lose ➔➔

❑ Not Sure ➥ **go to Q 7**

❑ Not sure ➥ **go to Q 7**

❑ Gain ➔➔

How much?

☐☐☐.☐ Kg

or

☐☐☐.☐ Lbs

❑ Not sure

How much?

➥ **go to Q 5**

Identifier # ☐☐☐☐☐

☐☐☐.☐ Kg

or

☐☐☐.☐ Lbs

❑ Not sure

➥ **go to Q 6**

Identifier # | | | | | |

5. What are you currently doing to lose weight? (*Do NOT read out responses. Check (✓) all that apply. After each verbal response, ask, "Is there anything else you are doing?"*)

- ❑ Changing eating habits (such as reducing portions, eating less fat)
- ❑ Exercising more
- ❑ Following a specific diet plan
- ❑ Skipping meals
- ❑ Taking diet pills
- ❑ Taking meal replacements/supplements (specify _____)
- ❑ Attending a weight control program
- ❑ Receiving dietary counselling with registered dietitian/nutritionist
- ❑ Receiving dietary counselling (other, specify_____)
- ❑ Other (specify_____)

➥ **GO TO QUESTION 7a**

6. What are you currently doing to gain weight? (*Do NOT read responses. Check (✓) all that apply. After each verbal response, ask, "Is there anything else you are doing?"*)

- ❑ Changing eating habits (such as increasing portions, eating more frequently, eating higher calorie foods)
- ❑ Exercising more
- ❑ Restricting exercise
- ❑ Following a specific diet plan
- ❑ Taking meal replacements/supplements (specify_____)
- ❑ Receiving dietary counselling with registered dietitian/nutritionist
- ❑ Receiving dietary counselling (other, specify_____)
- ❑ Other (specify_____)

7a. The next question addresses your exercise habits and is based upon the following definition of exercise. (*Show card. Read definition*.)

Exercise includes activities such as swimming, aerobic dancing, biking, rowing, jogging, brisk walking, etc. Activities that are primarily sedentary, such as bowling, or playing golf with a cart, would not be considered exercise. (*Ask the respondent if he/she understands the definition. Repeat the definition if necessary*.)

Considering this definition, please listen to the following statements and answer yes or no. (*Check (✓) the response*)

I currently exercise.

- ❑ Yes ➥ **go to question 7c**
- ❑ No

7b. I intend to exercise in the next 6 months.

- ❑ Yes ➥ **go to question 8**
- ❑ No ➥ **go to question 8**

Identifier # | | | | | |

7c. I'm going to read you a definition of ***REGULAR*** exercise to consider for the next statement. ***REGULAR*** exercise is equal to 3 times or more per week for 20 minutes or longer each time. (*Show card. Read definition. Ask the respondent if he/she understands the definition. Repeat the definition if necessary*.)

I currently exercise ***REGULARLY***.

- ❑ Yes ➥ **go to question 7d**
- ❑ No ➥ **go to question 8**

7d. I have been exercising ***REGULARLY*** for the past 6 months.

- ❑ Yes
- ❑ No

The next set of questions are about your weight and the way you feel about your body.

8. On a scale of 1-5, where 1 is very uncomfortable and 5 is very comfortable, how comfortable do you feel about your body when you see yourself in a mirror? (*Show card. Circle answer.*)

1	2	3	4	5	
Very Uncomfortable	Somewhat Uncomfortable	Neutral (neither comfortable nor uncomfortable)	Somewhat Comfortable	Very Comfortable	Not Sure

9. First, I'm going to read out some statements. please state whether the statement is true (T) or false (F) for you. (*If respondent cannot decide whether a statement is true or false for them, ask them to identify whether it is true or false most of the time*)

i. I do not eat some foods because they make me fat..... T F

ii. When I feel 'down' or sad, I often overeat..... T F

iii. I deliberately take small helpings as a means of controlling my weight ..... T F

iv. Sometimes when I start eating, I just can't seem to stop ..... T F

v. When I feel lonely, I console myself by eating ..... T F

10. For the next set of questions, I'm going to ask you to indicate which response best describes your eating behaviour.

i. How often are you restricting your food intake in a conscious effort to control your weight. Would you say you do this:

1	2	3	4
Rarely	Sometimes	Usually	Always

Identifier # | | | | | |

10. (continued)

ii. Do you go on eating binges even though you are not hungry? Would you say you do this: (***Only*** *if asked to define binge, read the following definition: A binge means eating a very large amount of food in a very short period of time, and feeling that you can't control how much you're eating.*)

1	2	3	4
Never	Rarely	Sometimes	At least weekly

iii. How likely are you to consciously eat less than you want. Would you say you are:

1	2	3	4
Unlikely	Slightly likely	Moderately likely	Very likely

iv. On a scale of 0-5, where 0 means no restraint in eating (eating whatever you want, whenever you want), and 5 means total restraint (constantly limiting food intake and never 'giving in'), how would you rate yourself? (*Show card. Circle response*).

0	1	2	3	4	5
eat whatever you want, whenever you want	usually eat whatever you want, whenever you want	often eat whatever you want, whenever you want	often limit food intake, but often 'give in'	usually limit food intake, rarely 'give in'	constantly limit food intake, never 'give in'

11a. The next question is about your lifestyle physical activity which is a bit different from exercise. (*Show card. Read definition*.)

Lifestyle physical activity means walking leisurely, vacuuming, digging in the garden, climbing stairs or any other physical activity where the exertion is similar to these. (*Ask respondent if he/she understand the definition. Repeat the definition if necessary*.)

Considering this definition, please listen to the following statements and answer yes or no. (*Check (✓) the response*)

I am currently physically active.

- ❑ Yes ➥ **go to question 11c**
- ❑ No

11b. I intend to become physically active in the next 6 months.

- ❑ Yes ➥ **go to question 12**
- ❑ No ➥ **go to question 12**

Identifier # | | | | | |

11c. I'm going to read you a definition of ***REGULAR*** lifestyle physical activity to consider for the next statement. ***REGULAR*** lifestyle physical activity means accumulating 30 minutes or more in the above activities per day for at least 4 days per week. For example, you could take one 30 minute walk, jog, bike or swim or three 10 minute walks or 15 minutes of vacuuming plus 10 minutes of digging plus 5 minutes of climbing stairs. Listen to the following statement and answer yes or no. (*Show card. Read definition and example. Ask the respondent if he/she understands the definition and example. Repeat if necessary*.)

I am ***REGULARLY*** physically active.

- ❑ Yes
- ❑ No ➥ **go to question 12**

11d. I have been ***REGULARLY*** physically active for the past 6 months.

- ❑ Yes
- ❑ No

12. What prevents you from being more physically active (*This includes both lifestyle physical activity and exercise. Do NOT read list. Check (✓) all that apply. Use prompt, "Anything else?" after each response.*)

- ❑ I am active enough already
- ❑ Illness or disability
- ❑ Lack of time
- ❑ Lack of transportation
- ❑ Lack of money
- ❑ Lack of easily accessible facilities
- ❑ Lack of interesting or relevant activities
- ❑ Lack of motivation or will power
- ❑ Other interests or priorities
- ❑ Other commitments such as children, family, school or work
- ❑ Weather
- ❑ Too tired / no energy
- ❑ No one to exercise with
- ❑ Other (specify _____)
- ❑ None of the above

Identifier # | | | | | |

The following questions are about your dental health and practices.

13. Adults can have up to 32 natural teeth but over time people lose some of them. How many natural teeth, including crowns do you have? (*Read response categories*.)

- ❑ 20 or more natural teeth
- ❑ between 10 and 19 teeth
- ❑ between 1 and 10 natural teeth
- ❑ no natural teeth

14. Currently, do your gums bleed when you eat or brush your teeth?

- ❑ Yes
- ❑ No

15. Currently, do you have any problems or difficulties biting or chewing your food?

- ❑ Yes
- ❑ No

16. Which of the following do you do daily? (*Read response categories. Check (✓) all that apply*.)

- ❑ Clean my teeth with a toothbrush
- ❑ Use a toothpaste containing fluoride
- ❑ Use dental floss
- ❑ Use a mouth rinse
- ❑ Restrict my intake of sugar to prevent dental decay
- ❑ None of the above

17. Do you wear partial or full dentures?

- ❑ Yes ➔➔➔
- ❑ No ➥ **go to question 19**

Which of the following do you do daily? (*Read response categories. Check (✓) all that apply*.)

- ❑ Clean my dentures
- ❑ Leave my dentures out at night
- ❑ Neither of the above

18. About how long ago was your last visit to the dentist? (*Read response categories. Check (✓) one*.)

- ❑ less than 1 year
- ❑ more than 1 year, up to 2 years ago
- ❑ more than 2 years, up to 5 years ago
- ❑ more than 5 years
- ❑ never been to the dentist

Identifier # | | | | | |

The following questions are about food handling practices in your home. If you are not the person who prepares food in your home, answer the questions according to what is usually done in your home.

19. How do you usually cook hamburgers for yourself? (*Show card. Read response categories*.)

- ❑ Rare (pink in the middle)
- ❑ Medium (brown throughout with a little pink in the middle)
- ❑ Well done (no pink, juices running clear)
- ❑ Don't know
- ❑ Don't serve hamburgers

20. Having cooked a large casserole with meat in it for the next day, how do you usually cool it? (*Show card. Read response categories. If the person does not eat meat, substitute poultry or fish in the question.*)

- ❑ Leave it on the stove/counter for more than 2 hours before putting it in the refrigerator
- ❑ Leave it on the stove/counter for up to 2 hours before putting it in the refrigerator
- ❑ Put it in the refrigerator immediately after cooking
- ❑ Separate it immediately into smaller portions and placing them into the refrigerator
- ❑ None of the above
- ❑ Don't know
- ❑ Don't cook casseroles with meat in it for the next day

21. Between handling with your bare hands raw poultry and a salad, what do you usually do? (*Show card. Read response categories. If the person does not eat poultry, substitute fish or meat in the question*.)

- ❑ Rinse your hands
- ❑ Wash your hands with soap and water
- ❑ Wipe your hands only
- ❑ None of the above
- ❑ Don't know
- ❑ Don't handle raw poultry / Don't handle with bare hands

22. Having used a dish cloth to wipe up after cutting raw fish, what do you usually do? (*Show card. Read response categories. If the person does not eat fish, substitute meat or poultry in the question.*)

- ❑ Discard the dish cloth, including paper towel
- ❑ Set the dish cloth aside until needed again
- ❑ Rinse out the dish cloth in water before using again
- ❑ Put the dish cloth in the laundry
- ❑ Wash the dish cloth in soap and water before using again
- ❑ Sterilize the dish cloth with very hot water, or sanitiser (eg. chlorine solution)
- ❑ None of the above
- ❑ Don't know
- ❑ Don't cut raw fish

Identifier # | | | | | |

Next, I am going to ask some questions about your family's food situation.

23. In the past 12 months, did you or anyone else in your family worry that there would not be enough to eat because of a lack of money?

- ❑ Yes
- ❑ No
- ❑ Don't know

24. In the past 12 months, did you or anyone else in your family not have enough food to eat because of a lack of money?

- ❑ Yes
- ❑ No
- ❑ Don't know

25. In the past 12 months, did you or anyone else in your family not eat the quality or variety of foods that you wanted to eat because of a lack of money?

- ❑ Yes
- ❑ No
- ❑ Don't know

➥ **If respondent answered Yes to any of Q 23, 24 OR 25, go to Q 26**
➥ **If respondent answered No or Don't know to all of Q 23, 24 AND 25, go to Q 29**

---

26. In the past 12 months, how often did you or anyone in your family receive food from a food bank, soup kitchen or other charitable agency because there was not enough money for food?

- ❑ About every week
- ❑ About every other week
- ❑ About every month
- ❑ About 6 times
- ❑ About once or twice
- ❑ Not at all
- ❑ Don't know

27. In the past 12 months, how often did you or anyone in your family eat cheaper foods or eat the same foods for several days in a row because there was not enough money for food?

- ❑ About every week
- ❑ About every other week
- ❑ About every month
- ❑ About 6 times
- ❑ About once or twice
- ❑ Not at all
- ❑ Don't know

28. In the past 12 months, how often did you or other members of your family skip meals or eat less than you should because there was not enough money for food?

- ❑ About every week
- ❑ About most every other week
- ❑ About every month
- ❑ About 6 times
- ❑ About once or twice
- ❑ Not at all
- ❑ Don't know

29. In some parts of Canada there are food action programs to help people with their food situation. Do you think any of the following programs would help you? (*Read definittions of programs*.)

a. Community Kitchens - a small group of people get together to plan, shop and cook for themselves and their families (usually in a community centre), sharing the cost, and taking the food home to be eaten.

- ❑ Yes
- ❑ No
- ❑ Don't know

b. Food Buying Clubs - a large group of people get together to buy food directly from wholesalers and local growers, to sort and package for delivery to or pick-up by club members.

- ❑ Yes
- ❑ No
- ❑ Don't know

c. Community Gardens - people grow fruits and vegetables for themselves and their families at a public garden usually with advice and support of volunteer gardeners.

- ❑ Yes
- ❑ No
- ❑ Don't know

d. Community Food Advisors - volunteers are trained to share their food skills in free workshops usually offered through community centres on preparing low cost, nutritious meals.

- ❑ Yes
- ❑ No
- ❑ Don't know

Identifier # | | | | | |

Next I'm going to ask some questions about food shopping.

30. Thinking about the food in the store where you do or a member of your family does most of the food shopping, on a scale of 1 to 5 where 1 is strongly disagree and 5 is strongly agree, how would you respond to the following statements? (*Show response cards*.)

The food is reasonably priced.

1	2	3	4	5	
Strongly Disagree	Disagree	Neutral (neither agree nor disagree)	Agree	Strongly Agree	Don't Know

The food is of reasonable quality.

1	2	3	4	5	
Strongly Disagree	Disagree	Neutral (neither agree nor disagree)	Agree	Strongly Agree	Don't Know

There is reasonable variety in the food available.

1	2	3	4	5	
Strongly Disagree	Disagree	Neutral (neither agree nor disagree)	Agree	Strongly Agree	Don't Know

31. When available, do you choose to buy foods grown or produced in B.C. instead of food grown or produced elsewhere? (*Read response categories*.)

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Never
- ❑ Don't know
- ❑ Don't shop

32. When available, do you choose to buy organically grown foods instead of conventionally produced foods? (*Read response categories*.)

- ❑ Always
- ❑ Often
- ❑ Sometimes
- ❑ Never
- ❑ Don't know
- ❑ Don't shop

Identifier # | | | | | |

Now I'm going to ask you about your consumption of foods from sources outside of the commercial food supply. These include home-grown and wild foods.

33. In the past 12 months, did you eat any berries grown in B.C.? These include home-grown or wild strawberries, blueberries, raspberries, blackberries, salmonberries, huckleberries and gooseberries. (*Prompt - This does not include berries bought at the grocery store or farmers market or picked at a u-pick*).

❑ Yes ❑ No ➥ **go to question 34**
❑ Don't know ➥ **go to question 34**

Over what time period did you eat these berries, including berries that were made into jam, canned or frozen and eaten later in the past 12 months? (*Read list*)	In that time period, how often did you eat these berries? (*Prompt - either per day, per week, per month or per year*)		On average, how much did you eat each time you ate some?		COMMENTS
	#	DAY/D WEEK/W MONTH/M YEAR/Y	REFERENCE PORTION SIZE OR MODEL	HOW MUCH/ HOW MANY?	
❑ over 2 weeks ❑ over 1 month ❑ over 3 months ❑ over 6 months ❑ over 12 months ❑ other, specify:			1 SP-S (jam) ½ CUP		

34. In the past 12 months, did you eat any wild mushrooms grown in B.C.? (*Prompt - This does not include mushrooms bought in the grocery store or farmers market*)

❑ Yes ❑ No ➥ **go to question 35** ❑ Don't know ➥ **go to question 35**

Over what time period did you eat wild mushrooms in the past 12 months? (*Read list*)	In that time period, how often did you eat wild mushrooms? (*Prompt - either per day, per week, per month or per year*)		On average, how much did you eat each time you ate some?		COMMENTS
	#	DAY/D WEEK/W MONTH/M YEAR/Y	REFERENCE PORTION SIZE OR MODEL	HOW MUCH/ HOW MANY?	
❑ over 2 weeks ❑ over 1 month ❑ over 3 months ❑ over 6 months ❑ over 12 months ❑ other, specify:			½ CUP		

Identifier # | | | | | |

35. In the past 12 months, did you eat any wild fish caught in B.C.? (*Prompt - This does not include fish bought in the grocery store or fish market or caught at a fish farm.*)

❑ Yes ❑ No ➥ **go to question 36** ❑ Don't know ➥ **go to question 36**

What kind of wild fish did you eat? (*Read list. Check (✓) all that apply*)	Over what time period did you eat this fish, including the fish that was smoked, canned or frozen and eaten later in the past 12 months? (*Read list*) A - over 2 weeks B - over 1 month C - over 3 months D - over 6 months E - over 12 months F - other (specify)	In that time period, how often did you eat this fish? (*Prompt - either per day, per week, per month or per year*)		On average, how much did you eat each time you ate some?	
		#	DAY/D WEEK/W MONTH/M YEAR/Y	REFERENCE PORTION SIZE OR MODEL	HOW MUCH/ HOW MANY?
❑ salmon				PC-S	
❑ salmon liver				1 liver	
❑ trout				PC-S	
❑ trout liver				1 liver	
❑ whitefish				PC-S	
❑ whitefish liver				1 liver	
❑ chub				PC-S	
❑ chub liver				1 liver	
❑ burbot				PC-S	
❑ burbot liver				1 liver	
❑ squawfish				PC-S	
❑ squawfish liver				1 liver	

COMMENTS:

36. In the past 12 months, did you eat any wild birds (such as duck, goose, partridge, quail and grouse) caught in B.C.? (*Prompt - This does not include wild birds bought in the grocery store or farmers market*.)

❑ Yes ❑ No ➥ **go to question 37** ❑ Don't know ➥ **go to question 37**

Over what time period did you eat wild birds, including the birds that were smoked or frozen and eaten later in the past 12 months? (*Read list*)	In that time period, how often did you eat wild birds? (*Prompt - either per day, per week, per month or per year*)		On average, how much did you eat each time you ate some?		COMMENTS
	#	DAY/D WEEK/W MONTH/M YEAR/Y	REFERENCE PORTION SIZE OR MODEL	HOW MUCH/ HOW MANY?	
❑ over 2 weeks ❑ over 1 month ❑ over 3 months ❑ over 6 months ❑ over 12 months					

Identifier # | | | | | |

36. In the past 12 months, did you eat any wild birds (such as duck, goose, partridge, quail and grouse) caught in B.C.? (*Prompt - This does not include wild birds bought in the grocery store or farmers market*.)

❑ Yes ❑ No ➥ **go to question 37** ❑ Don't know ➥ **go to question 37**

Over what time period did you eat wild birds, including the birds that were smoked or frozen and eaten later in the past 12 months? (*Read list*)	In that time period, how often did you eat wild birds? (*Prompt - either per day, per week, per month or per year*)		On average, how much did you eat each time you ate some?		COMMENTS
	#	DAY/D WEEK/W MONTH/M YEAR/Y	REFERENCE PORTION SIZE OR MODEL	HOW MUCH/ HOW MANY?	
❑ other, specify:			PC-S		

37. In the past 12 months, did you eat any wild shellfish caught in B.C.? (*Prompt - This does not include shellfish bought in the grocery store or fish market*.)

❑ Yes ❑ No ➥ **go to question 38** ❑ Don't know ➥ **go to question 38**

What kind of shellfish did you eat? (*Read list. Check (✓) all that apply*)	Over what time period did you eat this shellfish, including the shellfish that was canned or frozen and eaten later in the past 12 months? (*Read list*) A - over 2 weeks B - over 1 month C - over 3 months D - over 6 months E - over 12 months F - other (specify)	In that time period, how often did you eat this shellfish? (*Prompt- either per day, per week, per month or per year*)		On average, how much did you eat each time you ate some?	
		#	DAY/D WEEK/W MONTH/M YEAR/Y	REFERENCE PORTION SIZE OR MODEL	HOW MUCH/ HOW MANY?
❑ shrimp / prawns					
❑ oysters / mussels / clams					
❑ crab					
❑ crab digestive organs (show picture)					

COMMENTS:

38. In the past 12 months, did you eat any wild game (such as caribou, deer or rabbit) caught in B.C.? (*Prompt - This does not include game bought in the grocery store or farmers market*.)

❑ Yes ❑ No ➥ **go to next questionnaire** ❑ Don't know ➥ **go to next questionnaire**

Identifier # | | | | | |

(*Probe to find out if muscle, liver or kidney, was eaten*)	Over what time period did you eat wild game, including the game that was smoked, made into sausages or frozen and eaten later in the past 12 months? (*Read list*) A - over 2 weeks B - over 1 month C - over 3 months D - over 6 months E - over 12 months F - other (specify)	In that time period, how often did you eat wild game? (*Prompt - either per day, per week, per month or per year.*)		On average, how much did you eat each time you ate some?	
		#	DAY/D WEEK/W MONTH/M YEAR/Y	REFERENCE PORTION SIZE OR MODEL	HOW MUCH/ HOW MANY?
❑ muscle				PC-S	
❑ liver				1 liver	
❑ kidney				1 kidney	
COMMENTS:					

Appendix E

Demographic Questionnaire

Identifier # | | | | | |

B. C. DEMOGRAPHIC QUESTIONNAIRE (Fall Session) FORM E

In order to compare your answers with those provided by people from similar backgrounds, I would like to ask you a few questions about yourself.

1. (*Confirm with the respondent the date of birth provided on label.*)

day		month		year	

2. (*Confirm the gender provided on the label.*)

- ❑ Male
- ❑ Female

3. What is your current marital status? Are you: (*Read list*.)

- ❑ Married or *Living Common Law
- ❑ Divorced
- ❑ Separated
- ❑ Widowed
- ❑ Never Married

*Common Law is defined as adults of the opposite sex or same sex living together in a sexual union of 3 months or more duration. Ref.- Statistics Canada

4a. How many years have you spent in school, including the equivalent of elementary, high school, technical college and university, but not including kindergarten? (*Probe for full-time versus part-time. Full-time is 24 hours or more of class time per week; part-time is less than 24 hours of class time per week.*)

	Full-time years
	Part-time years

In what country did you complete most of your education? _____

4b. What is your highest grade or level of education? (*Do NOT read list. Check (✓) only one. Some probing may be required since a distinction is required between "some" and "completed"*.)

- ❑ No schooling
- ❑ Some Elementary
- ❑ Completed Elementary
- ❑ Some Secondary
- ❑ Completed Secondary
- ❑ Some Trade / Vocational Training
- ❑ Completed Trade / Vocational Training
- ❑ Some University
- ❑ Certificate or Diploma below Bachelor's Level
- ❑ Bachelor's Degree or Above

Identifier # | | | | | |

5. In the past 12 months, did your family receive income from any of the following financial assistance programs: *(Read list. Family is defined as a group of individuals related by blood, marriage including common-law, or adoption, who share a common dwelling unit at the time of the survey. Ref. - Statistics Canada. See definitions of financial assistance programs below if necessary*)

- ❑ Child Tax Benefit
- ❑ Guaranteed Income Supplement or Spouse's Allowance
- ❑ Income Assistance or Welfare
- ❑ Employment Insurance
- ❑ None of the above

Child Tax Benefit is paid to low-income families with children.
Guaranteed Income Supplement is paid to Old Age Security recipients who have little or no other income.
Spouse's Allowance is an income-tested, monthly benefit paid to the 60-64 year old legal or common-law spouse of an Old Age Security recipient, if that recipient is eligible for the Guaranteed Income Supplement.
Income Assistance or Welfare refers to B.C. Benefits which is an umbrella term for several benefit programs, namely Income Assistance, Youth Works, Disability Benefits and Child Care Benefits.
Employment Insurance benefits are paid to people who are available for and able to work but cannot find a job, and to those unable to work owing to illness, maternity or caring for a new-born or newly adopted child.

6a. How many people in your family are aged (include self): (*Family is defined as a group of individuals related by blood, marriage including common-law, or adoption, who share a common dwelling unit at the time of the survey. Ref. - Statistics Canada*.)

0 - 18 years ☐

19 - 64 years ☐

65+ years ☐

6b. How many people are in your household, including non-family members (include self)?

☐ # of people

7. Please look at the card and tell me, as close as you possibly can, the code which corresponds to your family income before taxes in the year 1998. (*Family is a group of individuals related by blood, marriage including common-law, or adoption, who share a common dwelling unit at the time of the survey. Ref. - Statistics Canada.*)

Income Range	Code
≤12,000	A
12,001-15,000	B
15,001-20,000	C
20,001-25,000	D
25,001-30,000	E
30,001-35,000	F
35,001-40,000	G
40,001-45,000	H
45,001-55,000	I
> 55,000	J
Don't know	K
Refused	L

☐ Code

Identifier # | | | | | |

8. Do you identify yourself as an aboriginal or First Nations person? This includes Indian, Inuit or Metis.

- ❑ Yes
- ❑ No

9a. Have you smoked 100 or more cigarettes in your life?

- ❑ Yes
- ❑ No ➔**go to question 10**
- ❑ Refused ➔**go to question 10**

9b. Do you usually smoke cigarettes every day?

- ❑ Yes
- ❑ No ➔ **go to question 9d**
- ❑ Refused ➔ **go to question 10**

9c. How many cigarettes do you smoke a day?

cigarettes per day

9d. (*The interviewer needs to record in the table below, the age at which the respondent started smoking, the age at which the respondent quit smoking, and the average daily consumption of cigarettes during that time period. This information should be recorded for **all smoking periods** in the respondent's life; ie. - the respondent may have quit smoking and then picked up the habit again more than once in his life. Once collected, this information will be entered into a computer and it will calculate average daily cigarette consumption*.)

Probing questions:

"At what age did you start smoking?"

" At what age did you quit smoking?"

"Did you quit smoking for one year or more and then restart more than once?"
IF YES, **"At what age did you start and quit smoking for each smoking period?"**
IF NO, go to next question

"On average, how many cigarettes did you smoke per day during the period from age _____ to age _____?"

IF respondent is a current smoker, record his present age in the "Age Stopped" column in the last Episode.

Episode	Age Started	Age Stopped *Or current age if still smoking*	Average Daily Consumption
1			
2			
3			

10. Have you smoked cigars or cigarillos 100 or more times in you life?

- ❑ Yes
- ❑ No
- ❑ Don't know
- ❑ Refused

The following question 11, 12 and 13 may sound repetitive, but they need to be asked in a specific way in order for the results to be compared to other provinces.

11a. During the past month, did you eat bread?

- ❑ Yes
- ❑ No ➔**go to question 12**

11b. What type of bread did you usually eat? (*Do NOT read list. Check (✓) only one*.)

- ❑ Whole wheat (100%, 60%)
- ❑ Multigrain / Cracked wheat
- ❑ White bread
- ❑ Rye / pumpernickel
- ❑ Other, specify: _____
- ❑ Don't know

12a. During the last month, did you use milk?

- ❑ Yes
- ❑ No ➔**go to question 13**

12b. What type of milk did you usually use? (*Do NOT read list. Check (✓) only one*.)

- ❑ Whole milk
- ❑ 2% milk
- ❑ 1% milk
- ❑ Skim milk
- ❑ Powdered skim milk
- ❑ Evaporated milk
- ❑ Other
- ❑ Don't know

13. During the past month, did you take any vitamin-mineral supplements?

- ❑ Yes
- ❑ No

Identifier # | | | | | |

We have reached the end of the questions. All that is left is for me to take some body measurements – your weight, height, and waist and hip circumferences.

14. Anthropometrics

Weight used for calibration

			.		Kg

Weight on scale of calibration weight:

			.		Kg

Weight: (*note on comment line if measurement may not be accurate and why*)

			.		Kg

or

			.		Lbs

❑ Measured
❑ Self-Reported (specify reason)
❑ Refused
Comments / Reason for Self-Report:
_____
_____

Height: (*note on comment line if measurement may not be accurate and why*)

			.		cm

or

	feet			.			inches

❑ Measured
❑ Self-Reported (specify reason)
❑ Refused
Comments / Reason for Self-Report:
_____
_____

If the respondent is 50 years old or over, ask the following question(s) regarding age-related height loss.

Are you aware of any changes in your height in your adult life?

❑ Yes ➔➔➔
❑ No ➔ **go to waist measurement**

How tall were you at age 20?

			.		cm

or

	feet			.			inches

❑ Don't know

Waist Circumference:

❑ Refused

First Measurement

			.		cm

Second Measurement

			.		cm

*Third Measurement

			.		cm

* only if difference between the first 2 measurements is > 0.4 cm

Identifier # | | | | | |

Hip Circumference:

❑ Refused

First measurement

| | | | . | | cm

Second measurement

| | | | . | | cm

*Third measurement

| | | | . | | cm

* only if difference between the first 2 measurements is > 0.4 cm

Thank you for your participation in the Survey. Your commitment of time and willingness to provide personal information is greatly appreciated.

Appendix F

Non-Response Questions

B.C. NUTRITION SURVEY – NON-RESPONSE QUESTIONS FORM A-2

Interviewer ID ☐☐ Identifier # ☐☐☐☐☐

If you face a refusal (02) or Location verified, temporary no contact (03): (*Read the following*)
In order to determine if people who say yes to the study are different than people who say no to the study, I would like to ask you 6 quick questions about your eating habits and your background.

1. During the past month, did you eat bread?

   ☐ Yes ☐ No

   If yes, what type of bread did you usually eat? (*Do NOT read list. Check (✔) only one*.)

   ☐ Whole Wheat (100%, 60%)
   ☐ Multigrain/Cracked Wheat
   ☐ White Bread
   ☐ Rye, Pumpernickel
   ☐ Other: _____
   ☐ Don't know

2. During the past month, did you use milk?

   ☐ Yes ☐ No

   If yes, what type of milk did you usually use? (*Do NOT read list. Check (✔) only one*.)

   ☐ Whole milk
   ☐ 2% milk
   ☐ 1% milk
   ☐ Skim milk
   ☐ Powdered milk
   ☐ Evaporated milk
   ☐ Other: _____
   ☐ Don't know

3. During the past month, did you take any vitamin-mineral supplement?

   ☐ Yes ☐ No

4. Have you smoked 100 or more cigarettes in your life?

   ☐ Yes ☐ No ➥ **go to Q5** ☐ Refused ➥ **go to Q5**

   Do you usually smoke cigarettes every day?

   ☐ Yes ☐ No ➥ **go to Q5** ☐ Refused ➥ **go to Q5**

   How many cigarettes do you smoke a day?

   ☐☐☐ # cigarettes per day

Identifier # | | | | | |

5. What is your current marital status? Are you: (*Read list*.)

01 ☐ Married or * Living Common Law
02 ☐ Divorced
03 ☐ Separated
04 ☐ Widowed
05 ☐ Never Married

*Common Law is defined as adults of the opposite sex or same sex living together in a sexual union of 3 months or more duration.

6. What is your highest grade or level of education? (*Do NOT read list. Check (✔) only one. Some probing may be required since a distinction is required between "some" and "completed"*.)

01 ☐ No schooling
02 ☐ Some Elementary
03 ☐ Completed Elementary
04 ☐ Some Secondary
05 ☐ Completed Secondary
06 ☐ Some Trade / Vocational Training
07 ☐ Completed Trade / Vocational Training
08 ☐ Some University
09 ☐ Certificate or Diploma below Bachelor's Level
10 ☐ Bachelor's Degree or Above

These are examples of the study questions, would you like to reconsider full articipation in the study?

Thank you for your time.

Appendix G

Participant's Letter

BRITISH COLUMBIA

September 13, 1999

Dear Resident:

The Ministry of Health and the Ministry Responsible for Seniors, the University of British Columbia and Health Canada are conducting a study of British Columbians' food habits and the factors that influence these food choices. Since 1990, Health Canada has sponsored similar studies in the other provinces, and this study in British Columbia will complete the national nutrition picture.

Approximately 2500 British Columbians will be included in this study. Your name has been chosen at random from the Ministry of Health Client Registry as a potential participant. While participation in the study is voluntary, your involvement would be valuable for several reasons. The information collected will help plan nutrition programs and services in the province. As well, the data from British Columbia will be combined with that from other provinces to help in understanding the eating habits of all Canadians. This information will help set food policies that ensure a consistent, safe and nutritious food supply for our nation. We hope that you will consider these factors and contribute your time to participate in this important project.

Between September 13 and December 10, 1999, a public health nurse or nutritionist will telephone you to ask for your participation and to answer any questions you may have. Should you agree to participate, this interviewer will come to your home at your convenience to collect the necessary information. The interviewer will ask you questions regarding your eating habits and will measure your weight, height, waist and hips. All measurements will be taken over light weight street clothes. The interview will last approximately 90 minutes. You may also be asked to take part in a follow-up interview a short time later.

All information that you provide will be held in strict confidence. Your name will not appear in any reports that arise from this study. You may refuse to answer any specific questions or to have body measurements taken. Also, if you agree to participate and then change your mind about participating, you may withdraw from the study at any time.

...2

Ministry of Health and
Ministry Responsible for Seniors

Public and Preventive Health Services
Preventive Health Branch

1520 Blanshard Street, 2nd Floor
Victoria BC V8W 3C8

Telephone: (250) 952-1536
Facsimile: (250) 952-1570

Should you, at any time, have questions regarding the study, please feel free to contact Lisa Forster-Coull, Principal Investigator, Ministry of Health and Ministry Responsible for Seniors, at (250) 952-1536. For further information, you can call the Ministry of Health's toll free number 1-800-465-4911.

We hope that you agree to participate in this important study. The information you provide will assist all British Columbians in making healthy food choices.

Sincerely,

Lisa Forster-Coull
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Ministry of Health
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Dr. Robert Fisk
Co-Investigator
Epidemiologist
Ministry of Health
(250) 952-1464

Si vous désirez cette correspondence en français, s.v.p. téléphonez au bureau d'enquête au 1-250-952-2321.

If you have recently moved or changed your telephone number, please contact the survey office at (250) 952-2321 or call the Ministry of Health's toll-free number at 1-800-465-4911 to leave a message. Thank you.

Appendix H

Request for Response Letter

BRITISH COLUMBIA

May 3, 1999

Dear

The Ministry of Health and the Ministry Responsible for Seniors, the University of British Columbia, and Health Canada are conducting a study of British Columbians' food habits and the factors that influence food choices. Approximately 2500 British Columbians will be included in this study. Your name has been chosen at random from the Ministry of Health Client Registry as a potential participant.

You have likely already received a letter outlining the study in more detail, and asking if you would like to participate. However, our survey staff working in your area have been unable to contact you. If you are interested in taking part in this survey, please call the survey office at (250) 952-2321.

If you have questions or want more information you can call the Ministry of Health toll-free number at 1-800-465-4911, or call me at (250) 952-1536. Thank you.

Sincerely,

Lisa Forster-Coull
Principal Investigator
British Columbia Nutrition Survey

LFC:ma

Ministry of Health and
Ministry Responsible for Seniors

Public and Preventive Health Division
Preventive Health Branch

1520 Blanshard St, Second Floor
Victoria BC V8W 3C8

Telephone: (250) 952-1536
Fax: (250) 952-1570

Appendix I

Thank You letter

Date:_____

Dear :

On behalf of the British Columbia Nutrition Survey Team, I would like to thank you for your participation in this survey. Your commitment of time and your willingness to provide dietary information is greatly appreciated.

It is well known that eating habits play a significant role in helping to maintain and improve health. The information gathered in the British Columbia Nutrition Survey will give health professionals a much better understanding of the eating habits of British Columbians. As a result, nutrition programs and policies can be developed that will help to improve the health and well-being of all British Columbians.

During your interview, you may have asked when the results of the survey would be available. It is anticipated that the compiled results will be available some time in the year 2001. The results of the survey will be announced to the media at that time, and copies of the survey will also be available from the Ministry of health and Ministry Responsible for Seniors.

Once again, thank you very much for being part of the British Columbia Nutrition Survey.

Sincerely,

_____

Interviewer
British Columbia Nutrition Survey

_____

Lisa Forster-Coull
Principal Investigator
British Columbia Nutrition Survey

Ministry of Health and
Ministry Responsible for Seniors

Preventive Health Branch
Public and Preventive Health Services

1520 Blanshard Street, 2nd Floor
Victoria BC V8W 3C8

Telephone: (250) 952-1533
Facsimile: (250) 952-1570

Appendix J

Data Entry Form (A-1)

BRITISH COLUMBIA NUTRITION SURVEY
DATA ENTRY FORM A-1

DATE FILE CLOSED: ☐☐☐☐☐☐
day month year

01☐ Interview Obtained in ❑ English ❑ Punjabi ❑ Chinese

or ☐ No Interview Obtained

⇩

REASON FOR NO INTERVIEW:

☐ Non Responding → reason for non-response:
- 02☐ Refusal, Reason: _____ → **Form A-2 completed** ☐Yes ☐No
- 03☐ Location verified, temporary no contact ↗
- 04☐ Language
- 05☐ Made appointment, failed to show or cancelled
- 06☐ Other: _____

☐ Not Resolved → reason not resolved:
- 07☐ Letter returned, no further info
- 08☐ No answer after at least 6 phone attempts
- 09☐ Cannot locate by phone or home visit
- 10☐ Other: _____

☐ Not Eligible → reason not eligible
- 11☐ Dead
- 12☐ Pregnant/Nursing
- 13☐ Moved out-of-province
- 14☐ Moved within province, but out of all the sampling regions
- 15☐ Hospitalization/extraordinary illness
- 16☐ Living in Institution or Reserve
- 17☐ Other: _____

SIGN OFF CONTROL CHECK (ID CODES):

INTERVIEWER ☐☐ **FACILITATOR** ☐☐

Interviewer's Opinion of the Information:

☐ Reliable
☐ Unable to recall one or more meals
☐ Unreliable, reason: _____

Final Status of Interview:

☐ Reliable complete response
☐ Reliable partial response
☐ Unacceptable response

TOTAL # OF PAGES IN PKG ☐☐ COORDINATOR ☐☐

Appendix K

Informed Consent Form

BRITISH COLUMBIA

Informed Consent for Interviewed Participants
British Columbia Nutrition Survey

The British Columbia Nutrition Survey is a province-wide study being conducted by representatives of the Ministry of Health and Ministry Responsible for Seniors, the University of British Columbia, and Health Canada. It is designed to describe the food habits of British Columbians.

The study will include 2500 adults between the ages of 18 and 84 years, chosen at random from the Ministry of Health Client Registry. The interview will include:

- a recall of what you have eaten in the past 24 hours;
- information regarding the frequency with which you eat specific foods;
- questions about specific food and nutrition issues; and
- measurements of your height, weight, waist and hips, taken in light-weight street clothes.

The interview will take approximately 90 minutes. Participation in the study is voluntary. If you agree to participate in the study, you may be one of a small number of people asked to repeat a portion of the interview a short time later.

In addition, you may be recontacted in the future for future research purposes. You may refuse to participate in future research. If you agree to participate in future research, a new informed consent for participants would be required.

All information you provide to the interviewer will be kept in strict confidence. Your name will not appear in any reports that arise from the study. All subject names will be coded and protected by use of a study number. As well, documents will be kept in a locked filing cabinet. Data records will be kept on computer hard drive (accessed by password) and on floppy disk (stored in a locked filing cabinet). The data obtained from this study may be shared by the Ministry of Health with other British Columbia health agencies for research purposes. Access to the data will follow strict research protocols and the safeguards of the Freedom of Information and Protection of Privacy Act.

Your participation is important because it will help plan nutrition programs and services in British Columbia. However, your rights to health care in the province or Canada will not be affected by your choice to participate or not participate in the study.

...2

Ministry of Health and
Ministry Responsible for Seniors

Preventive Health Branch
Public and Preventive Health Services

1520 Blanshard Street, 2nd Floor
Victoria BC V8W 3C8

Telephone: (250) 952-1533
Facsimile: (250) 952-1570

If you have any questions or desire further information with respect to this study, you may contact Lisa Forster-Coull, Principal Investigator, Ministry of Health and Ministry Responsible for Seniors, at (250) 952-1536.

If you have any concerns about your treatment or rights as a participant, you may contact Dr. Richard Spratley, Director of Research Services, University of British Columbia, at (604) 822-8598.

Consent:

I understand that my participation in the study is voluntary and that all the information that I provide will be held in strict confidence. My name will not appear in any reports that arise from data collected in the study. I may withdraw at any time or refuse to answer specific questions or have my body measurements taken.

I understand that I will not be paid for my participation in this study.

I have received a copy of this consent form for my own records.

Participant Date

Signature of Interviewer (Witness) Date

Lisa Forster-Coull
Principal Investigator
Nutritionist
Ministry of Health
(250) 952-1536

Dr. Ryna Levy Milne
Co-Investigator
Assistant Professor
University of British Columbia
(604) 822-6869

Lynne Blair
Co-Investigator
Manager
Ministry of Health
(250) 952-1534

Dr. Robert Fisk
Co-Investigator
Epidemiologist
Ministry of Health
(250) 952-1464

Document4

Appendix L

Methodology for Estimating Usual Intake

British Columbia Nutrition Survey 1999
Methodology for Estimating Usual Intake

BBCA Technical Report 451311-011
October 9, 2002

S. Hayward
B. Junkins
Bureau of Biostatistics and
Computer Applications
Food Directorate
Health Canada

British Columbia Nutrition Survey
Methodology for Estimating Usual Intake

British Columbia Nutrition Survey
Methodology for Estimating Usual Intake

1.0 Introduction

Population surveys are used to collect information on dietary knowledge, attitudes, behaviours and food and nutrient intake at an individual level. These data are used for many purposes including the development and evaluation of food and nutrition programs, incorporation in probabilistic exposure models for risk assessment, identification of emerging concern and perceptions of dietary trends.

The British Columbia Nutrition Survey (BCNS) is one of a series of Federal Provincial surveys designed to gather data to meet the needs of provincial researchers, health authorities and the Food Program in Health Canada. The 24 hour recall data are used to capture detailed information on all of the foods and beverages consumed in the previous 24 hour period. These data are of particular interest because the data includes both variability between individuals (inter-individual variation) and day to day variability for each individual (intra-individual variation). While standard analytical procedures can be used to estimate population means, these methods are not appropriate when describing the "usual" intake of the population, the percentiles of intake, or perhaps the proportion of the population who usually consumes above (or below) a specific cut-point. This report discusses the statistical methods used in the BCNS to estimate the distribution of usual intakes.

1.1 Background

The British Columbia Nutrition Survey (BCNS) was conducted as a federal-provincial collaboration in two phases: April-July 1999 (spring) and September-December 1999 (fall). During this time, men and women between the ages of 18 and 84, living in British Columbia (excluding those who were pregnant, lactating, institutionalized or living on reserve lands) were approached through an initial letter and telephone follow-up to participate in a food and nutrition survey. For those who agreed to participate, an "at home" visit was conducted by a member of a specially trained team of interviewers. These interviewers had completed a training course designed by Health Canada that was specifically dedicated to standardizing the collection of the diet and nutrition information using the various survey instruments. The recall data were collected during a face-to-face interview.

The survey consisted of five instruments: a 24 hour recall, a quantitative food frequency questionnaire, a demographic questionnaire, a provincial special interest questionnaire and information pertaining to the response/non-response status of sampled individuals. Approximately, half of the sample was interviewed during the Spring and the other half in the Fall of 1999. There was a repeat 24-hour recall for a sub-sample of the participants, every third name sampled being identified for a repeat. Both the initial and repeat interview days were randomly assigned to cover all days of the week, and the repeat interview was scheduled no sooner than one week after the first interview.

The data for all sampled individuals, responders and nonresponders, were entered by the Nutrition Research Division (NRD) in the Food Directorate in Health Canada using the in-house software NSS (Nutrition Survey System). This system was developed in the Food Directorate in Health Canada specifically for data entry and retrieval. The data were transferred from the NSS system to files for the statistical software SAS by FID. The data bases generated from this survey can be used for in depth analyses of inter-relationships between variables, nutrient, provenance and various other concerns related to health and nutrition.

1.2 Sample Design

The sampling plan for both phases, (or seasons), designed by the Special Surveys Methods Division in Statistics Canada (France Bilocq (1999)) was a stratified multi-stage sampling design. At the first stage of the sample selection, the population was stratified into three strata: Metro (stratum 1) consisting of 6 geographic regions (or sub-strata); Coastal (stratum 2) containing 1 geographic region (sub-stratum); and Non-metro consisting of 10 geographic regions (clusters). In strata one and two, each geographic region (substratum) was selected with certainty, termed "chosen with probability 1", while in stratum three, 4 geographic regions (or clusters) were randomly chosen with probability proportional to the population size of the regions, excluding remote areas accounting for less than four percent of the population. The British Columbia Health Register File (BCHR) was used as the frame to select the sample of individuals for each season. All individuals on the BCHRF that fell within the selected areas for each stratum were stratified into 14 age-sex groups: males/females, ages 18-24, 25-34, 35-44, 45-54, 55-64,65-74 and 75-84.

At the second stage, a sample of individuals was selected from the BCHR according to the sample allocation in each stratum-age-sex combination. An estimate of 5320 names was required to drawn in the Spring 1999 and divided equally for two seasons in order to obtain expected responses of 1364 in each season. The dividing process was done as the first, third, fifth name sampled ... etc., being identified for Spring (phase 1) and the second, fourth, sixth name sampled .... etc., being identified for Fall (phase 2). For more detailed information about the sample design, see Sample Design Specifications (France Bilocq, 1999).

A detailed analysis of response/nonresponse issues in the main study was conducted by the Statistics and Epidemiology Division in BBCA which is described in the technical document (BBCA E451311-011NR, L. Nguyen, B. Junkins (2002)). This document includes: the methodological development of sampling weights, detailed analyses of response rates and patterns, and assessment of magnitude and direction of potential bias.

In general, of the eligible individuals, 52% (1823) provided usable first interviews. While the survey design called for 1/3 of the interviews to be repeated, 26.3% of the interviews were repeated: in some age-sex groups the rates were closer to 20%. As noted in the nonresponse document there is evidence to suggest that bias may be present in the responding population due to over-representation of higher educated, nonsmokers who take vitamin supplements relative to the general population. Publication or release of data or analyses from the BCNS, including those pertaining to usual intakes, should disclose fully the nonresponse factors pertinent to interpretation of the results.

To incorporate the survey design into the development of sample variances, specialized software packages can be used (such as PC Carp, SUDAAN, Stata, Wes Var Complex Samples) employing various techniques such as Taylor linearization, the jackknife or the bootstrap. (See Cochran (1977) and Rust and Rao (1996) for statistical information on variance estimation in complex surveys).

2. Estimation of Usual Intake

Food intake reported by individuals varies for a number of reasons. First, we see variation because intakes vary from person to person: this is termed *between* person or *inter*-individual variability. However, single individual intakes also vary because people eat differently from day to day: this is termed *within* person, or *intra*-individual variability. The presence of these two components of variance results in a single day distribution of intakes for the population which is wider, with longer tails, than would be the distribution of usual intake. As a result, if the single day intake is used to examine the proportion of the population with usual intake exceeding a set point, that proportion would be an overestimate. Using single day intakes to estimate percentiles of population intakes will tend to exaggerate the proportion of individuals in the tails, or extremes of the intake distribution and can provide a significant misrepresentation. (For more information on the effect of day to day variability in dietary intakes see Liu *et. al* 1978, or Beaton *et. al.* 1979). However, there is great interest and need to provide estimates of percentiles of usual intake as well as to examine the distribution relative to fixed reference points. As a result, a method to derive a usual distribution from one day intakes is required.

The method of estimating the distribution of usual intakes described below is an adaptation of the method described by the US National Research Council in 1986. This stratum adjusted method reported in Karpinski and Nargundkar (1992) was developed and first used for the Nova Scotia Nutrition Survey (1992) where it was peer reviewed by an international panel. This method has also been evaluated at the Consensus Workshop on Dietary Assessment (1994).

A two-step procedure is used: first, find a normalizing transformation; and second, employ a linear transformation which provides a distribution of intakes without the intra-individual component. The modification of the NRC approach takes the form of using a hierarchical or nested Analysis of Variance (ANOVA) to accommodate different means in homogeneous subgroups during the calculation of the variance components.

These steps are detailed below.

The following notation will be used:

a:	geographic stratum	a = 1 (Metro), 2(Coastal), 3 (Non-Metro)
	or season	a = 1,2
i:	age/gender sampling group	i = 1, 2, ...,7 for males
		i = 8, 9, ..., 14 for females
k^{th} individual in the ai^{th} sampling stratum		$k = 1,2,...,k_{ai}$

s:	supplement use	s= 0,1 (if indicated taking supplements last month)
f:	recall number for the k^{th} individual,	f=1 for first interview and 2 for repeat recall.

It should be noted here that information about supplement use was not collected in all past federal-provincial surveys and that geographic stratum and season variables were both included in the model used to adjust the data. However, a supplement use variable was of interest for the role it might play when looking at the usual vitamin intakes from foods alone, as well as the total from foods plus supplements. The BC survey was the first survey for which such information was available. The choice of fixed effects is discussed in the context of estimation of usual intakes from both food and supplements in section 3.3.

2.1 Normality and Outliers

At the outset, an analysis was carried out using the observed single day intakes estimated for each nutrient or derived dietary variable (such as percent calories from lipids) of interest. This step is used to determine the scale on which the responses follow a Normal distribution as well as to identify outliers in the observed data set which could exert a large influence on the parametric analyses used to estimate intra- and inter- individual variance components. Four transformations are considered: the raw or untransformed scale, the square root scale, quarter root scale and the logarithmic scale. The raw scale and the log scale provide extremes for a class of power transformations, while the square root and quarter root scales provide intermediate powers for cases which are clearly not normal or log normal.

Let

X_{aiksf} represent the observed value for a particular nutrient;

and $Y_{aiksf}=\mathcal{T}(X_{aiksf})$ represent the normally transformed value of X_{aiksf}.

For each nutrient, analysis scale and sampling age-sex category, an analysis of variance was carried out for the following general model:

$$Y= G + \delta \qquad ...(1)$$

where G represents the fixed main effects for sampling strata (i.e., age group, sex, season, geographic region) and δ represents the random variation in average dietary intakes between subjects and the random day - to - day variation within a particular subject.

Assume for each age and sex category, that the random between subject effects follow a Normal distribution with mean zero and variance σ^2_{inter}. Assume further that the random variations within subjects follow a Normal distribution with zero mean and variance σ^2_{intra} and that these random errors between individuals and within individuals are independent of each other, and independent of the fixed effects. Then the analysis of variance of residuals (i.e., the difference between observed Y and the Y from model (1)) should have a distribution which is approximately Normal with zero mean and variance $\{ \sigma^2_{inter} + \sigma^2_{intra}\}$. A Shapiro-Wilk W test (D'Agostino and Stephens,1986) for

Normality is carried out on the analysis of variance residuals for each age-sex category. Standardized residuals (i.e., residual/square root of the residual mean square error) whose absolute value exceed 3.090 (standardized Normal deviate at the 0.001 level) are tentatively regarded as outliers. Normality tests are repeated for each age-sex category after eliminating identified outliers. An additional cycle of outlier elimination and Normality testing is carried out in order to reduce the impact of outliers on the results of Normality tests.

An additional test for 'within subject' outliers is also carried out. Given the assumptions above, the differences between replicate observations within individuals should follow Normal distribution with zero mean and common variance. Standardized differences, (i.e., (difference - mean)/standard deviation of differences), are tentatively eliminated as outliers if the absolute value exceeds 3.090.

The p-values for the Shapiro-Wilk W test for normality on the data set with outliers removed, are combined across the 6 pooled age-sex categories using Fisher's method (Steele and Torrie, 1960). The combined p-value is used as the basis for selecting the scale which most closely approximate Normality.

2.2 Estimation of inter-individual and intra-individual variability

The variation in the 24 hour recall can be partitioned into two main components (Beaton et. al., 1983): inter-individual (or between) variation and intra-individual (or within person) variation. As indicated in the National Research Council 1986 document on Nutrient Adequacy, age and sex are expected to be the primary determinants of the relative size of each of these components of variation. The technique below, as mentioned above, includes factors such as season or geographical region and supplement use as additional determinants in order to increase the homogeneity within each stratum in the analysis of variance.

Consider the following repeated measures model where the observed nutrient X has been transformed to Y by the function $\mathcal{F}$ (such as log for example) to the most appropriate analysis scale and outliers eliminated:

$$Y_{aiksf}=\mu_{ais} + c_{ais(k)} +e_{aisk(f)} \quad ... \ (2)$$

where

- μ_{ais} represents the fixed effect of stratum (a,i,s)
- $c_{ais(k)}$ represents the random variation in average intake for subject k in stratum (a,i,s)
- $e_{aisk(f)}$ represents the random variation for day f within subject k in stratum (a,i,s)

(For more information about random effects models and repeated measures models see standard texts such as Snedecor and Cochran (1980) and Searle et al (1992))

The same assumptions are made as above in the analysis of outliers, the $c_{ais(k)}$ and $e_{aiks(f)}$ are independent random variables with variances $\sigma^2_{inter(i)}$ (between) and $\sigma^2_{intra(i)}$ (within) respectively for

the age-sex group i. These components of variance are used to develop the adjustment variable R_i defined below and transform the single day intakes into a usual distribution.

Repeat 24 hour recalls are used to measure the day to day variability in diet within an individual. The analysis of variance and expected mean squares for each age-sex group are completed based on method of moments for hierarchical classifications with unequal numbers. (Kempthorne, 1952) Estimates of the variance components are obtained by equating the observed mean squares with the corresponding expected mean squares and solving the resulting equations for estimates of $s^2_{inter(i)}$ and $s^2_{intra(i)}$.

Within each recall collection, (i.e., either the initial or repeat recall component), the Y_{aiskf} have a normal distribution with mean μ_{aisf} and variance $\sigma^2_{inter(i)} + \sigma^2_{intra(i)}$. A distribution of average subject intakes which is free from intra-individual variation can be simulated from the original distribution by a linear transformation of the form:

$$Z(Y)_{aiskf} = \mu_{aisf} + R_i (Y_{aiskf} - \mu_{aisf}) \qquad \text{... (3)}$$

where

$$R_i = \sqrt{\frac{\sigma^2_{inter(i)}}{\sigma^2_{intra(i)} + \sigma^2_{inter(i)}}} \qquad \text{... (4)}$$

R_i increases to 1 as the ratio of $\sigma^2_{intra(i)}$ to $\sigma^2_{inter(i)}$ becomes small: i.e., when the intra-individual variation is much smaller than the inter-individual variation. (This ratio of the "within to between" components is often reported in the literature.)

The transformed variable $Z(Y)_{aikf}$ then follows a Normal distribution with mean μ_{aif} and variance $\sigma^2_{inter(i)}$. The mean and variance parameters are unknown, however, a suitable approximation is obtained by substituting the estimated stratum means and variance components. Hence, on the transformed scale adjusted responses can be defined by

$$z(y)_{aiskf} = \bar{Y}_{aisf} + \hat{R}_i (y_{aiskf} - \bar{Y}_{aisf}) \qquad \text{... (5)}$$

where: $\bar{Y}_{aisf}$ is the mean of the stratum (a,i,s,f);

and

$$\hat{R}_i = \sqrt{\frac{s^2_{inter(i)}}{s^2_{intra(i)} + s^2_{inter(i)}}} \qquad \text{... (6)}$$

where $s^2_{inter(i)}$ and $s^2_{intra(i)}$ are sample estimates for $\sigma^2_{inter(i)}$ and $\sigma^2_{intra(i)}$ respectively

Rearranging (5) we can write:

$$z(y)_{aiskf} = (1 - \hat{R}_i)\overline{Y}_{aisf} + \hat{R}_i(y_{aiskf}) \qquad \ldots (7)$$

From (7), we see that the observations are adjusted by "shrinking" them toward the mean. One way to understand this process is to consider the extremes: when $\hat{R}_i$ =0, so that only day to day variability is present, then the observations would be replaced by the mean; when $\hat{R}_i$ =1, so that no day to day variability is present, then the original data points are used. When both intra- and inter-person variability is present then the data are adjusted to a value between these extremes.

The inverse transformation is then applied to the z(y)'s to derive the adjusted responses on the original scale, i.e., Z_{aiskf} : that is,

$$Z_{aiskf} = \mathcal{F}^{-1}[z(y_{aiskf})].$$

The adjustments are applied to all of the observations, including those classified as outliers and which are not included in either the normality analysis or the variance component estimation. The empirical distribution of the adjusted responses preserves the same shape as the original variables, and will have approximately the same median.

During the estimation of the variance components, the method of moments can result in negative values for the inter-individual variability. This can be due to a number of reasons including small sample size and the presence of influential observations not identified at the outlier detection step. It is also possible that while not negative, the inter individual variability will be very close to zero so that the ratio of the "within to between" is extraordinarily large and unstable. In these circumstances, the process for looking for outliers is repeated as above, except that the cut off level for examining the standardized residuals is dropped slightly, to 2.576 (for the within subject phase only), in addition, a graphical review is undertaken to assess these influential observations. The graphical review consists of plotting the differences against the means for each pair of recall and followup recall. This allows for the identification of records for which the mean of the repeat observations is close to the overall mean but for which there is a large difference between the repeat observations. Such an observation would contribute little to the between subject variability but would be a large component to the within subject variability thus contributing to the high ratio of within to between variability. These observations are removed as outliers in an effort to stabilise the variance components.

3 Usual Intakes from Food and Supplements

During the BCNS, information on intakes of vitamin and mineral supplements was collected for both the day of the food recall as well as the ususal intake over the past month. For each of these time spans, the DIN of the supplement was collected wherever possible as well as the number of doses and the size of a single dose. This allowed nutrients to be assigned very specifically to the reported supplements using the new NSS data entry system and the Therapeutic Products Program current Drug Product Database (DPD).

Ideally, one would like to take the nutrient intake from supplements and food sources on the recall day and apply the same procedure as outlined above to estimate usual intake from all sources However, there are two features of supplement intake which makes this method of adjustment difficult to apply to nutrient intakes from supplements or from food plus supplements. First, the distribution of a nutrient intake from supplements tends to consist of a combination of a mass function distribution at specific bolus doses and a distribution of non-specific doses. This makes it difficult to find a parsimonious transformation to form a smooth, symmetric distribution for the adjustment on any scale. The second problem is that nutrient intakes from supplements tend to be the same from one day to another for a large proportion of the population. This means that for these subjects there is little intra-person variability contributed by the supplement portion for consumers, whereas this portion adds tremendous inter-person variability making the variance components potentially very unstable unless some "binning" by supplement dose is considered . Some efforts were made in this direction and more work will be pursued in the longer term looking at alternative adjustment software as well.

However, an alternative approach was considered: could the food intake be adjusted as above, and the longer term estimate of supplement intake from the past month added to the food intake? In order that this be an appropriate approach, there were a number of methodological considerations: it is necessary that information is available that allows for the estimation of usual intakes from supplements and that the intakes from supplements are essentially uncorrelated with the intakes from foods. Both these issues are discussed in the following sections and discussed in more detail in **Methodology for Estimating Usual Intake of Micro-Nutrients from Food and Supplements**, (Hayward, (2003)).

Consider the following repeated measures model where the observed nutrient X has been transformed to Y by the function $\mathcal{T}$ (such as log for example) to the most appropriate analysis scale and outliers eliminated:

$$Y_{kG}^{fv} = \mu_G^{fv} + c_{G(k)}^{fv} + e_{Gk(f)}^{fv}, \qquad \text{... (8)}$$

The superscript *'fv'* indicates intakes from both food and vitamin and mineral supplements and in the following discussion a superscript of *'f'* alone indicates intakes from food and of *'v'* alone indicates intakes from vitamin and mineral supplements. This model is expressed in the same form as for intakes from food only in section 2. If everything was as we would like it, then we would assume the following,

$$c^{fv}_{G(k)} \sim N(0, \sigma^2_{B_{fv}}) \qquad e^{fv}_{Gk(f)} \sim N(0, \sigma^2_{W_{fv}})$$

but because of the behaviour of nutrient intakes from supplements only the weaker assumption of zero expectation will hold, i.e.

$$E(c^{fv}_{G(k)}) = E(e^{fv}_{Gk(f)}) = 0$$

$$\text{var}(c^{fv}_{G(k)}) = \sigma^2_{B_{fv}}$$

and $$\text{var}(e^{fv}_{Gk(f)}) = \sigma^2_{W_{fv}}$$

Now we would like to find an adjustment $Z(Y^{fv})$ such that

$$E(Z(Y^{fv})) = \mu^{fv}_G$$

and $$V(Z(Y^{fv})) = \sigma^2_{B_{fv}}$$

Consider the estimate of total food plus supplement intake for those that have a total of 2 recall estimates. If we separate the intakes in model 8 into two separate models, one for food and one for supplement intakes then we have the models:

$$Y^f_{kG} = \mu^f_G + c^f_{G(k)} + e^f_{Gk(f)} \qquad ...(9)$$

and $$Y^v_{kG} = \mu^v_G + c^v_{G(k)} + e^v_{Gk(f)} \qquad ...(10)$$

where

$$c^f_{G(k)} \sim N(0, \sigma^2_{B_f}) \qquad e^f_{Gk(f)} \sim N(0, \sigma^2_{W_f})$$

$$E(c^v_{G(k)}) = E(e^v_{Gk(f)}) = 0$$

$$\text{var}(c^v_{G(k)}) = \sigma^2_{B_v} \qquad \text{var}(e^v_{Gk(f)}) = \sigma^2_{W_v}$$

Now if the

$$\text{cov}(c^f_{G(k)}, c^v_{G(k)}) = 0$$

$$\text{cov}(c^f_{G(k)}, e^f_{Gk(f)}) = 0$$

$$\text{cov}(c^v_{G(k)}, e^v_{Gk(f)}) = 0$$

and $$\text{cov}(e^f_{Gk(f)}, e^v_{Gk(f)}) = 0$$

then, if we can find adjustments $Z(Y^f)$ and $Z(Y^v)$ such that

$$E(Z(Y^f)) \sim \mu_G^f \qquad V(Z(Y^f)) \sim \sigma_{B_f}^2$$

$$E(Z(Y^v)) \sim \mu_G^v \qquad V(Z(Y^v)) \sim \sigma_{B_v}^2$$

we can estimate $Z(Y^{fv})$ by the sum $Z(Y^f) + Z(Y^v)$.

The adjustment for nutrient intakes from food as described in section 2 satisfies the requirements for $Z(Y^f)$. If we use the longer term estimate of supplement intake from the past month for $Z(Y^v)$ then given that supplement use is consistent over time for a large proportion of the population and assuming that the recall of supplement use is reasonably accurate then the first requirement,

$$E(Z(Y^v)) \sim \mu_G^v$$

is satisfied and the variance can be expressed as

$$V(Z(Y^v)) \sim \sigma_{B_v}^2 + \frac{\sigma_{W_v}^2}{M}$$

Note: Previous studies have demonstrated that the intra-person variability of semi-quantitative food frequency responses is similar to that of the average of responses from a multiple number of days of food recalls (Liu (1994), Sempos (1991)). However, little work has been done in the case of semi-quantitative supplement frequency responses. Fortunately, $\sigma_{W_v}^2$ is quite small and without specifying M in the above formula, we can use this variance estimate to illustrate that the contribution of $\sigma_{W_v}^2$ to the overall variance of $Z(Y^v)$ is small and further reduced by the factor M. Thus $V(Z(Y^v)) \sim \sigma_{B_v}^2$ and the second requirement for $Z(Y^v)$ is satisfied.

3.1 Supplement intake reporting and estimation of usual supplement intake

In order to assess how to characterize usual nutrient intakes from supplements it was necessary to investigate the pattern of reported supplement use from the yesterday recalls as well as the frequency of supplement use reported in the past month. The following table, 3.1.1, summarizes patterns of supplement use between the two 24 hour (yesterday) recalls for all persons with two recalls.

Table 3.1.1. Comparison of two day supplement recalls

	Participants with a repeat 24 hour recall: Comparison of 2 day supplement recalls			
nutrient	% not reporting supplements on either day	% reporting supplements on only 1 of 2 days	* % reporting supplements on both days	concordance of dose for those reporting on both days (i.e. col *)
folic acid	68%	7%	24%	88%
pantothenic acid	73%	7%	20%	90%
riboflavin	68%	8%	24%	91%
thiamin	68%	8%	24%	91%
vitamin B6	67%	8%	26%	89%
vitamin B12	69%	8%	24%	89%
vitamin C	57%	9%	34%	82%
vitamin A	69%	6%	25%	87%
calcium	61%	8%	31%	80%
magnesium	70%	7%	23%	82%
phosphorous	81%	5%	14%	94%
potassium	79%	5%	16%	89%
iron	75%	6%	19%	90%
zinc	71%	9%	21%	90%

Most people reported no nutrient intake from supplements on either day (57% to 81%). Five to nine percent reported nutrient intake from supplements on only one of the two days and 14% to 31% reported nutrient intakes on both days. Although the number reporting nutrient intakes from supplements on only one day is less than 10% for all nutrients, this accounts for approximately 1/4 of those who reported nutrient intakes from supplements on one or both days. A high percentage of those who reported intakes from supplements for the various nutrients on both days, reported the same intakes for both days (80% to 94%). Thus, the within subject variability, $\sigma^2_{W,}$, is extremely small (approaching zero) for 80% to 90% of the population. This leaves a small percentage with any day to day difference to estimate of which, as noted, approximately 1/4 did not report intakes on one of the two days. This gives inconsistent within subject variability making it difficult to estimate appropriately.

The following table, 3.1.2, summarizes patterns of supplement use between the first 24 hour (yesterday) recall and the monthly supplement frequency recall for all first recalls.

Table 3.1.2. Comparison of yesterday and monthly supplement report.

nutrient	Compare yesterday and monthly supplement report: all 1st recalls			
	no intake monthly or yesterday	monthly but no yesterday intake	* yesterday & monthly intakes	concordance of dose if intake reported both yesterday & monthly (i.e. col *)
folic acid	65%	8%	27%	66%
pantothenic acid	68%	8%	24%	64%
riboflavin	62%	9%	29%	66%
thiamin	63%	9%	28%	66%
vitamin B6	62%	9%	29%	65%
vitamin B12	63%	9%	28%	66%
vitamin C	51%	12%	37%	62%
vitamin A	63%	9%	28%	66%
calcium	57%	9%	34%	61%
magnesium	68%	7%	25%	65%
phosphorous	80%	5%	15%	68%
potassium	77%	6%	18%	68%
iron	73%	7%	20%	63%
zinc	69%	7%	23%	65%

It can be seen that approximately two thirds of the daily intakes for users, as reported on the monthly recalls, were the same as the first recall intakes. This suggests that there is a high proportion of supplement users who take supplements regularly and thus provide a good estimate of usual supplement intake in their monthly recall. In the absence of a method for adjusting the reported intakes from the 24hr recalls, the monthly recall provides an alternative. The degree of accuracy of the reported monthly intakes for the remaining one third of users, for which reported monthly intakes were different from the first recall intakes, will vary but as this corresponds to approximately 10% of the total population of respondents, it is felt that this will have a minor impact on the overall distributions of nutrient intakes.

3.2 Correlation of supplement intake and combining intakes from food and supplements

A method has been developed to adjust the bivariate distribution of two nutrients which removes the intra-subject correlation as well as the intra-subject variability of each individual nutrient (Hayward, 2003, *in progress*) but it would be difficult to adapt this method to the nutrient intakes from foods and supplements for the same reasons it would be difficult to apply a univariate adjustment to nutrient intakes from supplements. However, if it can be shown that nutrient intakes from food have a small correlation with nutrient intakes from supplement use for supplement users

then, as mentioned above, the usual intakes derived for food can be added to the usual intakes derived separately for nutrient intakes from supplements.

Correlations between nutrient intakes from food (first recall) and from supplements (monthly), users only, were determined for 8 age-sex groups and 14 micro-nutrients for the BC nutrient survey. These correlations were adjusted or deattenuated, by the method given in Rosner and Willett (1988), for the intra-subject variability of the food intakes. Of all these 8×14 correlations only six were significantly different from zero at the 5% level. Many of the correlations were quite small even after deattenuation and there was generally no consistent pattern of correlation across the age-sex groups. Thus, the nutrient intakes from supplements are essentially independent from nutrient intakes from food. Since there is no need to remove the intra-subject correlation the usual intakes from food and the supplements can be determined separately. By definition the usual intakes are free of intra-subject variability, thus the adjusted intakes from food, $Z(Y^f)$, and the usual intakes from supplements, $Z(Y^v)$, are distributed such that

$$E(Z(Y^f)) \sim \mu_G^f \qquad V(Z(Y^f)) \sim \sigma_{B_f}^2$$

$$E(Z(Y^v)) \sim \mu_G^v \qquad V(Z(Y^v)) \sim \sigma_{B_v}^2$$

and $\mathrm{cov}(Z(Y^f), Z(Y^v)) \sim 0$.

This takes care of the covariance of the between subject errors of food and supplements, $\mathrm{cov}(c^f_{G(k)}, c^v_{G(k)})$. As for the two covariances of within subject errors with between subject errors across food and supplement intakes, $\mathbf{cov}(c^f_{G(k)}, e^f_{Gk(f)})$ and $\mathbf{cov}(c^v_{G(k)}, e^v_{Gk(f)})$, there is no postulated mechanism for an association of these errors and it is not expected that there would be a non-zero correlation . On the other hand, the covariance of the within subject errors of food and supplements, $\mathbf{cov}(e^f_{Gk(f)}, e^v_{Gk(f)})$, may not be zero. This has not been investigated, however it should be small, especially since the within subject variability of supplement intakes is quite small for a large percentage of the population of supplement users, i.e ~ 0. This is an area of future research. Given the satisfaction of these conditions, the intakes remain uncorrelated when transforming back to the original scale and thus can be summed on this scale to arrive at a usual intake from both food and supplements.

3.3 Fixed effects

As in previous discussion, the fixed effects are collectively referred to by *'G'*. The fixed effects are chosen so that *G* defines an appropriate set of subpopulations for which the expected intakes,

$$E(Y_{kG}^{fv}) = \mu_G^{fv}$$

are correct for the comparisons that are made after adjusting for usual intakes. It was important to consider supplement use as one of the fixed effects in *G*, since for any comparison of subpopulations defined by supplement use, it was important that the expected intakes from food have the correct expectations for these subpopulations, whether the intake was from foods or from both food and supplements.

Investigation of supplement use indicated that it was a significant factor for many of the nutrient intakes from foods, whereas geographic stratum and/or season were often less significant. If supplement use is not included as a factor, then the adjusted food intakes will have expectations that fall in the middle of the separate expectations for each group defined by supplement use and the difference in food intakes between supplement users and non-users will be reduced. Therefore, it was desirable to include it as a factor in the ANOVA model when adjusting the food intakes. However, in order to maintain the stability of the adjustment procedure it was necessary to drop either geographic stratum or season from the model. Season was the first choice to drop since it was generally found to be not a significant factor for nutrient intakes from food, however it proved to be quite a significant factor for vitamin C. In the end a model including age/gender and geographic stratum along with supplement use as factors was used for all nutrients except vitamin C for which the model included season and not geographic stratum.

4. Results and Discussion

All of the published nutrients with the exception of alcohol, caffeine and carotene were adjusted using the method discussed previously for food intakes. Alcohol, caffeine and carotene were not included in the process because of the extreme shape of their distributions. A large percentage of their distributions were located at a single point (i.e., zero grams of the nutrient). Usual intakes from both food and supplements were determined only for those nutrients for which there was reported intakes from supplements.

Transformations were successfully identified after removing <5% of the data as outliers for the scale which provided the best fit. The transformation chosen for each nutrient is shown in Table 6.1.

After the initial estimation, there were extreme ratios of within/between variance components in at least one age-sex group, for sodium, vitamin A, iron, thiamin, potassium, niacin, linlenic acid, folacin and dietary folic equivalents. There were negative variance components in at least one age-sex group for % calories from protein, iron thiamin folic acid and vitamin C. After a graphical review, influential observations were identified for each nutrient. Removal of these influential individuals stabilized the variance components for all nutrients.

Cholesterol had nine observations with a value of "0" intake on the recall which results in missing values when a log transformation is used in the calculation of the adjusted intake. In these cases, the closest nutrient value from an individual in the same age-sex-season group was imputed for the calculation of adjusted intake only.

For the fourteen micro-nutrients commonly available in supplements, usual daily intakes were derived from the monthly recalls of supplement use. These were then added to the adjusted food intakes to provide a distribution of usual intakes from both food and supplements.

Table 6.1 provides the estimates of the inter and the intra individual variability, as well as the ratio of the "within variance to between variance" and the adjusted value R. Figures 7.1 - 7.9 illustrate the effect of the adjustment process by plotting the distribution of the single day observed intake and the adjusted distribution for percent calories from the macro nutrients, dietary fibre, cholesterol and energy. These graphs demonstrate that the adjusted distribution has the same shape and median as the original variable, but that the tails on either side have been reduced. Figures 7.10 - 7.14 illustrate the effect of the adjustment process for both food and supplements for the micro-nutrients vitamin C, zinc, magnesium, thiamin and dietary folate equivalents. The contribution of supplements can be seen in the distributions for vitamin C, zinc, thiamin and the dietary folate equivalents as extra bumps (modes) in the right tail of the distribution. Zinc provides a good illustration of the effect of including supplement use as one of the adjustment factors when adjusting food intake. The effect can be seen as an increase in the separation of the distributions around the main, or food only, mode and the secondary mode which corresponds to a specific dose of supplement intake for the females. The dietary folate equivalent intakes are interesting in that they show pronounced modes for two doses of folic acid intake which do not show in the distribution for the males.

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6. Tables

Table 6.1 Variance Components

Nutrient (transformation)	pooled age-sex group	within component	between component	ratio of within/between	adjustment factor R
% energy from lipids	M 18-34	62.4245	12.1441	5.14031	0.40356
	M 35-54	57.6402	13.8155	4.17213	0.43971
	M 55-74	31.0570	33.2226	0.93481	0.71892
	M 75-85	41.4214	27.2860	1.51805	0.63019
	F 18-34	52.9895	22.7915	2.32497	0.54841
	F 35-54	57.0946	29.6022	1.92873	0.58433
	F 55-74	55.7389	27.2352	2.04658	0.57292
	F 75-85	38.4408	23.4850	1.63683	0.61583
% energy from carbohydrates	M 18-34	89.9815	23.6953	3.79744	0.45656
	M 35-54	43.1073	58.2888	0.73955	0.75820
	M 55-74	29.1867	59.9265	0.48704	0.82005
	M 75-85	55.2771	40.2847	1.37216	0.64927
	F 18-34	61.5273	30.8872	1.99200	0.57812
	F 35-54	82.4517	19.8296	4.15800	0.44031
	F 55-74	68.3055	37.2050	1.83592	0.59382
	F 75-85	52.1776	34.6757	1.50473	0.63186
% energy from saturates ($\sqrt{}$)	M 18-34	0.2783	0.0867	3.20956	0.48740
	M 35-54	0.2687	0.0959	2.80184	0.51287
	M 55-74	0.2176	0.1882	1.15616	0.68102
	M 75-85	0.1460	0.2411	0.60549	0.78922
	F 18-34	0.2966	0.1394	2.12817	0.56540
	F 35-54	0.3088	0.1536	2.01016	0.57638
	F 55-74	0.2649	0.2005	1.32136	0.65634
	F 75-85	0.2206	0.1909	1.15548	0.68113
% energy from monosaturates	M 18-34	15.5354	2.2821	6.80755	0.35788
	M 35-54	14.4981	2.3202	6.24864	0.37143
	M 55-74	7.4526	7.9471	0.93777	0.71837
	M 75-85	11.0134	4.5040	2.44525	0.53875
	F 18-34	14.8440	2.4305	6.10730	0.37510
	F 35-54	15.6901	4.6402	3.38136	0.47774
	F 55-74	11.0088	7.2639	1.51554	0.63050
	F 75-85	9.2792	5.2078	1.78179	0.59957
% energy from polyunsaturates ($\sqrt[4]{}$)	M 18-34	0.0238	0.0035	6.82003	0.35760
	M 35-54	0.0173	0.0103	1.67732	0.61115
	M 55-74	0.0139	0.0139	0.99907	0.70727

Nutrient (transformation)	pooled age-sex group	within component	between component	ratio of within/between	adjustment factor R
	M 75-85	0.0139	0.0095	1.46392	0.63707
	F 18-34	0.0202	0.0038	5.39472	0.39545
	F 35-54	0.0185	0.0117	1.58511	0.62196
	F 55-74	0.0186	0.0101	1.83524	0.59389
	F 75-85	0.0150	0.0135	1.10866	0.68865
total energy ($\sqrt{}$)	M 18-34	46.8258	67.8106	0.69054	0.76911
	M 35-54	53.2503	22.7683	2.33880	0.54727
	M 55-74	21.0692	41.1541	0.51196	0.81326
	M 75-85	24.7985	19.2530	1.28804	0.66110
	F 18-34	49.5601	12.3025	4.02845	0.44595
	F 35-54	31.1940	20.1890	1.54510	0.62683
	F 55-74	16.7642	21.0548	0.79621	0.74614
	F 75-85	28.1535	10.2927	2.73529	0.51741
cholesterol (log)	M 18-34	0.3322	0.2948	1.12673	0.68572
	M 35-54	0.3879	0.1076	3.60591	0.46595
	M 55-74	0.30411	0.29846	1.01893	0.70378
	M 75-85	0.38590	0.18171	2.12371	0.56580
	F 18-34	0.47009	0.23907	1.96634	0.58062
	F 35-54	0.40886	0.15440	2.64811	0.52356
	F 55-74	0.53194	0.06547	8.12502	0.33104
	F 75-85	0.42729	0.10947	3.90335	0.45160
% energy from protein (log)	M 18-34	0.05881	0.03970	1.48157	0.63480
	M 35-54	0.04282	0.03249	1.31772	0.65686
	M 55-74	0.05435	0.01947	2.79142	0.51357
	M 75-85	0.04417	0.03279	1.34686	0.65276
	F 18-34	0.06635	0.03173	2.09127	0.56876
	F 35-54	0.06934	0.02936	2.36156	0.54542
	F 55-74	0.06931	0.01145	6.05358	0.37653
	F 75-85	0.05105	0.00991	5.15234	0.40316

Nutrient (transformation)	pooled age-sex group	within component	between component	ratio of within/between	adjustment factor R
Sodium ($\sqrt[4]{}$)	M 18-34	0.62942	0.29097	2.16317	0.56226
	M 35-54	0.69404	0.19437	3.57075	0.46774
	M 55-74	0.41962	0.41520	1.01064	0.70523
	M 75-85	0.36975	0.23074	1.60245	0.61988
	F 18-34	0.40302	0.23015	1.75112	0.60290
	F 35-54	0.34573	0.30798	1.12255	0.68639
	F 55-74	0.40632	0.15814	2.56947	0.52930
	F 75-85	0.47365	0.10545	4.49182	0.42672
total fibre ($\sqrt[4]{}$)	M 18-34	0.06587	0.01641	4.01519	0.44654
	M 35-54	0.05407	0.02555	2.11593	0.56651
	M 55-74	0.02737	0.04655	0.58790	0.79357
	M 75-85	0.03601	0.03207	1.12306	0.68631
	F 18-34	0.04546	0.01783	2.55009	0.53074
	F 35-54	0.03539	0.03493	1.01320	0.70478
	F 55-74	0.02956	0.03639	0.81240	0.74280
	F 75-85	0.06204	0.01177	5.26861	0.39941
vitamin C ($\sqrt[4]{}$)	M 18-34	0.50669	0.05921	8.55772	0.32346
	M 35-54	0.21389	0.31663	0.67552	0.77255
	M 55-74	0.25579	0.17320	1.47681	0.63541
	M 75-85	0.29952	0.06980	4.29139	0.43473
	F 18-34	0.45331	0.11525	3.93309	0.45024
	F 35-54	0.29654	0.10989	2.69850	0.51998
	F 55-74	0.22405	0.12246	1.82956	0.59448
	F 75-85	0.15797	0.18614	0.84864	0.73548
vitamin A (log)	M 18-34	0.56990	0.09257	6.15667	0.37380
	M 35-54	0.26603	0.25145	1.05799	0.69707
	M 55-74	0.47361	0.17110	2.76800	0.51516
	M 75-85	0.39143	0.30025	1.30367	0.65885
	F 18-34	0.44882	0.20104	2.23246	0.55620
	F 35-54	0.55744	0.22916	2.43257	0.53975
	F 55-74	0.53408	0.08311	6.42605	0.36696
	F 75-85	0.51615	0.05521	9.34811	0.31086

Nutrient (transformation)	pooled age-sex group	within component	between component	ratio of within/between	adjustment factor R
zinc ($\sqrt[4]{}$)	M 18-34	0.03063	0.02118	1.44648	0.63934
	M 35-54	0.04108	0.01318	3.11629	0.49289
	M 55-74	0.01806	0.02169	0.83293	0.73863
	M 75-85	0.02180	0.01448	1.50502	0.63182
	F 18-34	0.028583	0.004894	5.83996	0.38236
	F 35-54	0.026630	0.011358	2.34473	0.54679
	F 55-74	0.021672	0.010284	2.10737	0.56729
	F 75-85	0.021348	0.009430	2.26392	0.55352
iron ($\sqrt[4]{}$)	M 18-34	0.050277	0.015239	3.29929	0.48228
	M 35-54	0.033572	0.019721	1.70229	0.60832
	M 55-74	0.015798	0.016234	0.97318	0.71190
	M 75-85	0.020149	0.010713	1.88069	0.58918
	F 18-34	0.034297	0.008126	4.22083	0.43765
	F 35-54	0.022756	0.015308	1.48650	0.63417
	F 55-74	0.019050	0.013878	1.37266	0.64921
	F 75-85	0.025316	0.004693	5.39466	0.39545
vitamin B12 ($\sqrt[4]{}$)	M 18-34	0.043596	0.031136	1.40017	0.64547
	M 35-54	0.066985	0.020441	3.27693	0.48354
	M 55-74	0.029982	0.032134	0.93302	0.71925
	M 75-85	0.038311	0.020833	1.83898	0.59350
	F 18-34	0.042845	0.013010	3.29312	0.48263
	F 35-54	0.040217	0.013485	2.98233	0.50111
	F 55-74	0.032653	0.013108	2.49112	0.53520
	F 75-85	0.031363	0.012331	2.54339	0.53124
vitamin B6 ($\sqrt{}$)	M 18-34	0.077805	0.048114	1.61709	0.61815
	M 35-54	0.087787	0.014841	5.91499	0.38028
	M 55-74	0.044747	0.039022	1.14671	0.68252
	M 75-85	0.040524	0.020829	1.94557	0.58266
	F 18-34	0.068557	0.011141	6.15336	0.37389
	F 35-54	0.057206	0.019254	2.97112	0.50181
	F 55-74	0.034085	0.032522	1.04805	0.69876
	F 75-85	0.035113	0.026737	1.31330	0.65748

Nutrient (transformation)	pooled age-sex group	within component	between component	ratio of within/between	adjustment factor R
thiamin ($\sqrt[4]{}$)	M 18-34	0.023380	0.005066	4.61489	0.42202
	M 35-54	0.020670	0.002983	6.92879	0.35514
	M 55-74	0.007470	0.009679	0.77182	0.75126
	M 75-85	0.010735	0.001242	8.64631	0.32197
	F 18-34	0.012922	0.008927	1.44749	0.63920
	F 35-54	0.013903	0.003507	3.96470	0.44880
	F 55-74	0.009144	0.005379	1.69986	0.60860
	F 75-85	0.013409	0.001532	8.75510	0.32017
riboflavin ($\sqrt[4]{}$)	M 18-34	0.007096	0.015061	0.47118	0.82445
	M 35-54	0.011201	0.004716	2.37523	0.54431
	M 55-74	0.005237	0.007523	0.69618	0.76783
	M 75-85	0.008725	0.003443	2.53446	0.53191
	F 18-34	0.012038	0.003734	3.22386	0.48657
	F 35-54	0.008687	0.004662	1.86327	0.59097
	F 55-74	0.006871	0.004197	1.63714	0.61579
	F 75-85	0.005458	0.005998	0.91001	0.72357
protein ($\sqrt[4]{}$)	M 18-34	0.055413	0.077320	0.71667	0.76323
	M 35-54	0.074322	0.028637	2.59526	0.52739
	M 55-74	0.042767	0.055780	0.76670	0.75235
	M 75-85	0.041277	0.028185	1.46451	0.63699
	F 18-34	0.065723	0.023273	2.82402	0.51138
	F 35-54	0.070053	0.013268	5.27994	0.39905
	F 55-74	0.0390	0.0288	1.35626	0.65146
	F 75-85	0.0501	0.0174	2.87902	0.50774
potassium ($\sqrt{}$)	M 18-34	98.3454	77.5063	1.26887	0.66389
	M 35-54	81.0078	48.2016	1.68060	0.61078
	M 55-74	41.4236	64.1470	0.64576	0.77950
	M 75-85	34.3456	47.0199	0.73045	0.76019
	F 18-34	90.5973	12.3561	7.33218	0.34643
	F 35-54	69.7490	27.5315	2.53342	0.53199
	F 55-74	39.9063	51.0318	0.78199	0.74911
	F 75-85	41.5723	38.6627	1.07526	0.69417

Nutrient (transformation)	pooled age-sex group	within component	between component	ratio of within/between	adjustment factor R
phosphorous ($\sqrt[4]{}$)	M 18-34	0.2653	0.3214	0.82525	0.74018
	M 35-54	0.3397	0.0527	6.44189	0.36657
	M 55-74	0.1375	0.2271	0.60534	0.78925
	M 75-85	0.1573	0.1200	1.31035	0.65790
	F 18-34	0.3068	0.0509	6.03008	0.37716
	F 35-54	0.2161	0.0779	2.77452	0.51472
	F 55-74	0.1228	0.1892	0.64917	0.77870
	F 75-85	0.1791	0.1332	1.34526	0.65299
pantothenic acid ($\sqrt[4]{}$)	M 18-34	0.0233	0.0145	1.60850	0.61916
	M 35-54	0.0229	0.0044	5.14871	0.40328
	M 55-74	0.0078	0.0172	0.45483	0.82907
	M 75-85	0.0115	0.0076	1.49885	0.63260
	F 18-34	0.0193	0.0049	3.94460	0.44971
	F 35-54	0.0137	0.0127	1.07118	0.69485
	F 55-74	0.0087	0.0100	0.86941	0.73139
	F 75-85	0.0121	0.0062	1.94985	0.58224
niacin ($\sqrt[4]{}$)	M 18-34	0.0396	0.0621	0.63711	0.78156
	M 35-54	0.0489	0.0216	2.25994	0.55385
	M 55-74	0.0270	0.0291	0.92802	0.72019
	M 75-85	0.0289	0.0140	2.05978	0.57168
	F 18-34	0.0478	0.0085	5.65217	0.38772
	F 35-54	0.0403	0.0106	3.79590	0.45663
	F 55-74	0.0307	0.0189	1.62299	0.61745
	F 75-85	0.0315	0.0152	2.08065	0.56974
magnesium ($\sqrt[4]{}$)	M 18-34	0.1206	0.0997	1.20957	0.67274
	M 35-54	0.1758	0.0286	6.15386	0.37388
	M 55-74	0.0688	0.0917	0.75051	0.75582
	M 75-85	0.0799	0.0667	1.19839	0.67445
	F 18-34	0.1199	0.0295	4.06187	0.44447
	F 35-54	0.1044	0.0581	1.79601	0.59804
	F 55-74	0.0635	0.0934	0.68055	0.77139
	F 75-85	0.1070	0.0303	3.53636	0.46951

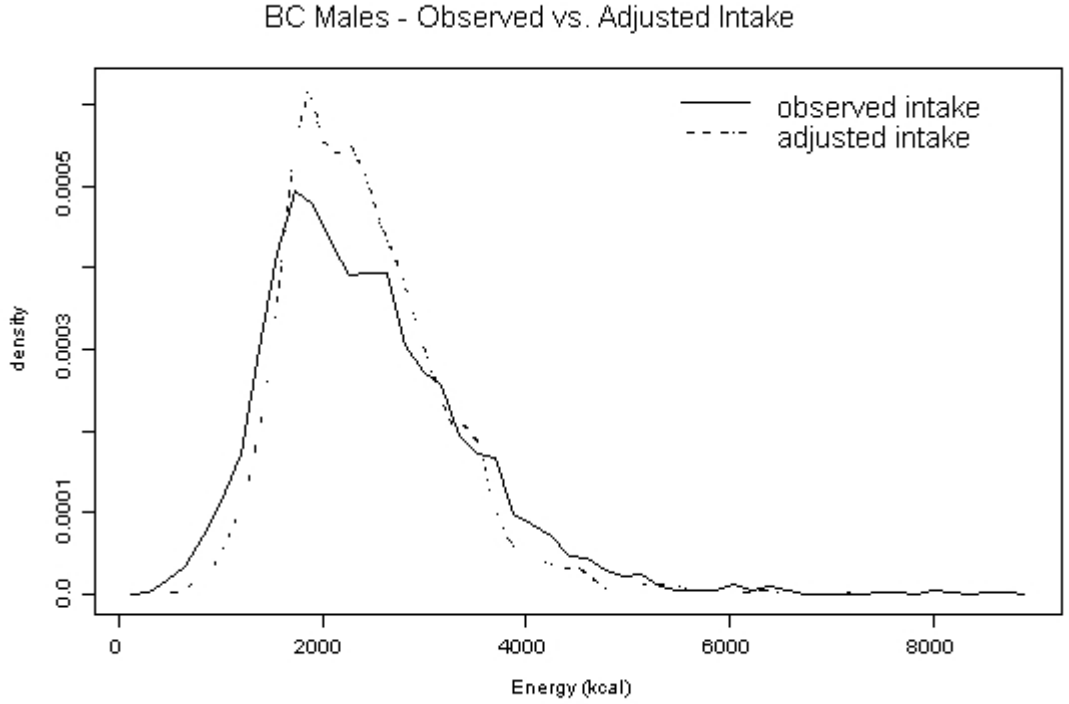
Nutrient (transformation)	pooled age-sex group	within component	between component	ratio of within/between	adjustment factor R
linoleic acid ($\sqrt[4]{}$)	M 18-34	0.0573	0.0241	2.37611	0.54424
	M 35-54	0.0596	0.0318	1.87377	0.58989
	M 55-74	0.0303	0.0461	0.65679	0.77690
	M 75-85	0.0364	0.0265	1.37609	0.64874
	F 18-34	0.0524	0.0173	3.02185	0.49864
	F 35-54	0.0593	0.0135	4.38506	0.43093
	F 55-74	0.0429	0.0143	2.99710	0.50018
	F 75-85	0.0388	0.0146	2.65975	0.52273
linlenic acid ($\sqrt[4]{}$)	M 18-34	0.0237	0.01908	1.24412	0.66754
	M 35-54	0.0259	0.01846	1.40376	0.64499
	M 55-74	0.0186	0.02931	0.63608	0.78180
	M 75-85	0.0248	0.01242	1.99795	0.57755
	F 18-34	0.0365	0.00995	3.66528	0.46298
	F 35-54	0.0389	0.00915	4.25346	0.43629
	F 55-74	0.0333	0.00673	4.95053	0.40994
	F 75-85	0.0283	0.00612	4.61517	0.42201
folacin ($\sqrt[4]{}$)	M 18-34	0.2794	0.06439	4.33931	0.43277
	M 35-54	0.1884	0.07566	2.49064	0.53524
	M 55-74	0.0891	0.13598	0.65519	0.77728
	M 75-85	0.1436	0.01970	7.29088	0.34730
	F 18-34	0.1994	0.03201	6.22969	0.37191
	F 35-54	0.1297	0.12278	1.05593	0.69742
	F 55-74	0.1263	0.08538	1.47929	0.63509
	F 75-85	0.1116	0.06828	1.63398	0.61616
dietary folate equivalents ($\sqrt[4]{}$)	M 18-34	0.3749	0.06332	5.92095	0.38012
	M 35-54	0.2173	0.08847	2.45621	0.53790
	M 55-74	0.1099	0.16939	0.64901	0.77873
	M 75-85	0.1408	0.03143	4.47993	0.42718
	F 18-34	0.2521	0.03488	7.22903	0.34860
	F 35-54	0.1747	0.12963	1.34744	0.65268
	F 55-74	0.1494	0.08798	1.69788	0.60882
	F 75-85	0.1220	0.06249	1.95310	0.58192

Nutrient (transformation)	pooled age-sex group	within component	between component	ratio of within/between	adjustment factor R
folic acid ($\sqrt[4]{}$)	M 18-34	0.3846	0.06701	5.73974	0.38519
	M 35-54	0.3612	0.08494	4.25252	0.43633
	M 55-74	0.2376	0.20545	1.15627	0.68100
	M 75-85	0.1794	0.08555	2.09709	0.56823
	F 18-34	0.3138	0.06222	5.04398	0.40676
	F 35-54	0.3570	0.06631	5.38319	0.39580
	F 55-74	0.2523	0.06996	3.60652	0.46592
	F 75-85	0.2091	0.04691	4.45693	0.42808
natural folate (log)	M 18-34	0.2131	0.13201	1.61399	0.61851
	M 35-54	0.1430	0.11143	1.28375	0.66172
	M 55-74	0.1117	0.10543	1.05982	0.69676
	M 75-85	0.1345	0.08293	1.62133	0.61764
	F 18-34	0.2468	0.03343	7.38154	0.34541
	F 35-54	0.1238	0.16505	0.75036	0.75585
	F 55-74	0.1426	0.11877	1.20072	0.67409
	F 75-85	0.1277	0.10343	1.23458	0.66896
carbohydrates ($\sqrt{}$)	M 18-34	10.5752	7.80288	1.35529	0.65160
	M 35-54	7.3534	6.21547	1.18308	0.67681
	M 55-74	3.0620	5.69667	0.53750	0.80648
	M 75-85	4.3496	2.45560	1.77132	0.60070
	F 18-34	8.5861	1.24156	6.91561	0.35543
	F 35-54	6.1602	2.42123	2.54423	0.53118
	F 55-74	4.1568	2.59518	1.60175	0.61996
	F 75-85	5.2249	1.08909	4.79749	0.41532
calcium ($\sqrt[4]{}$)	M 18-34	0.3574	0.40572	0.88088	0.72915
	M 35-54	0.2626	0.25513	1.02916	0.70201
	M 55-74	0.21688	0.27415	0.79108	0.74721
	M 75-85	0.16922	0.21148	0.80018	0.74532
	F 18-34	0.32759	0.23115	1.41721	0.64319
	F 35-54	0.34535	0.16475	2.09619	0.56831
	F 55-74	0.17386	0.28228	0.61591	0.78667
	F 75-85	0.15087	0.22923	0.65815	0.77658

Nutrient (transformation)	pooled age-sex group	within component	between component	ratio of within/between	adjustment factor R
lipids ($\sqrt{}$)	M 18-34	2.96732	3.29151	0.90151	0.72519
	M 35-54	3.24763	1.22435	2.65254	0.52324
	M 55-74	1.62193	2.59758	0.62440	0.78461
	M 75-85	1.88155	1.54451	1.21822	0.67143
	F 18-34	2.65983	1.52738	1.74143	0.60396
	F 35-54	2.30122	1.57631	1.45988	0.63759
	F 55-74	1.80640	1.18131	1.52916	0.62880
	F 75-85	1.58536	0.95199	1.66531	0.61253
total monosaturates ($\sqrt[4]{}$)	M 18-34	0.06097	0.05557	1.09727	0.69052
	M 35-54	0.07913	0.01241	6.37562	0.36821
	M 55-74	0.03650	0.06021	0.60624	0.78903
	M 75-85	0.04536	0.03593	1.26255	0.66481
	F 18-34	0.07153	0.02584	2.76815	0.51515
	F 35-54	0.05941	0.02657	2.23543	0.55595
	F 55-74	0.04450	0.03277	1.35804	0.65121
	F 75-85	0.04479	0.03002	1.49208	0.63346
total polunsaturates ($\sqrt[4]{}$)	M 18-34	0.05438	0.03588	1.51560	0.63049
	M 35-54	0.05635	0.03094	1.82117	0.59537
	M 55-74	0.03581	0.03937	0.90967	0.72364
	M 75-85	0.03623	0.02393	1.51433	0.63065
	F 18-34	0.04913	0.02038	2.41030	0.54151
	F 35-54	0.04884	0.02328	2.09785	0.56816
	F 55-74	0.03580	0.02516	1.42248	0.64250
	F 75-85	0.02892	0.02872	1.00715	0.70585
total saturates ($\sqrt[4]{}$)	M 18-34	0.04955	0.05940	0.83403	0.73841
	M 35-54	0.05946	0.02942	2.02078	0.57536
	M 55-74	0.04798	0.05421	0.88507	0.72834
	M 75-85	0.02849	0.06341	0.44929	0.83066
	F 18-34	0.07049	0.03592	1.96220	0.58102
	F 35-54	0.04881	0.04330	1.12729	0.68563
	F 55-74	0.05293	0.03861	1.37086	0.64945
	F 75-85	0.04312	0.03465	1.24427	0.66752

Graphs of Usual and One Day Distributions:

Figure 7.1
BC Observed vs. Adjusted Intake
Energy: Males and Females



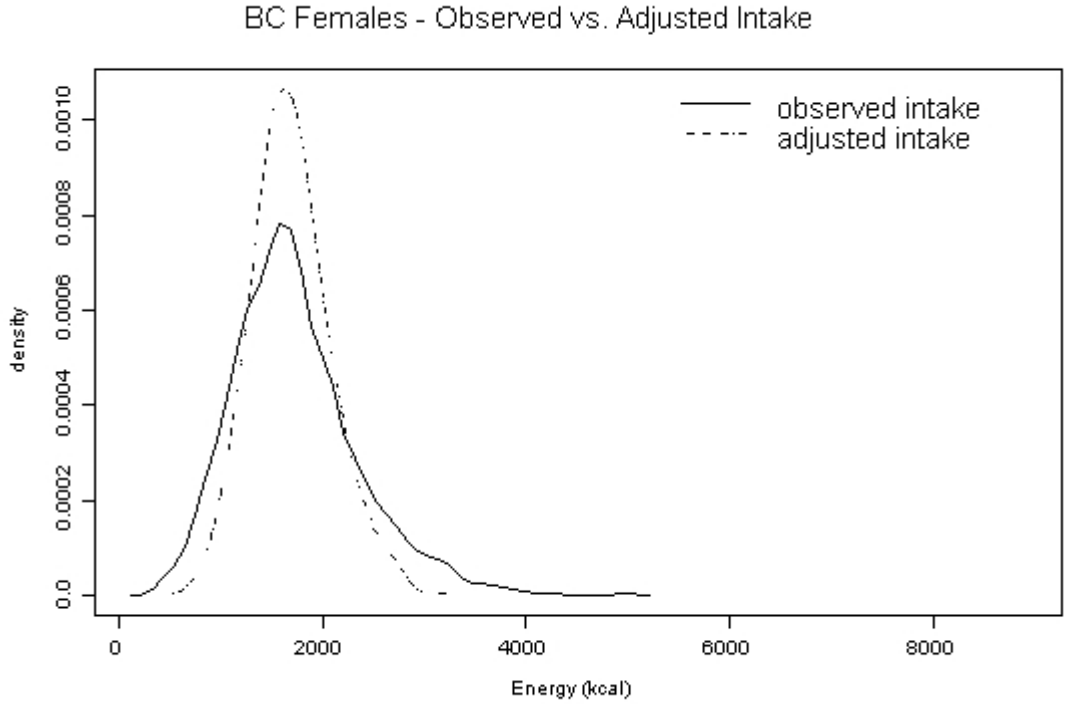
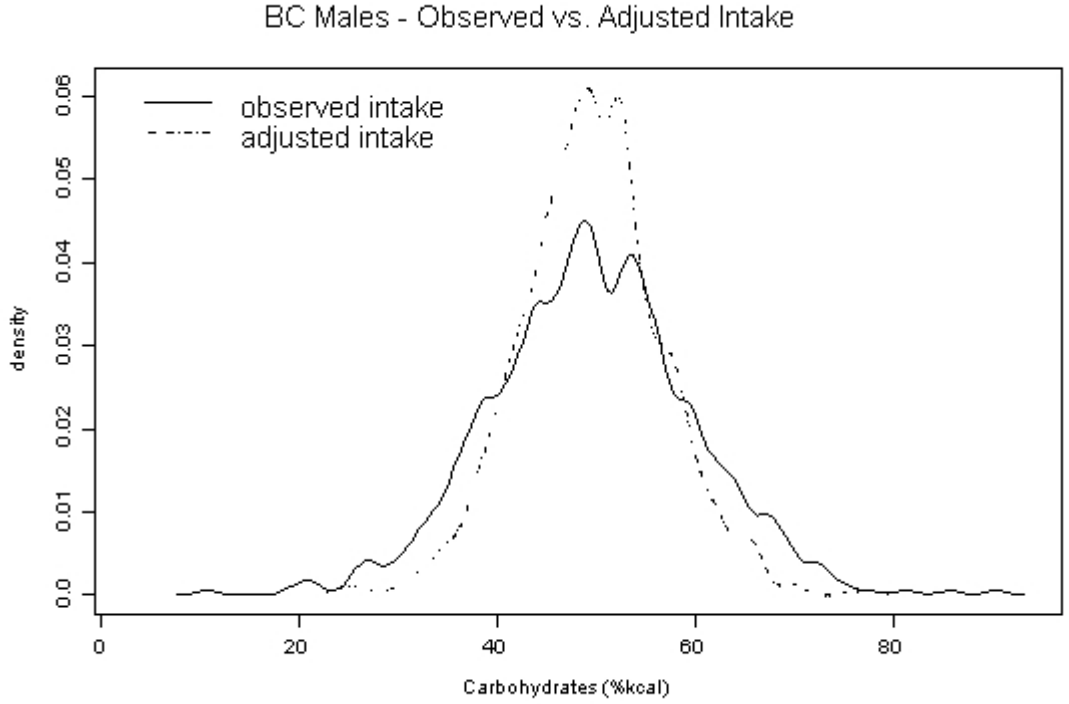


Figure 7.2
BC Observed vs. Adjusted Intake
Percent Calories from Carbohydrate: Males and Females



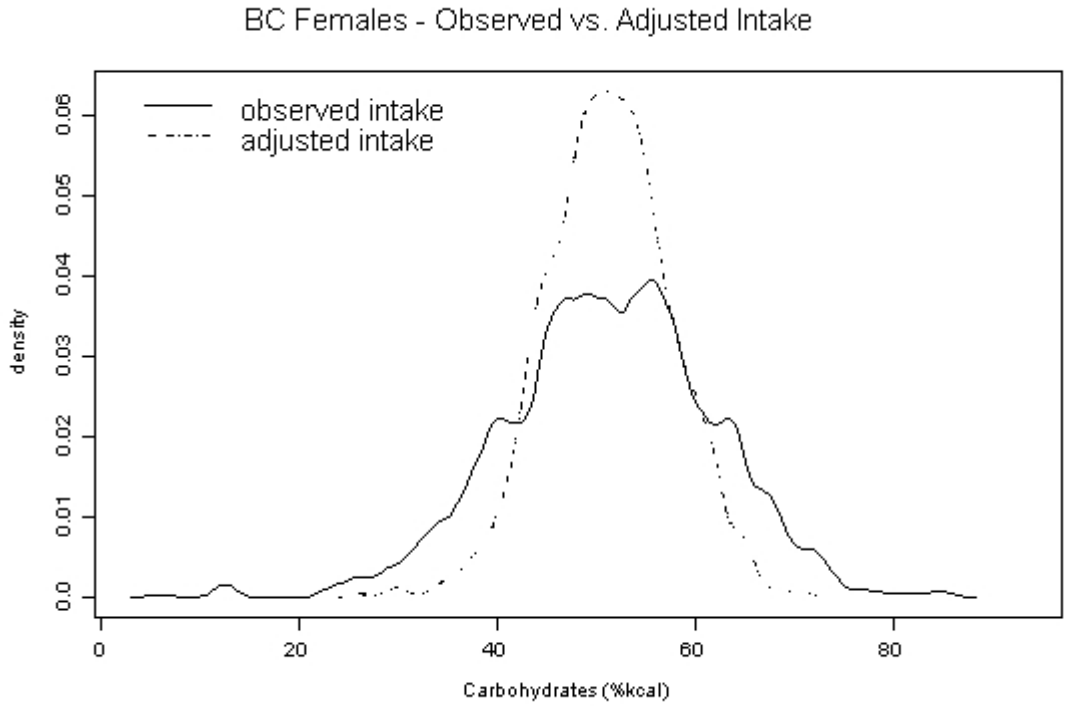
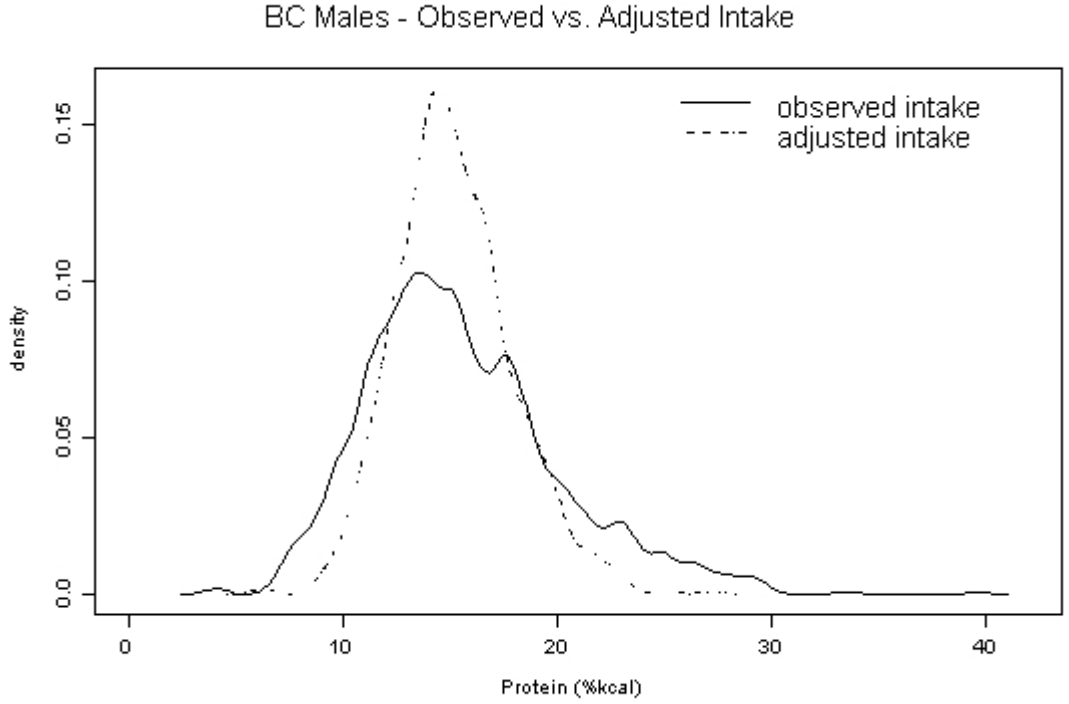


Figure 7.3
BC Observed vs. Adjusted Intake
Percent Calories from Protein: Males and Females



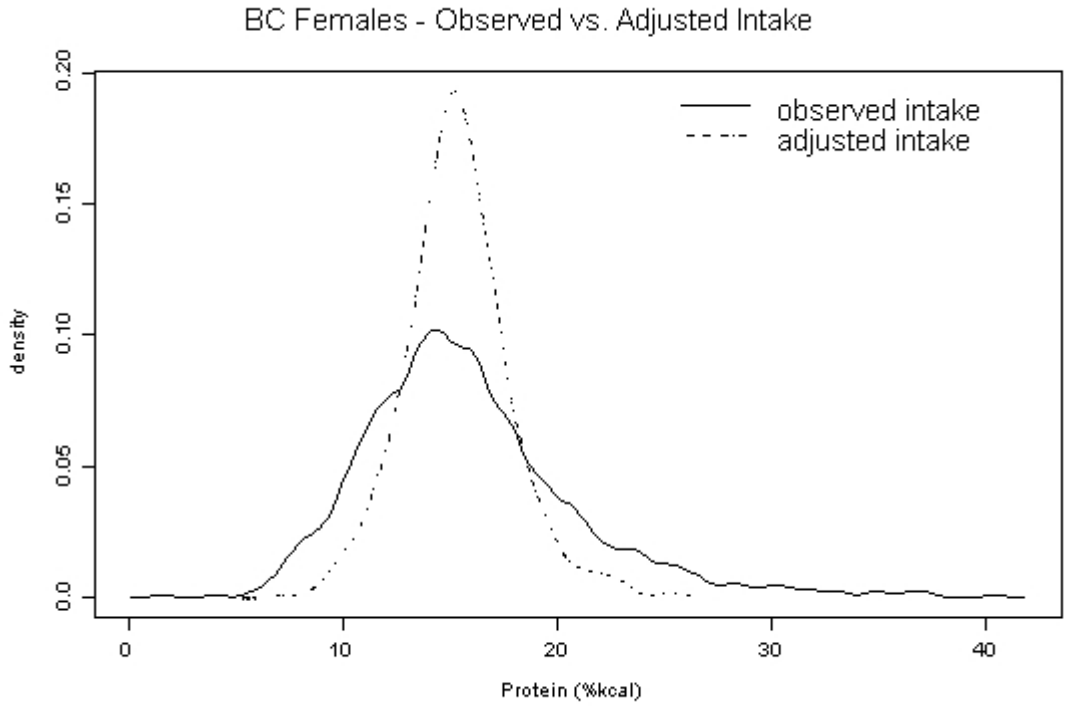
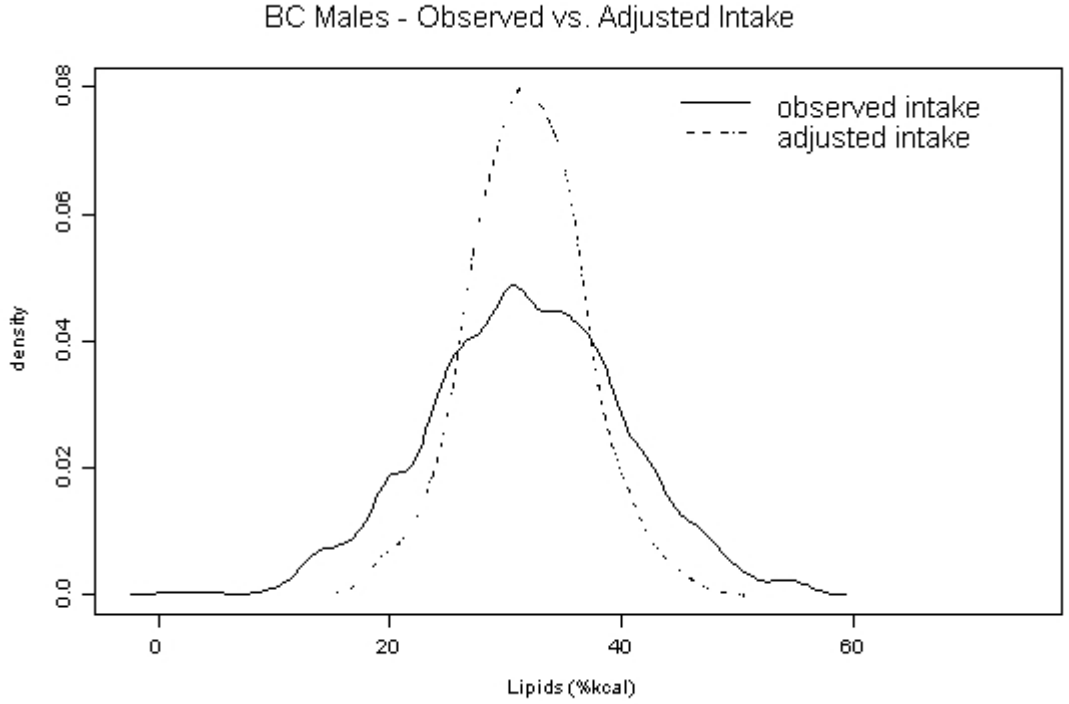


Figure 7.4
BC Observed vs. Adjusted Intake
Percent Calories from Lipids: Males and Females



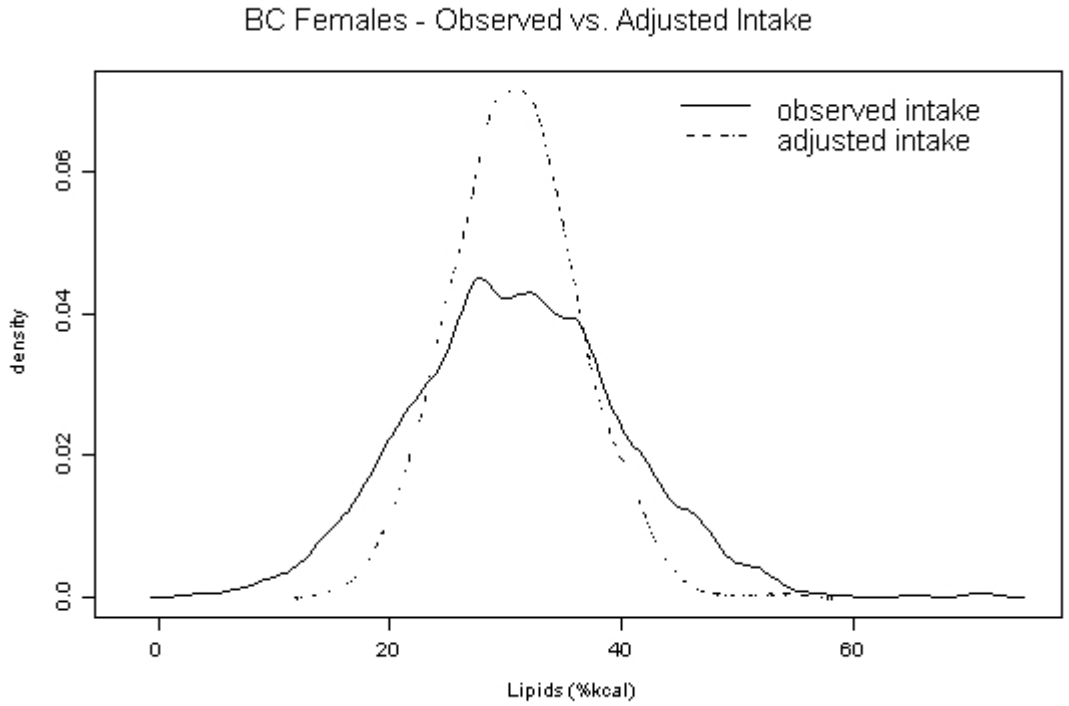
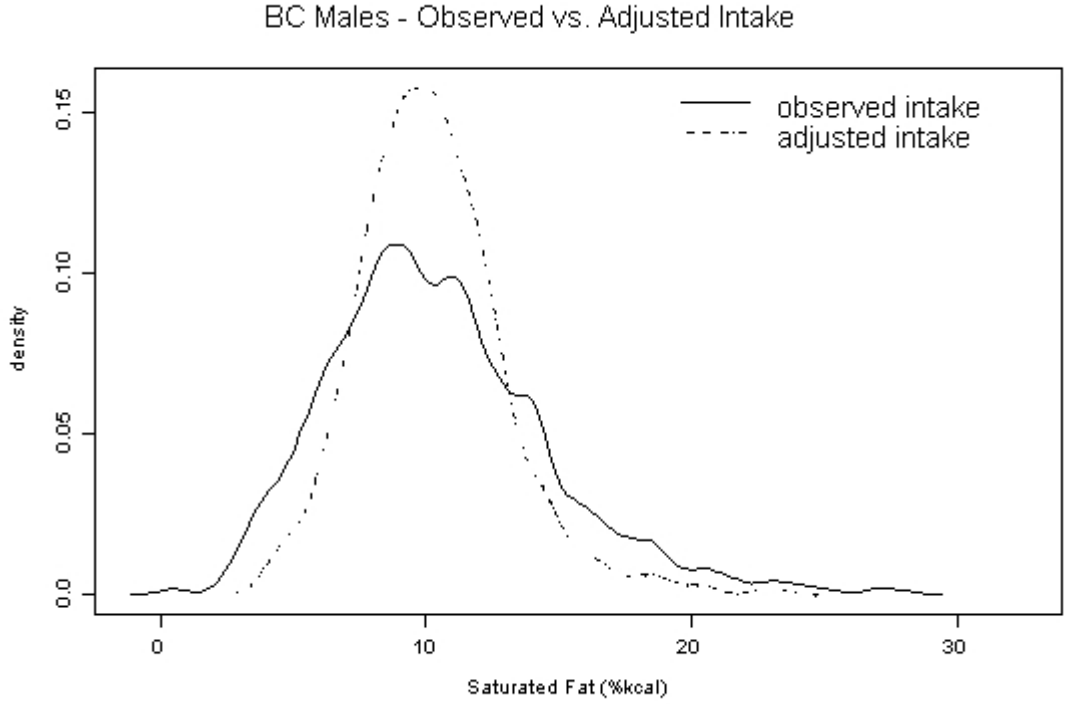


Figure 7.5
BC Observed vs. Adjusted Intake
Percent Calories from Saturated Fat: Males and Females



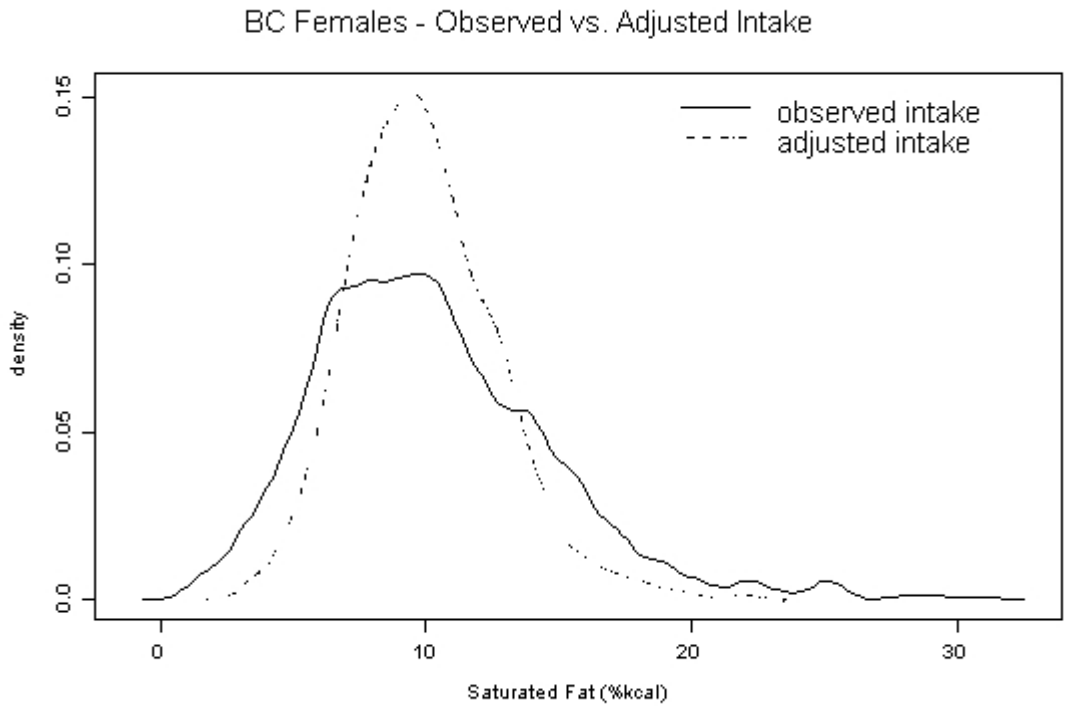
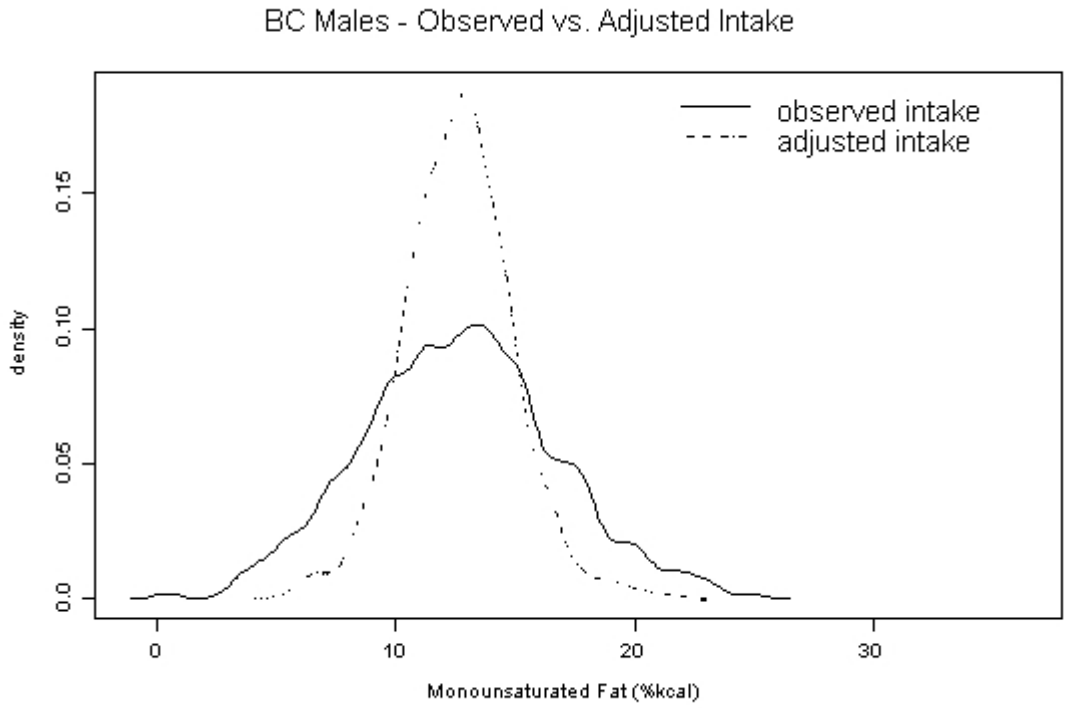


Figure 7.6
BC Observed vs. Adjusted Intake
Percent Calories from Monounsaturated Fat: Males and Females



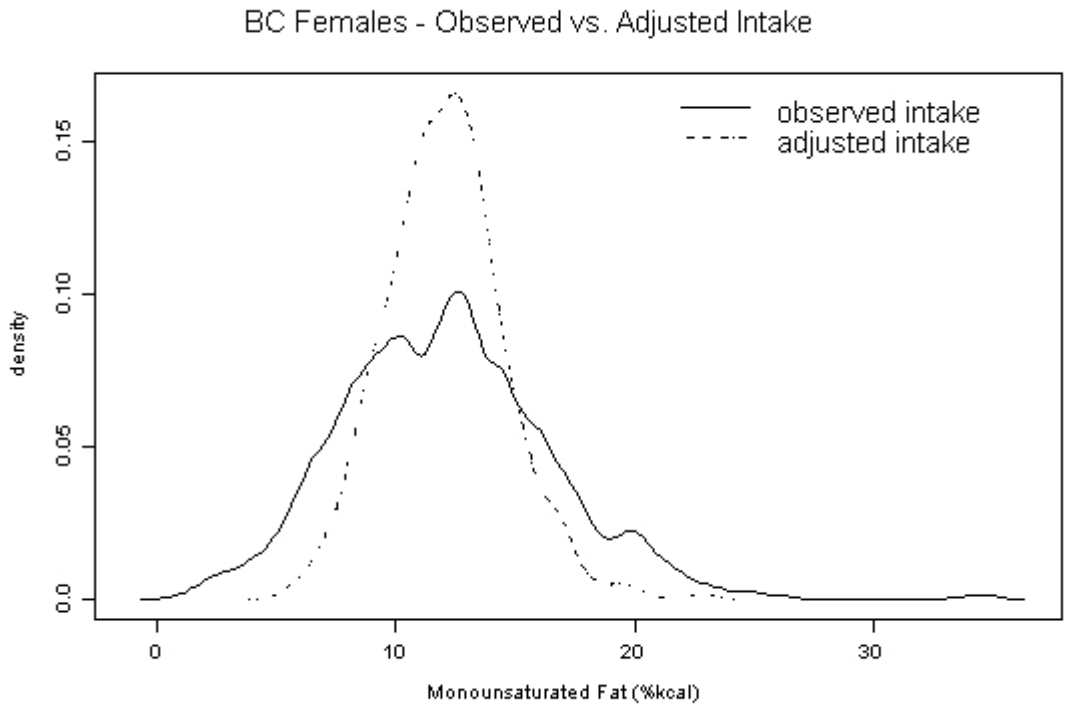
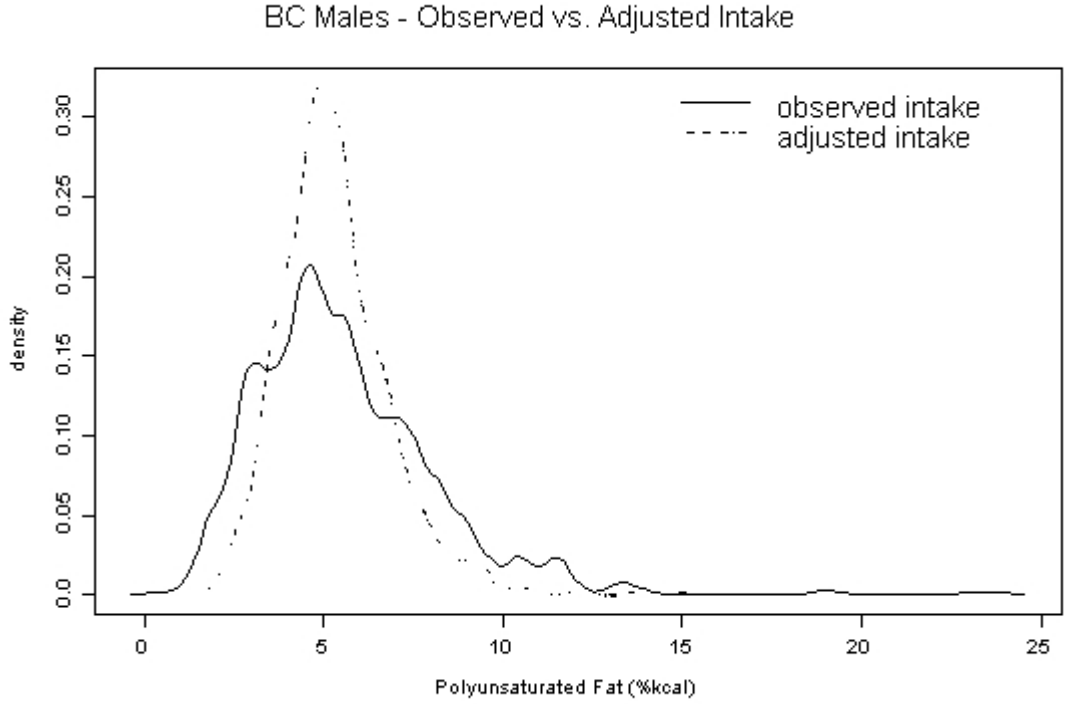


Figure 7.7
BC Observed vs. Adjusted Intake
Percent Calories from Polyunsaturated Fat: Males and Females



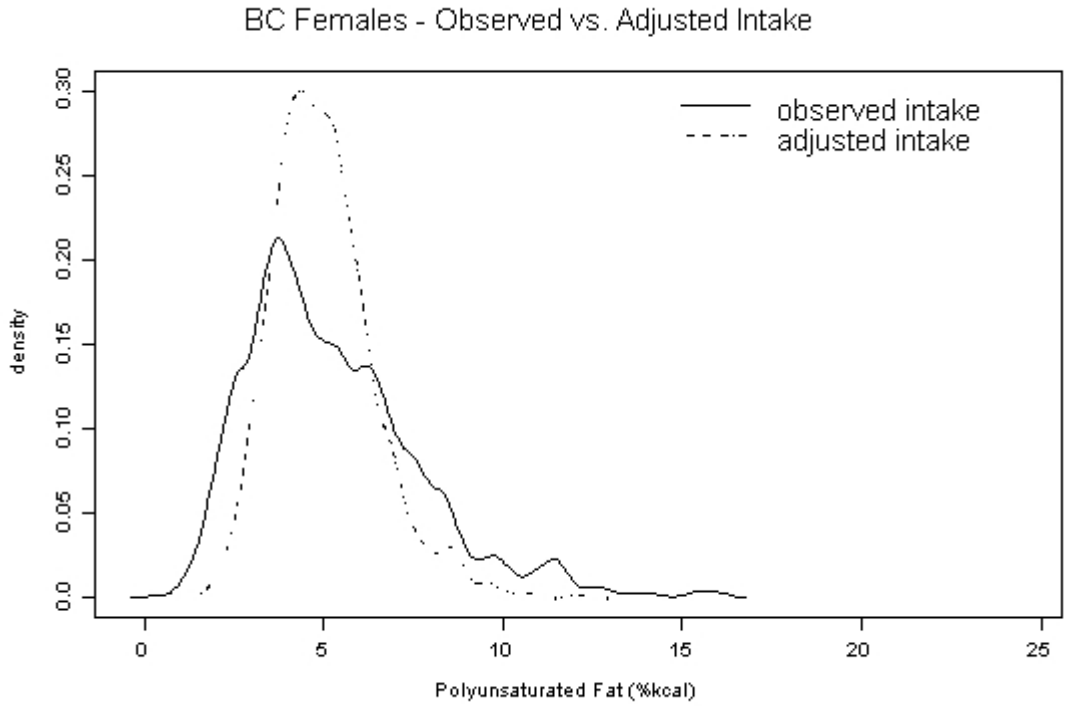
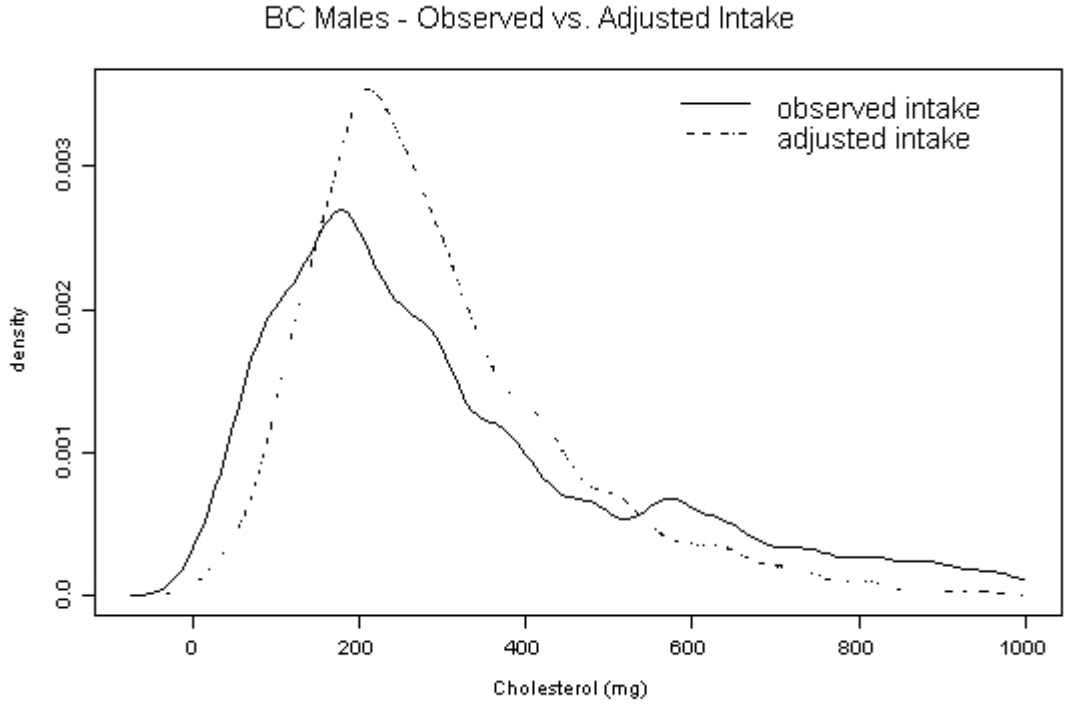


Figure 7.8
BC Observed vs. Adjusted Intake
Cholesterol (mg): Males and Females



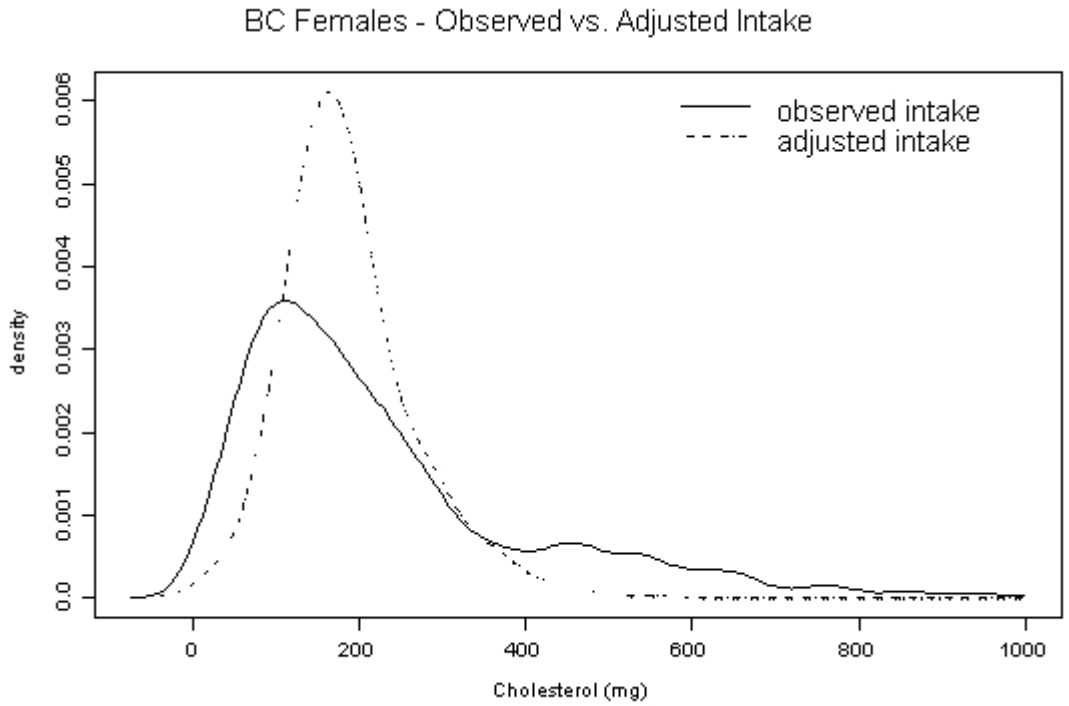
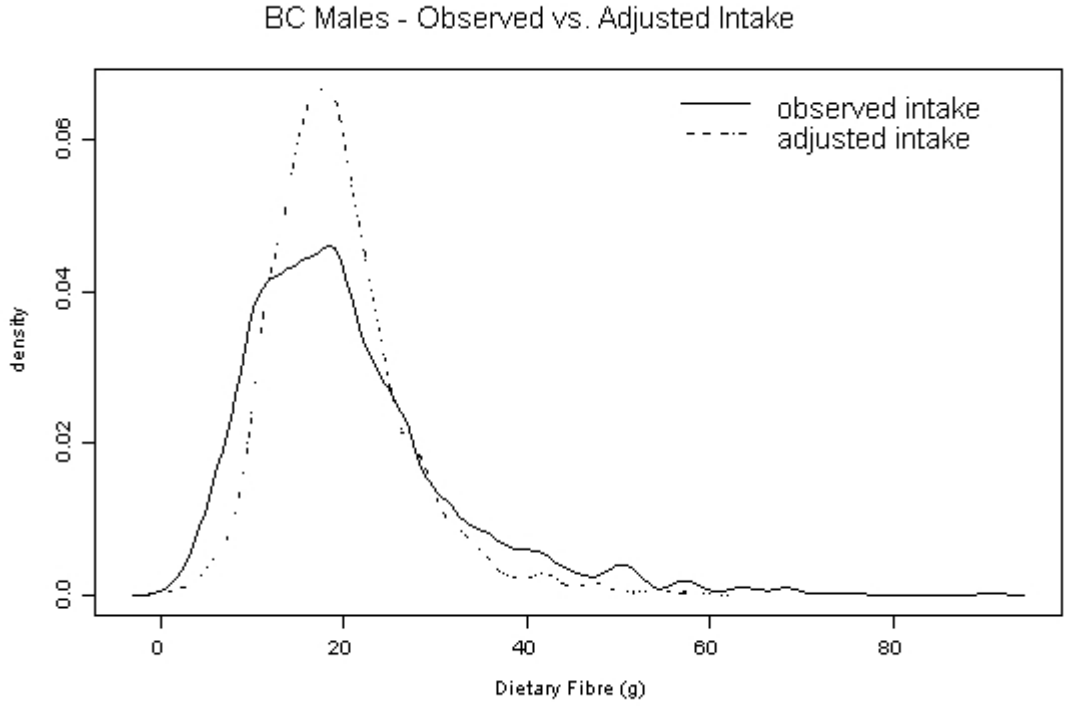


Figure 7.9
BC Observed vs. Adjusted Intake
Dietary Fibre(g): Males and Females



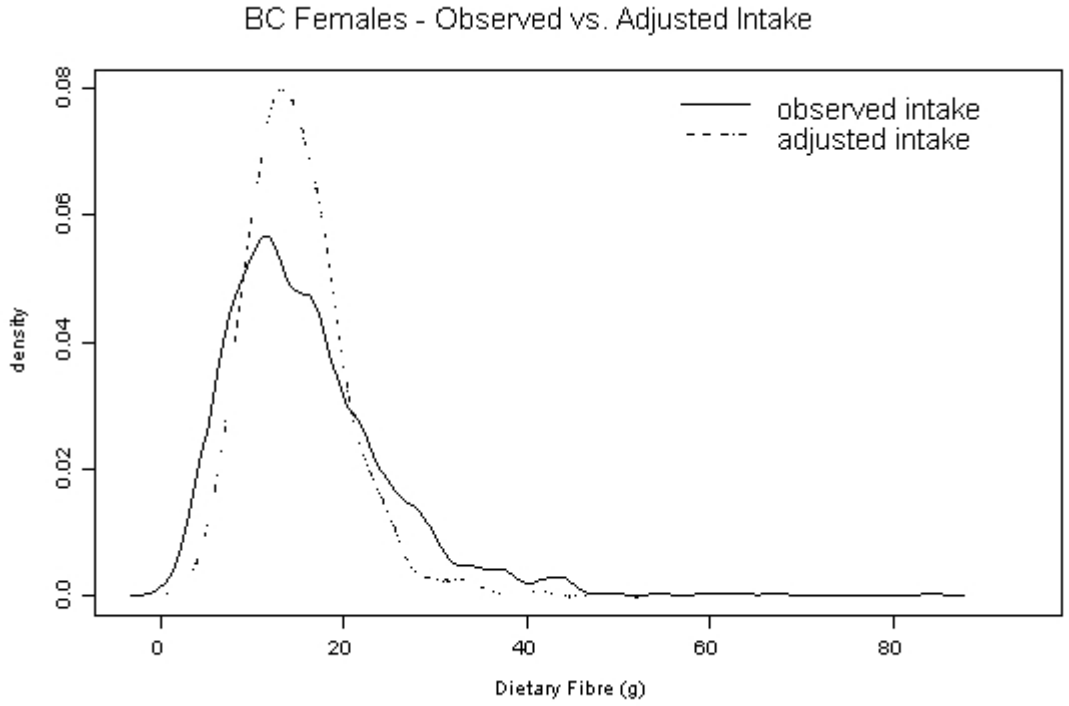
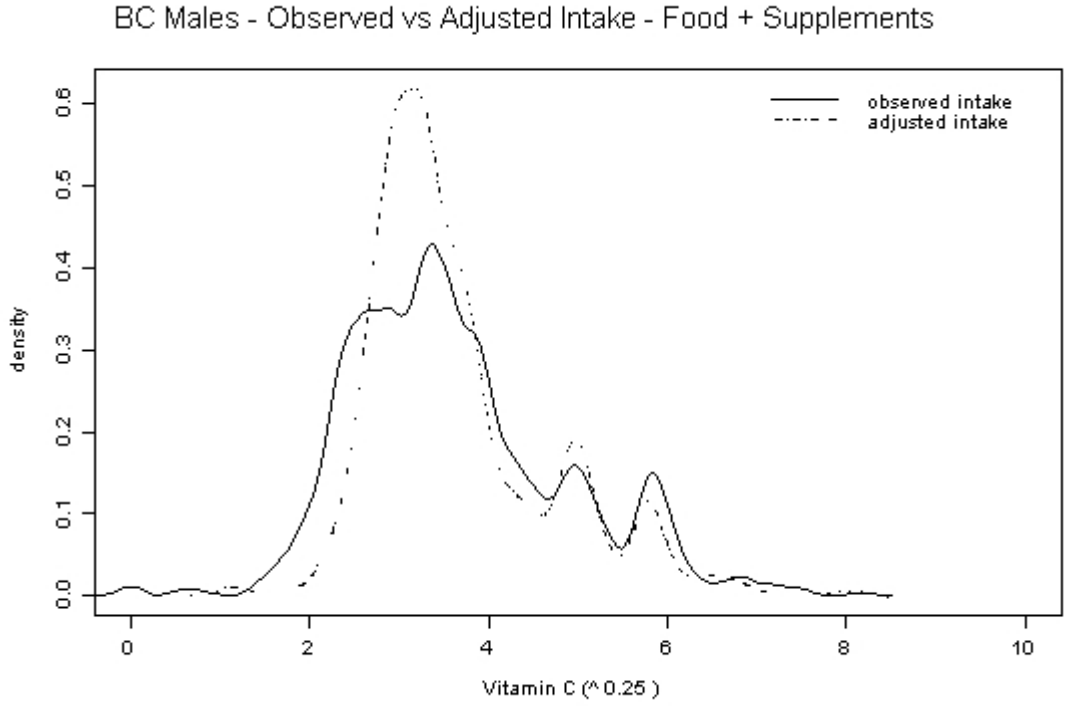


Figure 7.10
BC Observed vs. Adjusted Intake from Food and Supplements
Vitamin C (mg): Males and Females



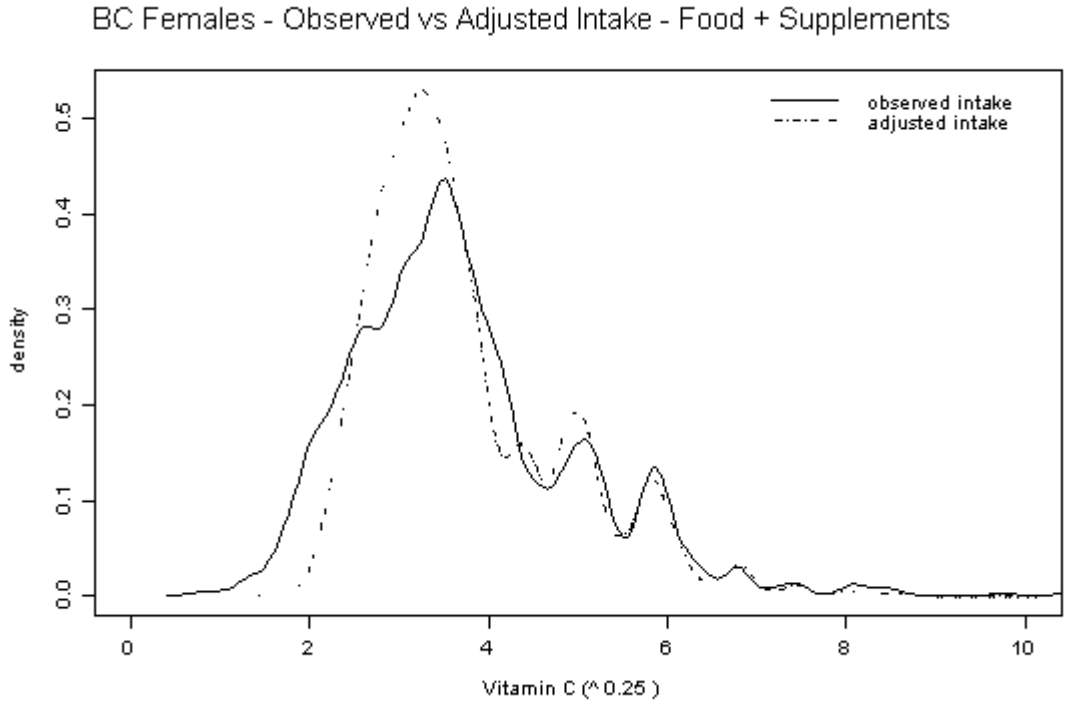
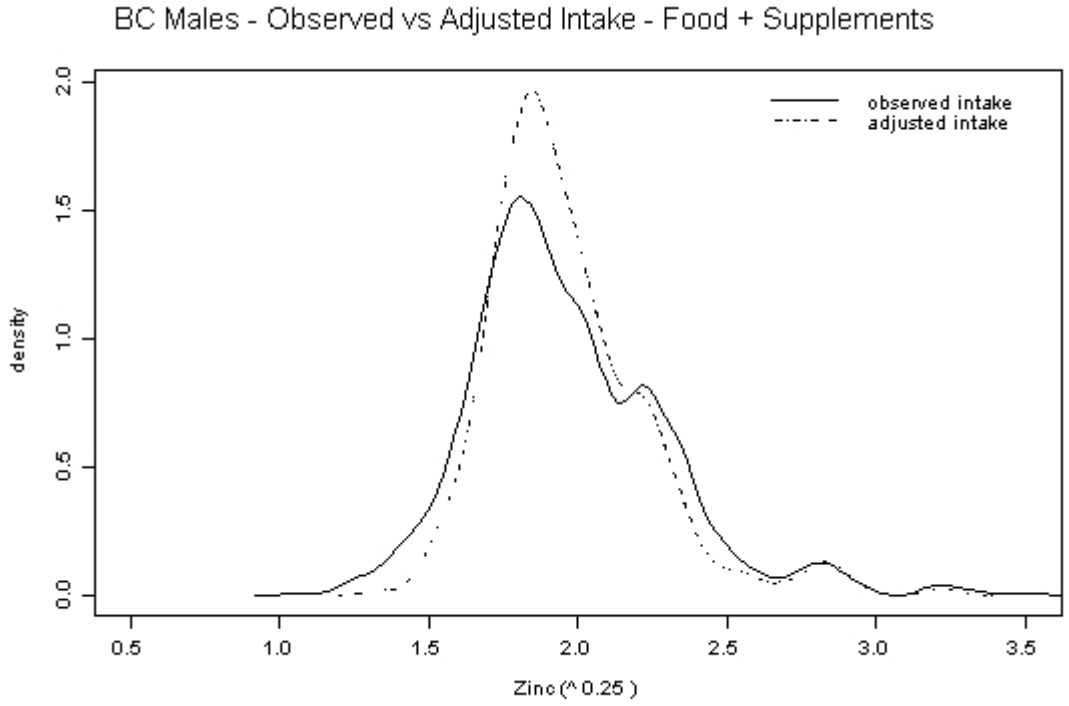


Figure 7.11
BC Observed vs. Adjusted Intake from Food and Supplements
Zinc (mg): Males and Females



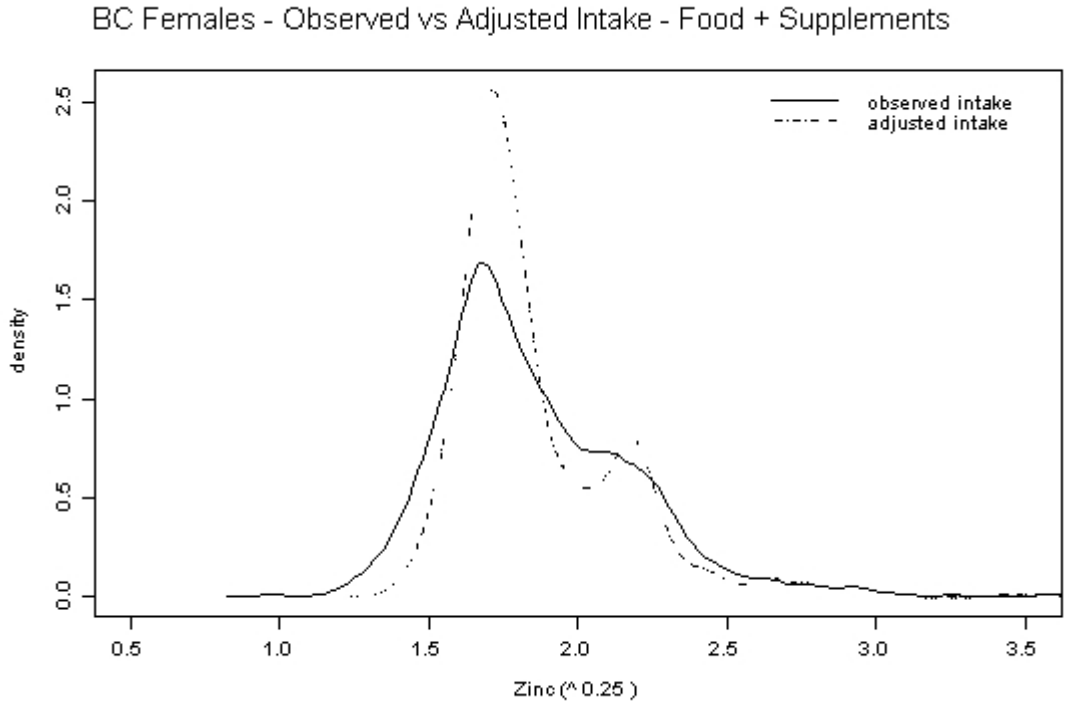
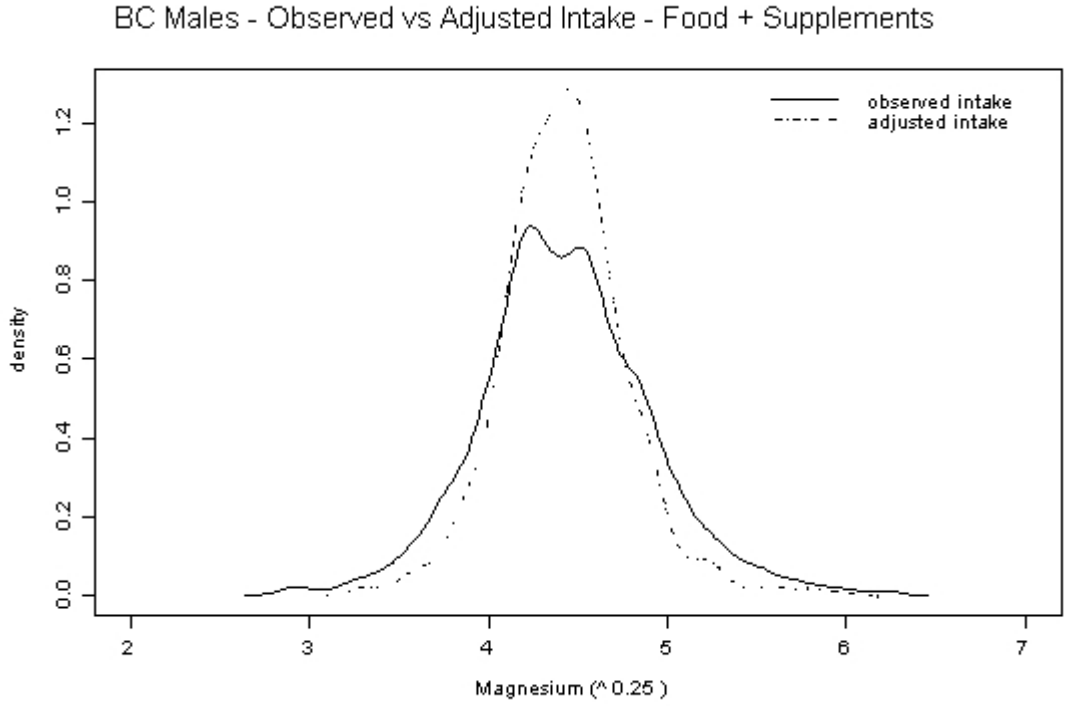


Figure 7.12
BC Observed vs. Adjusted Intake from Food and Supplements
Magnesium (mg): Males and Females



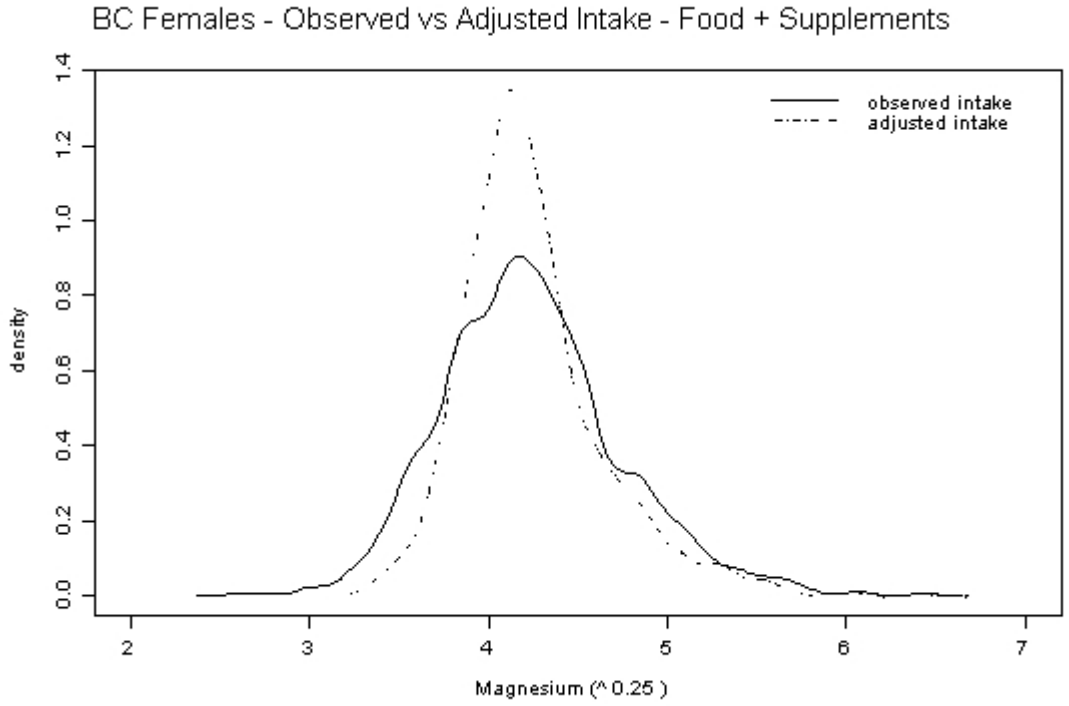
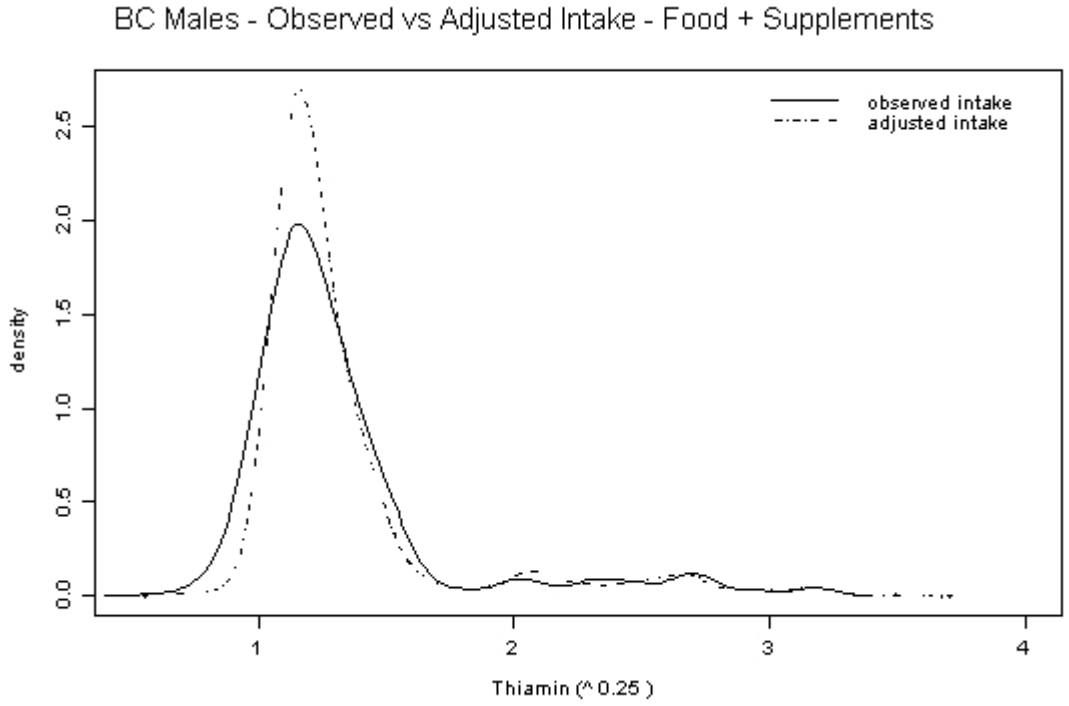


Figure 7.13
BC Observed vs. Adjusted Intake from Food and Supplements
Thiamin (mg): Males and Females



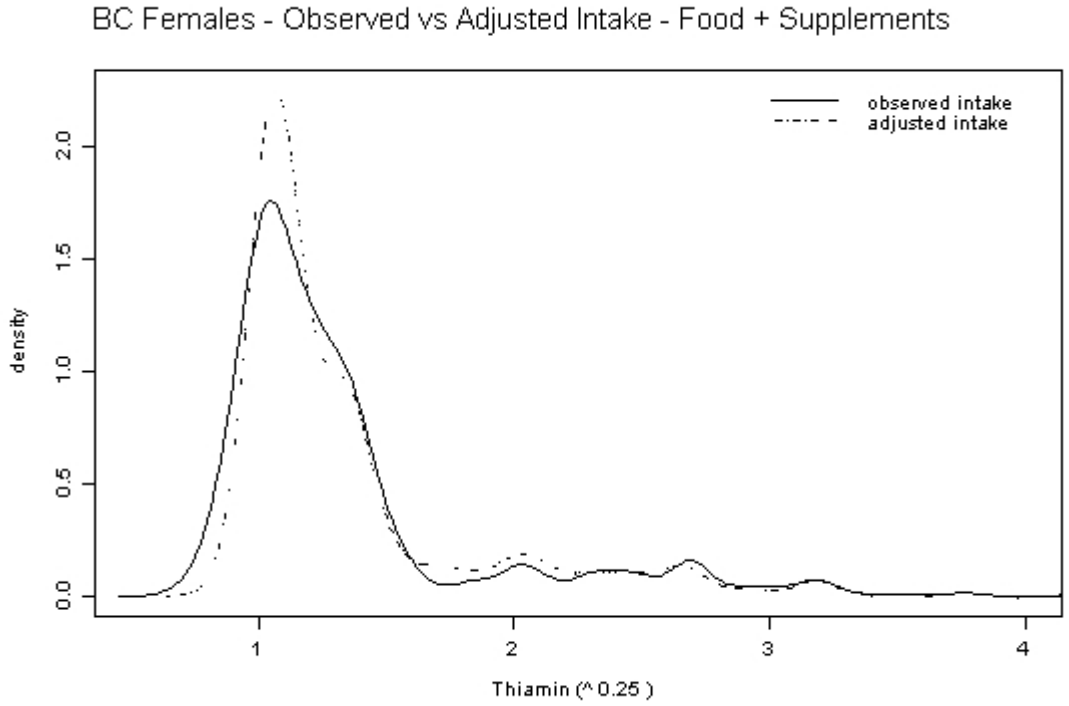
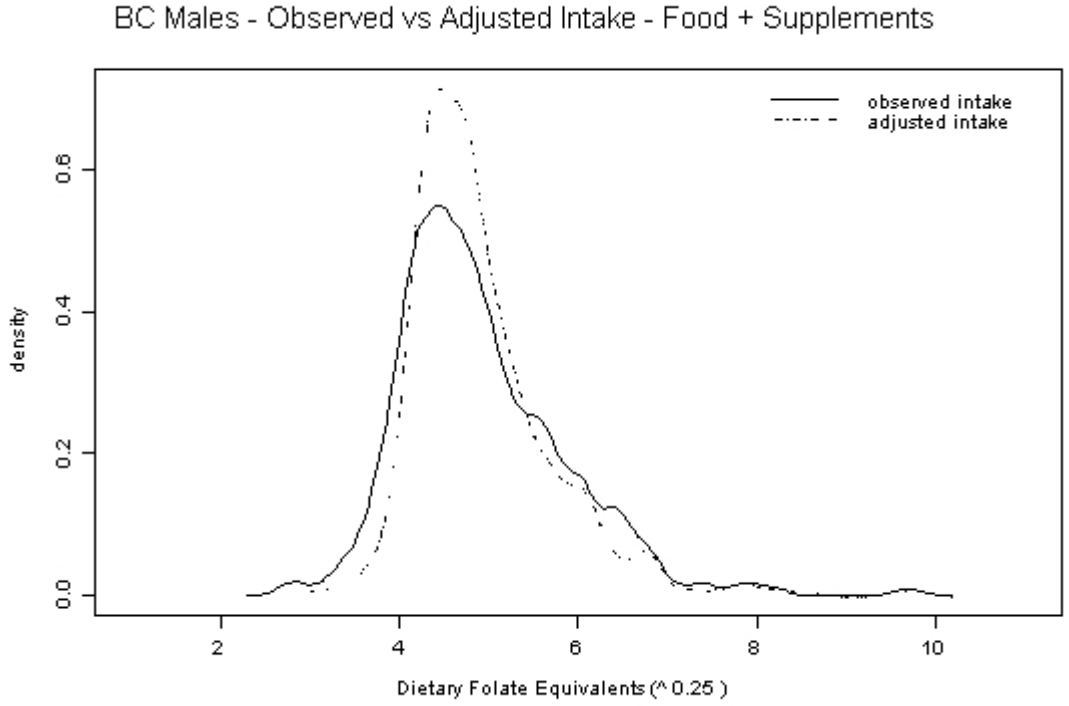
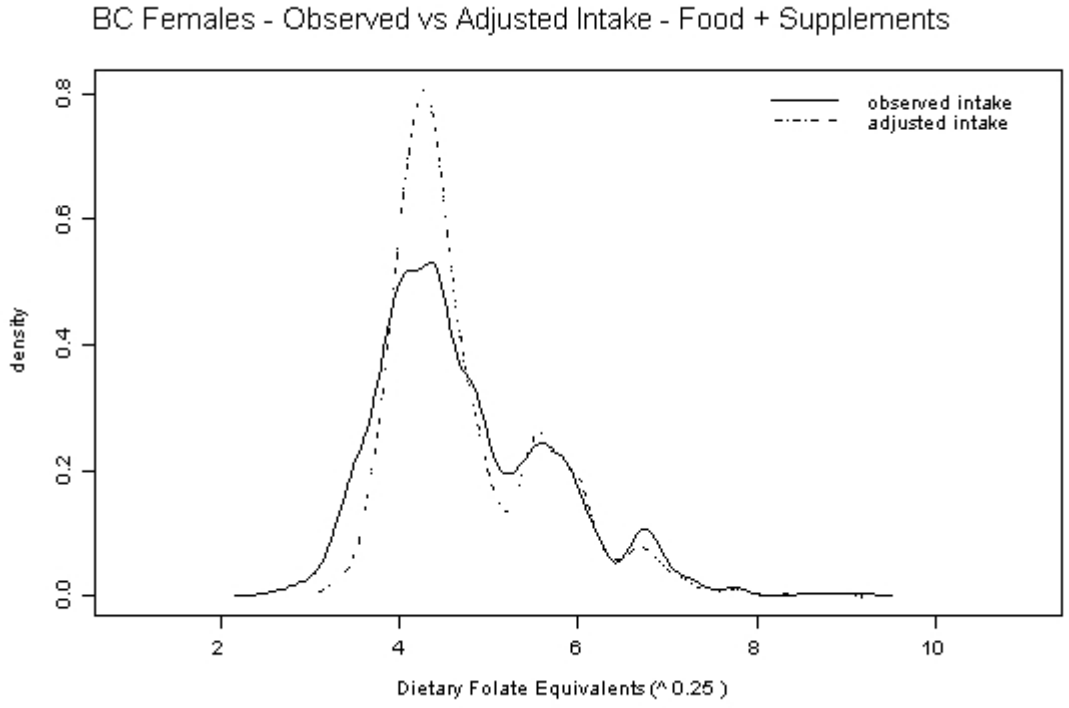


Figure 7.14
BC Observed vs. Adjusted Intake from Food and Supplements
Dietary Folate Equivalents: Males and Females





Appendix M

Probability of Inadequate Iron Intakes in British Columbia Iron Obtained from Foods Only

Probability of Inadequate Iron Intakes in British Columbia

Iron Obtained from Foods only

(Please note that in September 2002, the Bureau of Biostatistics and Computer Applications (BBCA) performed an analysis, similar to that contained in this report, of the probability of inadequate iron intakes from food source using the first version of the BCADJFDX data. Errors were subsequently found in the data and a second version was released in January 2003. The current analysis uses the second version of the BCADJFDX data, and is intended to replace the previous analysis)

The EAR cutpoint method is an appropriate short cut method where the underlying assumptions are met (Carriquiry (1999), FNB (2000)). This is the case for most nutrients considered but with some notable exceptions including iron. In the case of iron, the assumption that the requirement distribution be symmetric is not met, since this is known to be skewed for menstruating women (FNB(2000), page 51). For nutrients such as iron, the short cut EAR method cannot be used, and a more detailed mathematical treatment is need. The method used in this case is often termed "the full probability approach" where the full distributions of requirement and intake are used to estimate the probability that individuals with a particular intake would not meet their requirement. (FNB (1986)). This approach has been used historically to assess iron (Anderson *et. al* (1982)).

The analysis presented here uses the full probability approach but has expanded the methodology to allow a number of uncertainty factors to be included in the estimation: specifically, uncertainty around the fraction of oral contraceptive (OC) users and uncertainty around the distribution of iron intakes due to sampling. As noted in the FNB (2001) the distribution of requirements is significantly influenced by OC use and needs to be considered in arriving at an estimated requirements distribution for the population. In these calculations, the proportions of self reported OC users are estimated from the 136 and 300 BC respondents aged 19-30 and 31-49, respectively, who were healthy and not pregnant. These two samples are extracted from the 1998-1999 National Population Health Survey (NPHS) conducted by Statistics Canada (*For more information about NPHS 1998-1999 see http://www.statcan.ca/english/IPS/Data/82F0068XIE.htm*). Uncertainty in these proportions is characterized by the 95th% confidence interval calculated taking the complex survey design of the NPHS into effect, using the specialized variance estimation software SUDAAN. The distribution of iron intakes is estimated from usual food consumption of 1821 BC respondents aged 19-84 who responded to the BC Nutrition Survey. Uncertainty around the intake distribution is characterized using the 95th% confidence intervals for percentiles of the distribution accounting for the stratified sample design of the BC Nutrition Survey, again using SUDAAN.

The expanded probability method uses a two dimensional Monte Carlo simulation to propagate the uncertainties through the probability approach and the results are presented below. (A technical document will be available providing more details about the techniques used and comparing this approach with alternatives.)

Table 1

Weighted Fraction of Oral Contraceptive Users * and its 95% Confidence Interval in Adults Aged 19-49

Age group	Sample size	Weighted Mean	95% Lower Limit	95% Upper Limit
Female, 19-30	136	0.261	0.187	0.335
Female, 31-49	300	0.102	0.068	0.136

***** The weighted fraction of OC users and its 95% CI are estimated from the 1998-1999 National Population Health Survey (NPHS) data collected by Statistics Canada (*For more information about NPHS 1998-1999 see http://www.statcan.ca/english/IPS/Data/82F0068XIE.htm*).

Table 2

Estimated Percent of BC Population With Iron Intakes Below Requirement Including Uncertainty in OC Fraction and Intake Distribution

Estimated Percent BC Population Below Requirement (lower 95th CL, upper 95th CL)					
F 19-30 (n*=176) (%)	F 31-49 (n*=244) (%)	F 50 and over (n*=534) (%)	M 19-30 (n*=142) (%)	M 31-50 (n*=194) (%)	M 50 and over (n*=531) (%)
14.00 (12.82 –15.37)	19.71 (18.23 – 21.34)	1.43 (0.93 - 2.29)	0 (0 – 0.08)	0.02 (0 – 0.24)	0.98 (0.45 – 1.83)

References

Anderson, G.H. Peterson, R.D. and Beaton, G.H.(1982) "Estimating nutrient deficiencies in a population from dietary records: the use of probability analyses", *Nutr. Res*. **2,** 409-415.

Carriquiry, A.L. (1999) "Assessing the prevalence of nutrient inadequacy", *Pub. Health Nutr*. **2**, 23-33

Food and Nutrition Board, NRC (1986) *Nutrient Adequacy: Assessment Using Food Consumption Surveys*, National Academy Press: Washington.

Food and Nutrition Board, Institute of Medicine(2000) *Dietary Reference Intakes: Applications in Dietary Assessment*. National Academy Press: Washington

Food and Nutrition Board, Institute of Medicine(2001) *Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium and Zinc* National Academy Press: Washington

Appendix N

Probability of Inadequate Iron Intakes in British Columbia Iron Obtained from Foods and Supplements

Probability of Inadequate Iron Intakes in British Columbia

Iron Obtained from Foods And Supplements

(Please note that in November 2002, the Bureau of Biostatistics and Computer Application (BBCA) performed an analysis, similar to that contained in this report, of the probability of inadequate iron intakes from food and supplement source using the first version of the BCADJFDSUX data. Errors were subsequently found in the data and a second version was released in January 2003. The current analysis uses the second version of the BCADJFDSUX data, and is intended to replace the previous analysis.)

1. Methodology

The EAR cutpoint method is an appropriate shortcut method where the underlying assumptions are met (Carriquiry (1999), FNB (2000)). This is the case for most nutrients considered but with some notable exceptions including iron. In the case of iron, the assumption that the requirement distribution be symmetric is not met, since this is known to be skewed for menstruating women (FNB(2000), page 51). For nutrients such as iron, the shortcut EAR method cannot be used, and a more detailed mathematical treatment is needed. The method used in this case is often termed "the full probability approach" where the full distributions of requirement and intake are used to estimate the probability that individuals with a particular intake would not meet their requirement. (FNB (1986)). This approach has been used historically to assess iron (Anderson *et. al* (1982)).

The analysis presented here uses the full probability approach but has expanded the methodology to allow a number of uncertainty factors to be included in the estimation: specifically, uncertainty around the fraction of oral contraceptive (OC) users and uncertainty around the distribution of iron intakes due to sampling. As noted in the FNB (2001) the distribution of requirements is significantly influenced by OC use and needs to be considered in arriving at an estimated requirements distribution for the population. In these calculations, the proportions of self reported OC users are estimated from the 136 and 300 British Columbia (BC) respondents aged 19-30 and 31-49, respectively, who are healthy and not pregnant. These two samples are extracted from the 1998-1999 National Population Health Survey (NPHS) conducted by Statistics Canada (*For more information about NPHS 1998-1999 see http://www.statcan.ca/english/IPS/Data/82F0068XIE.htm*). Uncertainty in these proportions is characterized by the 95th% confidence interval calculated taking the complex survey design of the NPHS into account, using the specialized variance estimation software SUDAAN. The distribution of usual iron intakes is estimated from usual food and supplement consumptions of 1821 BC respondents aged 19 -84 who responded to the BC Nutrition Survey. Uncertainty around the intake distribution is characterized using the 95th% confidence intervals for percentiles of the distribution accounting for the stratified sample design of the BC Nutrition Survey, again using SUDAAN.

The expanded probability method uses a two dimensional Monte Carlo simulation to propagate the uncertainties through the probability approach and the results are presented in Tables 1 and 2. (A technical document will be available providing more details about the techniques used and comparing this approach with alternatives.)

Table 1
Weighted Fraction of Oral Contraceptive Users * and its 95% Confidence Interval
in Adults Aged 19-49

Age group	Sample size	Weighted Mean	95% Lower Limit	95% Upper Limit
Female, 19-30	136	0.261	0.187	0.335
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* The weighted fraction of OC users and its 95% CI are estimated from the 1998-1999 National Population Health Survey (NPHS) data collected by Statistics Canada (*For more information about NPHS 1996-1997 see* http://www.statcan.ca/english/IPS/Data/82F0068XIE.htm).

Table 2
Estimated Percent of BC Population With Iron Intakes Below Requirement
Including Uncertainty in OC Fraction and Intake Distribution

Estimated Percent BC Population Below Requirement (lower 95th CL, upper 95th CL)					
F 19-30 (n*=176) (%)	F 31-49 (n*=244) (%)	F 50 and over (n*=534) (%)	M 19-30 (n*=142) (%)	M 31-49 (n*=194) (%)	M 50 and over (n*=531) (%)
11.67 (10.06 -13.73)	15.62 (14.6-17.55)	0.8 (0.54- 1.11)	0.04 (0- 0.24)	0.03 (0.05 - 0.29)	0.97 (0.34 – 1.93)

* n= Sample size

2. Comments

- In November 2002, the BBCA performed an analysis of the probability of inadequate iron intakes in BC from food and supplement sources using the first version of the BCADJFDSUX data. A second version of this data has been released due to errors found in the first version. The analysis presented in this paper is based on the second version of the BCADJFDSUX data, and is intended to replace the previous analysis.

- In the '*techrep E451313- 011CV1, August 2002'* report by Hayward, 27% of the BC population reported consuming some supplemental iron, ranging with age in males from 19% - 24% and in females, 24%-40%. The two youngest female groups aged 19-30 and 31-49 have the percents of some supplemental iron of 28% and 36% respectively.

- Note that the probabilities of inadequate iron intakes in females and males found in the current analysis are slightly higher than those in the previous analysis (done in November 2002).

References

Anderson, G.H. Peterson, R.D. and Beaton, G.H.(1982) "Estimating nutrient deficiencies in a population from dietary records: the use of probability analyses", *Nutr. Res*. **2,** 409-415.

Carriquiry, A.L. (1999) "Assessing the prevalence of nutrient inadequacy", *Pub. Health Nutr*. **2**, 23-33

Food and Nutrition Board, NRC (1986) *Nutrient Adequacy: Assessment Using Food Consumption Surveys*, National Academy Press: Washington.

Food and Nutrition Board, Institute of Medicine(2000) *Dietary Reference Intakes: Applications in Dietary Assessment*. National Academy Press: Washington

Food and Nutrition Board, Institute of Medicine(2001) *Dietary Reference Intakes for Vitamin A, Vitamin K, Arsenic, Boron, Chromium, Copper, Iodine, Iron, Manganese, Molybdenum, Nickel, Silicon, Vanadium and Zinc* National Academy Press: Washington

Appendix O

Influence of Education Level, Low Income and Geographic Strata on the Intakes of Seven Nutrients Determined by Analysis of Variance

Appendix O: Influence of Education Level, Low Income and Geographic Strata on the Intakes of Seven Nutrients Determined by Analysis of Variance

Nutrient	Education Level		Low Income		Geographic Strata	
	F value	P value	F value	P value	F value	P value
Folate	1.299	.273	.955	.329	.974	.378
Vitamin B6	.373	.689	.066	.798	.794	.452
Vitamin B12	3.614	.027	.274	.601	.257	.759
Vitamin C	5.965	.003	.120	.729	.500	.607
Calcium	1.009	.365	.515	.473	.594	.552
Magnesium	.967	.381	1.552	.213	520	.595
Zinc	.486	.615	1.125	.289	1.538	.215

Appendix P

Analysis of Non-Response

ANALYSIS OF NONRESPONSE

BRITISH COLUMBIA NUTRITION SURVEY 1999

Report BBCA 451311-0010NR

February 2002

L. Nguyen,
B. Junkins
Bureau of Biostatistics and
Computer Applications
Food Directorate
Health Canada

Table of Contents

§ 1. Back ground

The British Columbia Nutrition Survey (NBNS) was conducted as a federal-provincial collaboration in two phases: April-July 1999 (spring) and September-December 1999 (fall). During this time, men and women between the ages of 18 and 84, living in British Columbia (excluding those who were pregnant, lactating, institutionalized or living on reserve lands) were approached through an initial letter and telephone follow-up to participate in a food and nutrition survey. The data were collected during a face-to-face interview. The survey consisted of five instruments: a 24 hour recall, a quantitative food frequency questionnaire, a demographic questionnaire, a provincial special interest questionnaire and information pertaining to the response/non-response status of sampled individuals. Approximately, half of the sample was interviewed during the Spring and the other half in the Fall of 1999. There was a repeat 24-hour recall for a sub-sample of the participants, every third name sampled being identified for a repeat.

A detailed analysis of response/non-response issues was conducted by the Bureau of Biostatistics and Computer Applications (BBCA) in the Food Directorate in Health Canada (HC). This document summarizes these results, discusses the development of survey weights, and examines some of the factors which may indicate potential bias in the nutritional results of the responding population due to the non-response mechanism.

1.1 Sample Design

The sampling plan for both phases, (or seasons), designed by the Special Surveys Methods Division in Statistics Canada, France Bilocq, 1999 (Appendix B1), was a stratified multi-stage sampling design. At the first stage of the sample selection, the population was stratified into three strata: Metro (stratum 1) consisting of 6 geographic regions (or sub-strata); Coastal (stratum 2) containing 1 geographic region (sub-stratum); and Non-metro consisting of 10 geographic regions (clusters). In strata one and two, each geographic region (substratum) was selected with certainty, termed “chosen with probability 1", while in stratum three, 4 geographic regions (or clusters) were randomly chosen with probability proportional to the population size of the regions. The British Columbia Health Register File (BCHR) was used as the frame to select the sample of individuals for each season. All individuals on the BCHRF that fell within the selected areas for each stratum were stratified into 14 age-sex groups: males/females, ages 18-24, 25-34, 35-44, 45-54, 55-64,65-74 and 75-84.

At the second stage, a sample of individuals was selected from the BCHR according to the sample allocation in each stratum-age-sex combination. An estimate of 5320 names was required to drawn in the Spring 1999 and divided equally for two seasons in order to obtain expected responses of 1364 in each season. The dividing process was done as the first, third, fifth name sampled ... etc., being identified for Spring (phase 1) and the second, fourth, sixth name sampled .... etc., being identified for Fall (phase 2). For more detailed information about the sample design, see Sample Design Specifications, France Bilocq, 1999.(Appendix B1)

Approximately one third of the sample was randomly selected for a repeat 24 hour recall. In

order to try covering all days equally, both the initial and repeat interview days were randomly assigned a day of the week and the repeat interview was scheduled no sooner than one week after the first interview.

It should be note that while the survey was conducted in 1999, the stratification and sampling of the primary units were done using 1996 census data and the sampling of individuals was done using 1999 BCHR.

Table 1.1 presents a summary of the sampling and resulting respondents with usable interviews by season (phase) and region. Table 1.2 summarizes the results by season and age-sex group. From 5273 people selected (2658 people drawn in spring and 2615 people drawn in the fall), there were 1823 usable first interviews (868 in the spring and 955 in the fall) and 479 usable second interviews (229 in the spring and 250 in the fall).

A summary of the sampling and resulting respondents is provided in Tables 1.1 and 1.2.

Table 1.1

BCNS: Sampling by Geographic Region and Season

	season																					
	Spring 99							Fall 99							Total							
	Number drawn	Number responding	Reliable completes	Reliable partial	Number respe-ats	Reliable complete repeat	Reliable partial repeat	Number drawn	Number respo-nding	Reliable complete nses	Reliable partial nse	Number respe-ats	Reliable complete repeat	Reliable partial repeat	Number drawn	Number respo-nding	Reliable complete nses	Reliable partial nse	Number respe-ats	Reliable complete repeat	Reliable partial repeat
Geographic region																						
Vancouver	447	157	151	6	46	46	0	450	165	162	3	41	41	0	897	322	313	9	87	87	0
Victoria	238	67	66	1	12	11	0	231	83	82	1	20	20	0	469	150	148	2	32	31	0
Nanaimo	135	41	41	0	10	10	0	134	54	54	0	11	11	0	269	95	95	0	21	21	0
Kamloops	149	44	44	0	12	12	0	146	64	63	0	15	15	0	295	108	107	0	27	27	0
Kelowna	165	53	53	0	11	11	0	162	60	59	1	13	13	0	327	113	112	1	24	24	0
Prince George	151	46	45	1	14	14	0	152	37	37	0	9	9	0	303	83	82	1	23	23	0
Coastal	618	186	184	1	51	51	0	603	237	235	2	76	76	0	1221	423	419	3	127	127	0
Kootenay	187	73	72	1	19	19	0	185	47	45	2	14	14	0	372	120	117	3	33	33	0
Chilliwack	188	53	52	1	11	10	1	183	69	68	1	17	17	0	371	122	120	2	28	27	1
Vernon	192	86	86	0	26	26	0	188	86	83	2	20	20	0	380	172	169	2	46	46	0
Terrace	188	63	63	0	18	18	0	181	55	53	2	14	14	0	369	118	116	2	32	32	0
Total	2658	869	857	11	230	228	1	2615	957	941	14	250	250	0	5273	1826	1798	25	480	478	1

Table 1.2
BCNS: Sampling by Age-Sex Group and Season

	season																					
	Spring 99							Fall 99							Total							
	Number drawn	Number responding	Relia-ble compl-ete respon-ses	Relia-ble parti-al respon-se	Number respe-ats	Relia-ble compl-ete repeat	Relia-ble parti-al repeat	Number drawn	Number respon-ding	Relia-ble compl-ete respon-ses	Relia-ble parti-al respon-se	Number respe-ats	Relia-ble compl-ete repeat	Relia-ble parti-al repeat	Number drawn	Number respon-ding	Relia-ble compl-ete respon-ses	Relia-ble parti-al respon-se	Number respe-ats	Relia-ble compl-ete repeat	Relia-ble parti-al repeat
age-sex group																						
M 18-24	177	44	44	0	12	12	0	175	41	41	0	12	12	0	352	85	85	0	24	24	0	
M 25-34	227	48	48	0	9	9	0	202	54	51	3	11	11	0	429	102	99	3	20	20	0	
M 35-44	177	45	44	1	9	9	0	177	60	59	1	17	17	0	354	105	103	2	26	26	0	
M 45-54	146	43	42	0	12	12	0	147	46	46	0	12	12	0	293	89	88	0	24	24	0	
M 55-54	128	44	42	2	12	12	0	145	51	51	0	12	12	0	273	95	93	2	24	24	0	
M 65-74	218	95	93	2	29	29	0	211	99	97	2	27	27	0	429	194	190	4	56	56	0	
M 75-84	255	98	96	2	30	28	1	250	103	100	1	28	28	0	505	201	196	3	58	56	1	
F 18-24	180	41	41	0	10	10	0	178	59	59	0	15	15	0	358	100	100	0	25	25	0	
F 25-34	226	65	64	1	19	19	0	216	63	62	1	17	17	0	442	128	126	2	36	36	0	
F 35-44	180	62	62	0	13	13	0	169	69	68	1	16	16	0	349	131	130	1	29	29	0	
F 45-54	136	64	63	1	15	15	0	148	60	60	0	17	17	0	284	124	123	1	32	32	0	
F 55-64	138	63	63	0	15	15	0	123	67	67	0	29	29	0	261	130	130	0	44	44	0	
F 65-74	211	71	70	1	20	20	0	219	98	95	3	15	15	0	430	169	165	4	35	35	0	
F 75-84	259	86	85	1	25	25	0	255	87	85	2	22	22	0	514	173	170	3	47	47	0	
Total	2658	869	857	11	230	228	1	2615	957	941	14	250	250	0	5273	1826	1798	25	480	478	1	

1.2 Nonresponse and Bias

The term "bias" is used to describe an effect which systematically distorts a result so that it loses its "representativeness" of the truth. Bias can arise in survey results for a number of reasons such as: a particular estimator chosen; errors in the respondent's answers (perhaps due to concealment of the truth, poorly designed questions, or ability of the respondent to answer); errors in the sampling operations; non-interviews or nonresponse. In this document, the concern is focussed on the last of these, and the potential biassing, or distorting effect that non-response in the BCNS may have on the survey results. The Tables 1.1 and 1.2 above suggest that there are geographical areas and age-sex groups where the biassing effects of non-response may need to be kept in mind. (In section 3, various rates to quantify the non-response are discussed.)

The mean of a variable is a good estimator to help understand the numerical aspect of bias. Suppose that:

$\bar{Y}$ = mean of a variable for the entire sample, and unbiased for population value μ;

$\bar{Y}_R$ = expected value of the mean of a variable for the respondents only; and

$\bar{Y}_{NR}$ = expected value of the mean of a variable for the non- respondents only.

Then bias due to the non-response, B, is defined as

$$B=\bar{Y}_R - \bar{Y} \qquad (1)$$

If we define P_{NR} as the probability of nonresponse and P_R as the probability of response, then we can rewrite $\bar{Y}$ as

$$\bar{Y} = \bar{Y}_R P_R + \bar{Y}_{NR} P_{NR} \qquad (2)$$

Combining (1) and (2), we find that the bias can be re-written as:

$$B=(\bar{Y}_R - \bar{Y}_{NR})P_{NR} \qquad (3)$$

From (3) we see that the bias will be large if there is a large difference between respondents and nonrespondents for the variable of interest, or if the probability of non-response is high. Hence, we need to evaluate two features of the survey outcome: the probability of non-response and the similarity of the responding/nonresponding population on the nutritional variables of interest.

Bias affects more than just the estimators from the survey: it also plays a role in the magnitude of the variances of the estimators. Consider an estimator $\bar{y}$ of a population value μ, formed from the respondents only. Let us say that it is biassed with an expected value of $\bar{Y}_R$ and a bias B.

Then $\bar{y}$ will be distributed about its own expected value with a variance V($\bar{y}$) and standard deviation SD($\bar{y}$). When we make statements about the accuracy of the estimate, it is this variance that is used in the calculations such as those declaring with a given probability, that the estimate is in error by more than 2 standard deviations. However, what is actually needed for these probability calculations is the variance of $\bar{y}$ about the true population value μ. This variance is termed Mean Square Error (MSE) and it can be shown that

$$MSE(\bar{y}) = V(\bar{y}) + B^2 \qquad (4)$$

The magnitude of V($\bar{y}$) can be minimized by increasing the number of sampled units. However, if the response mechanism is the same for all respondents, then the bias is not reduced with further sampling. The amount of the disturbance by the bias to the distribution of $\bar{y}$ depends on the ratio of the bias to the standard deviation of $\bar{y}$, i.e. B/SD($\bar{y}$). The ultimate effect of this unknown bias in the survey is to give rise to tests of hypotheses with incorrect probabilities.

In light of the substantial effect that bias from non-response can have on the estimates and tests of hypotheses, it is important to try and assess both the magnitude and the type of bias which may be in the BCNS.

§ 2. Non-response Methodology

Calculation of the response rates for the BCNS are based on the Statistics Canada Methods and Standards Committee document "Standards and Guidelines for Reporting of Non-response Rates: Definitions, Framework and Detailed Guidelines (1992)" These guidelines have been used to categorize the results from the initial contact and the interview step to estimate the magnitude and pattern of response.

2.1 Response Categories.

All of the narrative comments and non-response codes noted by the interviewers during the telephone recruitment were reviewed by BBCA and grouped into categories in a non-response accounting framework. A response category was assigned to each telephone recruitment outcome:

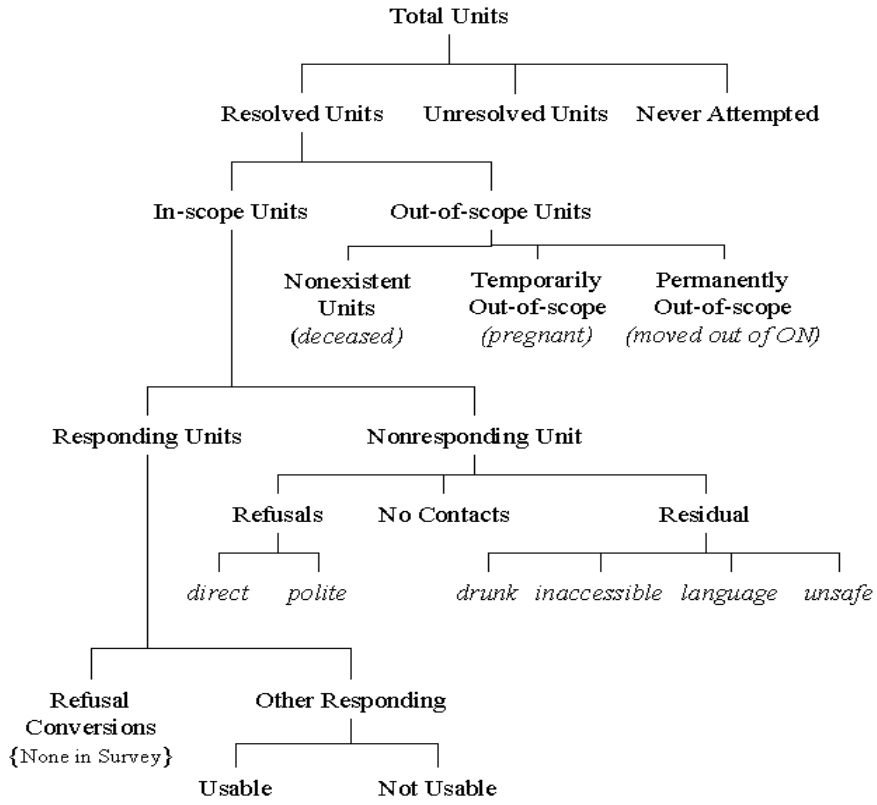
Responder →	granted an interview ;
Nonresponding →	in scope individuals who refused, were not available, or through some other circumstances were not able to complete an interview;
Not in scope →	individual not meeting the sampling criteria (pregnant for example); and
Not resolved →	never able to determine if in scope after six attempts at contact.

More details about these classes are provided in the Appendix A with examples of the types of responses which fit into each.

Figure 2.1 below is an adaptation of a similar figure given in the Statistics Canada Standards cited above, showing the different outcomes at data collection. (Examples of the type of responses are noted in italics on the figure.)

Figure 2.1

Respondent/Nonrespondent Categories[1]



[1] Chart adapted from Statistics Canada Methods and Standards Committee (1992) "Standards and Guidelines for Reporting of Non-response Rates: Definitions, Framework and Detailed Guidelines".

2.2 Response Summary - Accountability Table

The term "accountability tables" is often used in the literature to describe the summary tables accounting for the response/non-response status of each individual drawn for the sample (see page 29, "Incomplete Data in Sample Surveys" (1983) Vol. 1 Chapter 3, ed. W. Madow, H. Nisselson, I. Olkin) . Table 2.1 provides a general accountability table for the BCNS.

Table 2.1
Response Status for the BCNS by Season

Summary Status	Spring 1999	Fall 1999	Total
Drawn	2658	2615	5273
Attempted	2397	2502	4899
Resolved	1965	2044	4009
Eligible	1716	1772	3488
Responding with interview	869	957	1826
Response Usable 1st Recall (% of eligible cases)	868 (51%)	955 (54%)	1823 (52%)
Repeat Recalls (% of usable 1st Recalls)	229 (26%)	250 (26%)	479 (26%)

Accountability tables by age, sex and geographic region are provided in Appendix A3 (Tables A3.1 and A3.2). The detailed tables indicate that while the overall rate for repeat recalls is somewhat close to the 1/3 targeted, particular age-sex groups and regions give rise to concern.

§ 3. Calculation of Rates

3.1 Methodology

Calculation of "rates" for a survey such as the BCNS can be carried out in a number of ways and there are many examples in the literature. The methodology below follows the approach given in the Statistics Canada documentation "Standards and Guidelines for Reporting of Non-response Rates: Definitions, Framework and Detailed Guidelines (1992)".

3.1.1 Data Collection Rates vs. Analysis Rates

Two types of rates need to be considered: those related to the data collection process and those related to the analysis phase. The primary difference between the two types of rates lies in the classification of (1) the unresolved cases, and (2) the unusable interviews. The latter are considered successful responses at the data collection phase, however, at the analysis stage, they are considered as nonrespondents and are handled in a straightforward manner. The unresolved cases are more problematic. At data collection, the unresolved cases are clearly nonrespondents, and are considered as part of the total potential response group. At the analysis stage, this group needs to be examined more closely, looking at the reason these cases were left unresolved. If the unresolved are not responding because they have moved out the province or are dead, then they are out of the scope of the study, and do not add to the bias in the analysis. However, if they are unresolved because they represent a pocket of hard-to-reach individuals, then they are in scope and should be considered as potential responders. As such, these unresolved cases may contribute to bias in the analysis.

In the absence of information needed to estimate how many unresolved cases are actually in scope, one approach is to place upper and lower bounds on the analysis rates. The most optimistic assumption is that all unresolved cases are counted as out-of-scope individuals, i.e. zero in scope. Rates calculated under this assumption represent upper bounds. Alternatively, lower bounds are calculated under the assumption that all unresolved cases represent for in-scope individuals. The true rates likely lie between these values, rather than at the extremes.

3.1.2 Calculation of Rates

In the BC Nutrition Survey, there are four rates of interest: resolved/located, in-scope, refusal and response rate. Of these, only response rate needs to address the unresolved and unusable interview issue described above. Rate calculations are as follows:

1. Resolved Rate = $\frac{\text{Number Resolved}}{\text{Total Attempted}}$

2. In-scope Rate = $\frac{\text{Number In-scope}}{\text{Number Resolved}}$

3. Refusal Rate = $\frac{\text{Number of Refusals}}{\text{Number In-scope}}$

4. Response Rate

Data Collection:

$$\frac{\text{Number Responding}}{\text{Number In-scope + Unresolved}}$$

Analysis Stage:

$$\frac{\text{Number responding - Unusable}}{\text{Number In-scope + Estimated In-scope}}$$

where *estimated in-scope* represents the number of unresolved predicted to be in-scope. As discussed previously, in the absence of more information, the upper and lower bounds can be used.

3.2 Results

Detailed tables of the above rates are given in Appendix A4 by geographic region, age-sex group and season. Note that in the tables in Appendix A4, the value of "N" reflects the number in the denominator for the formulas above.

The text below provides some observations about the patterns of the different rates. Summary rates have been graphed below to illustrate the findings.

Resolved Rate (*graph 3.1, Appendix A4.1.1, A4.1.2*) Overall 82% of the names drawn were located and approached to participate in the survey. This rate varied across geographic areas with Prince George being lowest (73%) and Vernon being highest (89%). The Metro and Coastal regions had lower resolved rates than the Non-Metro regions with the exception of Kelowna (88%). The resolved rate of this region is as high as the Non-Metro regions. Generally, resolved rates were higher in males than females, but the pattern over age groups was consistent in both gender groups: the rate was lowest in the younger group and generally increased by age (With the exception of male age group 65 - 74: the resolved rate (88%) in this age group is slightly lower than in the male age group 55 - 64 (90%).) This pattern is expected as younger individuals are more likely to be more mobile than older ones.

In Scope Rate: *(graph 3.2, Appendix A4.2.1, A4.2.2)* Overall, 87% of the resolved names were in scope. The rate wasquite similar between the Metro and Coaster regions but slightly higher than the Non-metro regions (Kelowna highest (91%) and Chilliwack lowest (79%)). The pattern of in scope rates was consistent in both gender groups: the rate appeared to be lowest in the youngest age group (18-24) increasing with age and dropping off in the older age groups. This pattern is expected as pregnancy and transient residence affect the in scope status of the youngest ages, while factors such as severe illness, seasonal residences are prominent in the older groups.

Refusal Rate: *(graph 3.3, Appendix A4.3.1, A4.3.2)* Overall, 38% of the in-scope names refused to participate in the study. This rate varied amongst the geographic areas with Vancouver being the lowest (32%) and Chilliwack having the highest (46%). The pattern of refusal rates was quite consistent over the age groups for both genders up to about 64 years of age at which point, the

refusal rate increased by age for males and decreased by age for females.

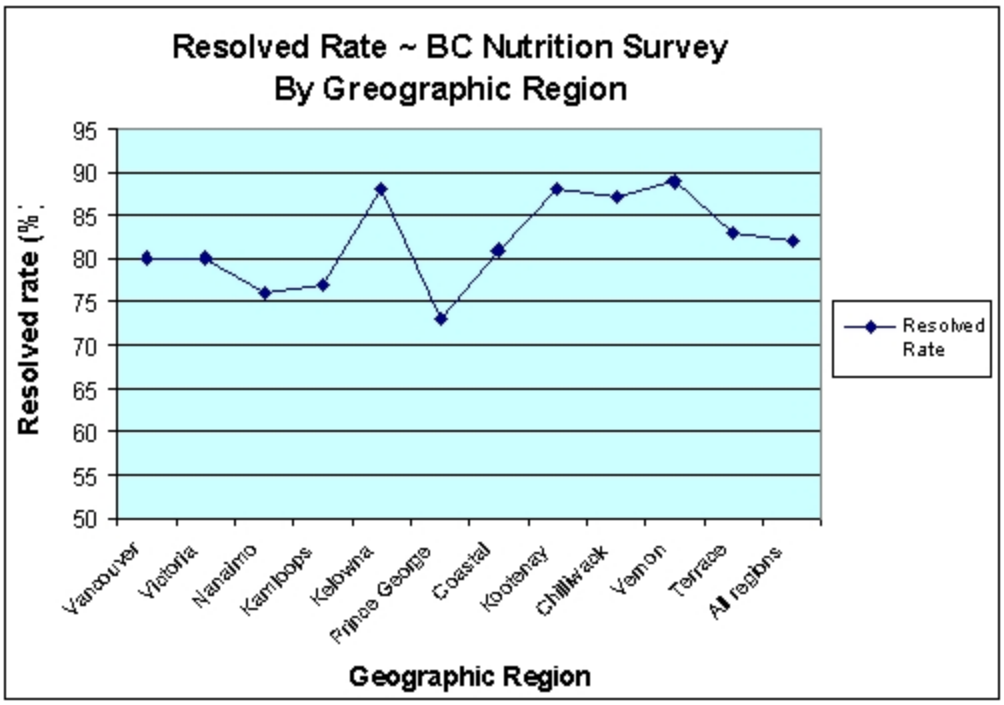
Response Rate: *(graph 3.4, Appendix A4.4.1, A4.4.2)* Overall, the lower and upper bounds of the response rate were 42% and 52% which are computed as:

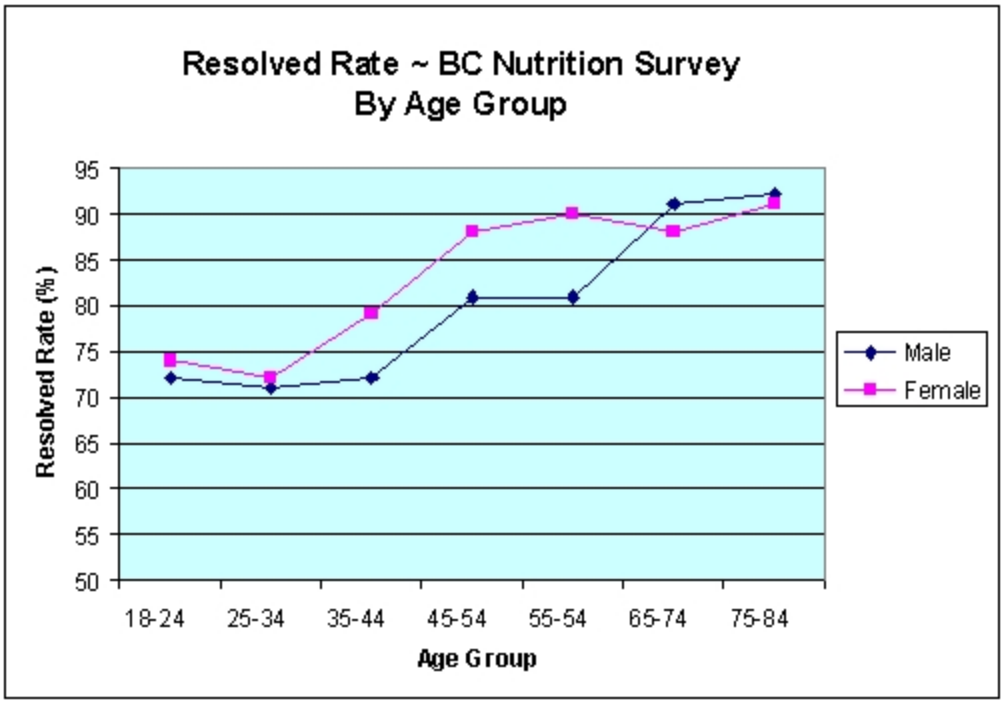
$$\text{The analysis stage of the lower response rate} = \frac{\text{Number of responding - Unusable}}{\text{Number of in scope + Number of unresolved}}$$

$$\text{The analysis stage of the higher response rate} = \frac{\text{Number of responding - Unusable}}{\text{Number of in scope}}$$

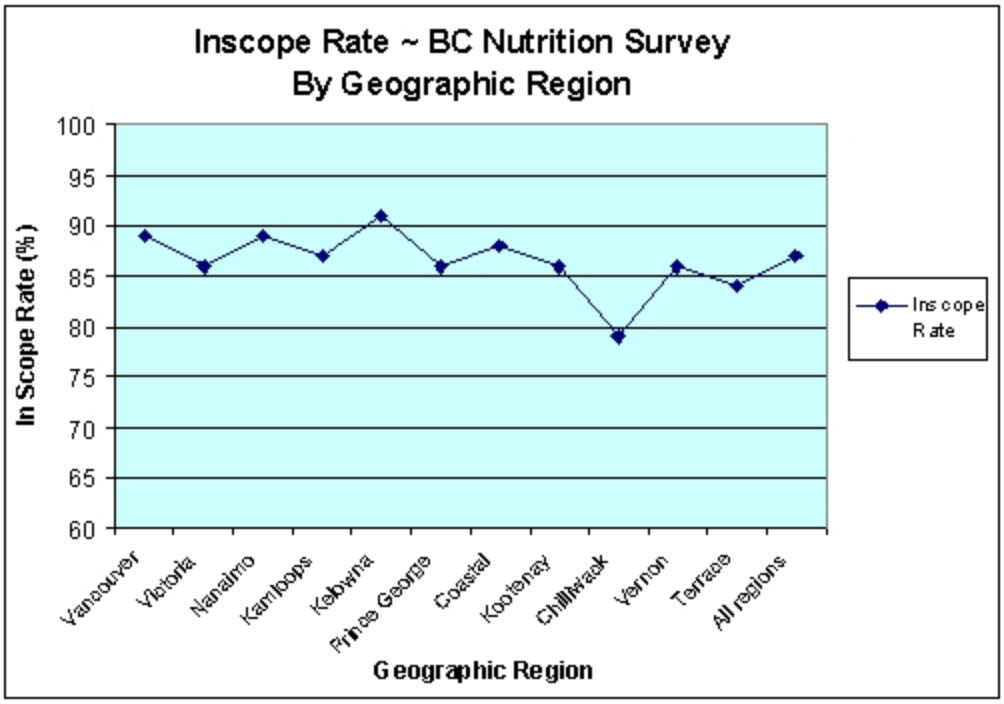
The response rates varied across geographic regions ranging from 31% to 52% for the lower bound and from 45% to 59% for the upper bound. Prince George had the lowest rate whle the highest rate was observed at Vernon. Among the geographic strata, the Metro and Coastal regions have a quite similar response rate (with the exception of Prince George). Response rates were higher for females than males up to 64 years of age at which point males have a slightly higher response rate. Generally, the rate increased with age then decreased in older inviduals: for females decreasing noticably after 64 years for females, but only slightly decreasing after 74 years for males.

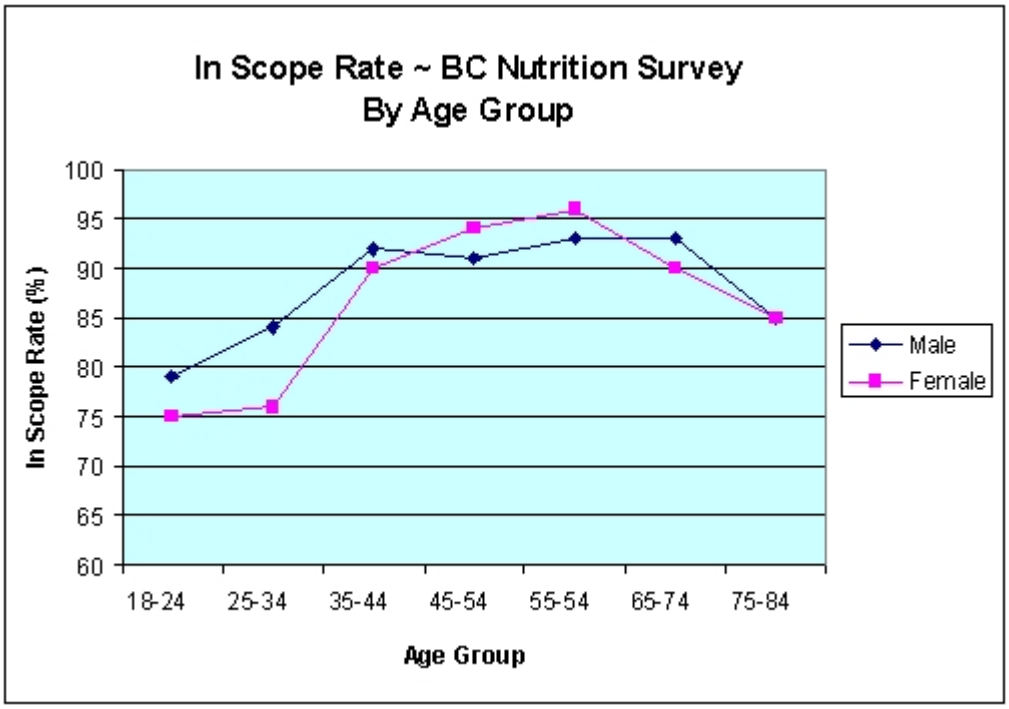
Graph 3.1 Resolved Rates



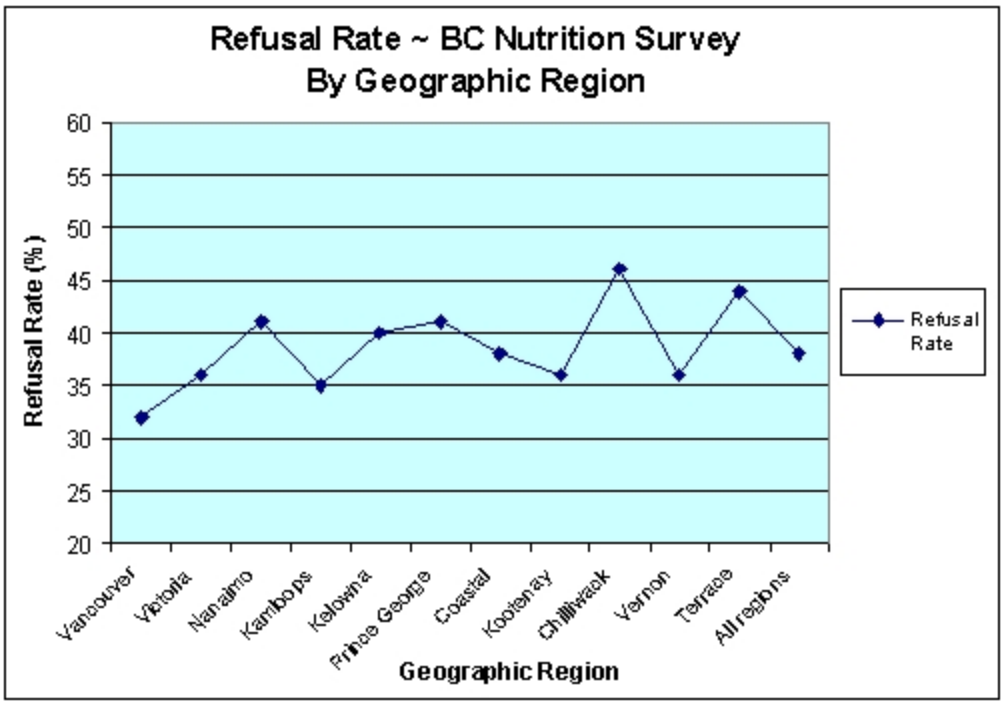


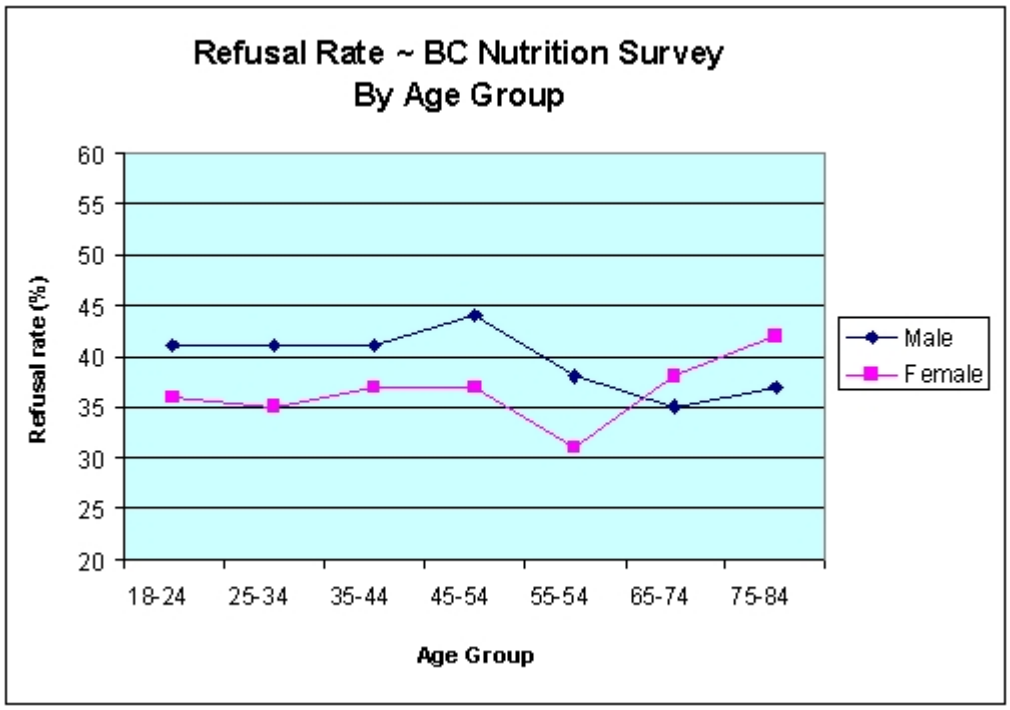
Graph 3.2 In Scope Rates



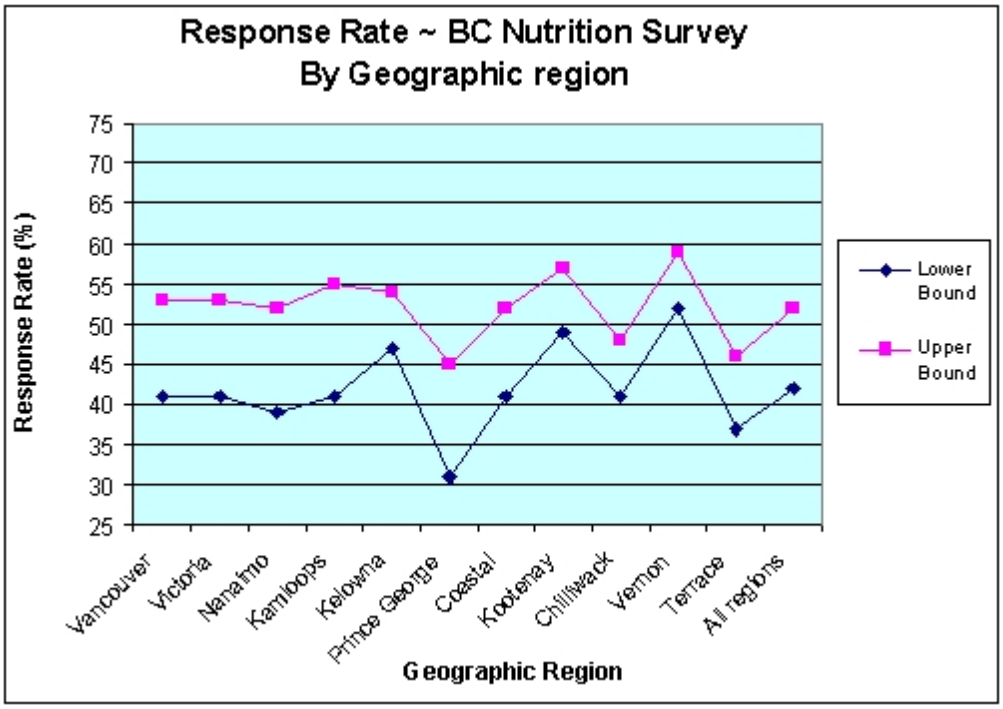


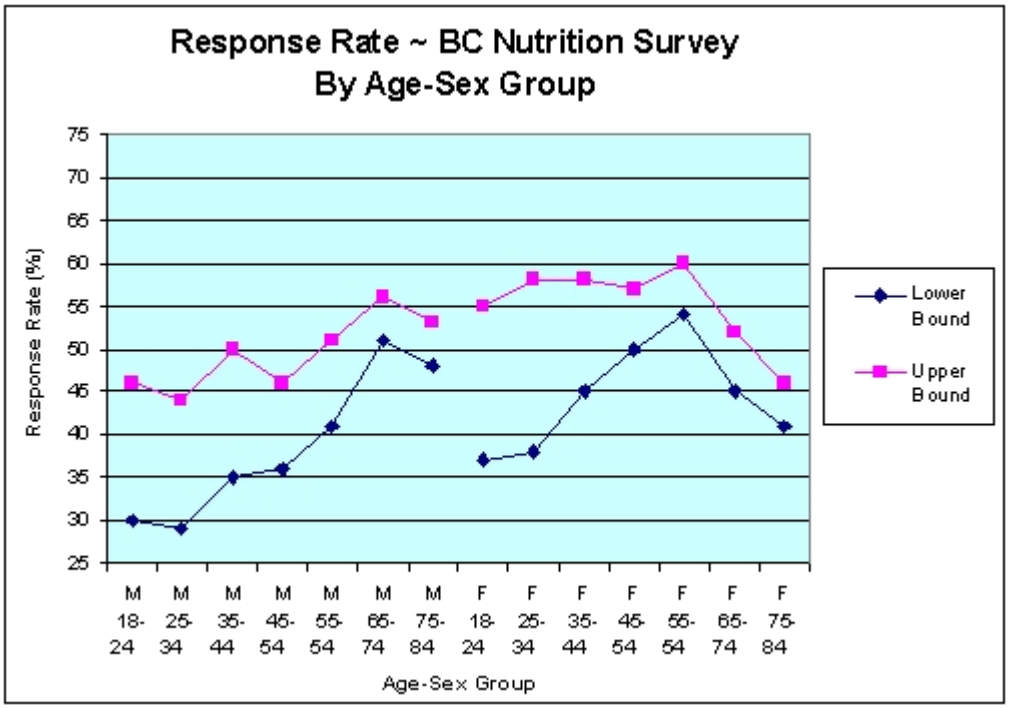
Graph 3.3 Refusal Rates

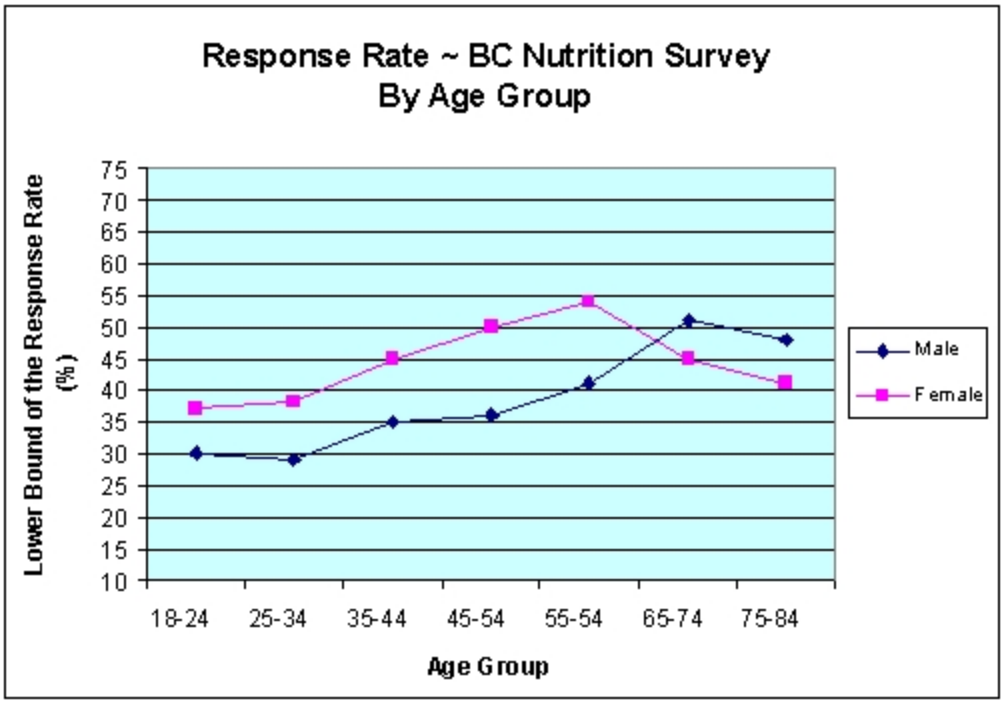


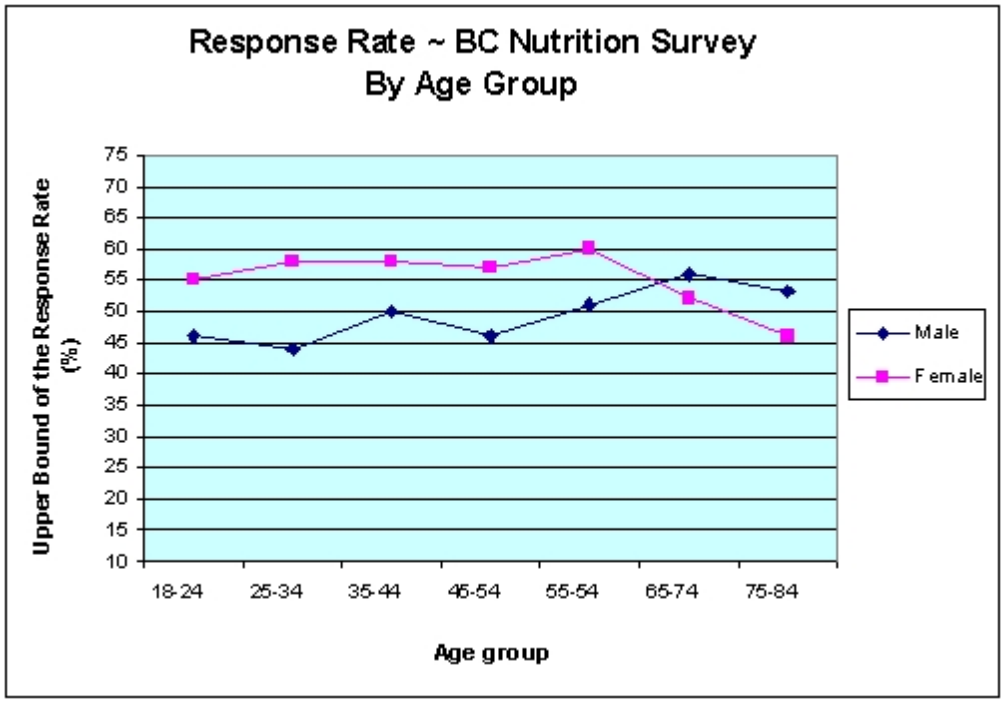


Graph 3.4 Response Rates


Response Rate ~ BC Nutrition Survey
By Geographic region
Response Rate (%)
75
70
65
60
55
50
45
40
35
30
25
Vancouver
Victoria
Nanaimo
Kamloops
Kelowna
Prince George
Coastal
Kootenay
Chilliwack
Vernon
Terrace
All regions
Geographic Region
Lower Bound
Upper Bound


Response Rate ~ BC Nutrition Survey
By Age-Sex Group
Response Rate (%)
75
70
65
60
55
50
45
40
35
30
25
M 18-24
M 25-34
M 35-44
M 45-54
M 55-54
M 65-74
M 75-84
F 18-24
F 25-34
F 35-44
F 45-54
F 55-54
F 65-74
F 75-84
Age-Sex Group
Lower Bound
Upper Bound


Response Rate ~ BC Nutrition Survey
By Age Group
Lower Bound of the Response Rate (%)
75
70
65
60
55
50
45
40
35
30
25
20
15
10
18-24
25-34
35-44
45-54
55-54
65-74
75-84
Age Group
Male
Female


Response Rate ~ BC Nutrition Survey
By Age Group
Upper Bound of the Response Rate (%)
75
70
65
60
55
50
45
40
35
30
25
20
15
10
18-24
25-34
35-44
45-54
55-54
65-74
75-84
Age group
Male
Female

3.3 Discussion

In spring 1999, phase one of data collection, 2658 names were drawn, contact was attempted for 2397 names, from which there were 868 usable interviews. 2615 names were drawn in fall 1999, of which 2502 were attempted and there were 955 usable interviews. In total there were 376 names drawn for which no contact was ever attempted or removed from the sampling frame because the data collection phases were ended before all of the names could be contacted or financial constraints limited activites. These "not attempted" or " removed" were spread fairly equally between seasons (261 & 113) as well as over age, sex and geographic regions. As a result, the not attempted and removed people do not appear to be selective or represent a particular pocket of individuals. Hence, it is not expected that they would add to the bias. The net result is a smaller number of respondents than would have been expected had all of the names been contacted: the smaller number will affect precision of the estimates but should not affect bias.

The overall response rate lies between 42% and 52%, Of particular concern are the lowest rates observed for the male group from 18-24 years, the female group from 75-84 years and the Prince George region. For the young males, the low rate reflects both low resolved rates and high refusal rates: for the older females, it is largely a function of the higher refusal rate. Tests suggest that the rates are to be differential over geographic regions and age-sex groups and hence the bias may present in the same pattern.

The small numbers of respondents in some of the geographic stratum-sex-age-season groups may result in some large sampling weights. Hence, some care will need to be taken when the weights are calculated, using weighting classes of groups with homogeneous response mechanisms. However, it is unlikely that any weighting scheme would be able to "adjust" and rectify the data for the magnitude of potential bias which is present due to the high non-response rate. Also, the paucity of responses in some areas will limit the level to which meaningful breakdowns can be made for results.

§4. Analysis of Factors Affecting Non-response

As mentioned above, to avoid pockets of large sampling weights, some pooling of groups with homogeneous response mechanisms may need to be developed. One step in this process is to examine in more detail the factors affecting the response outcome, identifying groups which may be suitable for pooling for the purpose of calculating weights.

4.1 Logistic Model

To examine the factors affecting response/Non-response outcome, a logistic regression is used to model the log of the relative odds of responding. For any season-region-age-sex cell {hij} in the survey, there is a probability, θ_{hij}, of responding. The logistic regression model relates the probability of responding to t explanatory variables through the relation:

$$\log\left[\frac{\theta_{hij}}{1-\theta_{hij}}\right] = \alpha + \sum_{k=1}^{t} \beta_k \, x_{hijk} \text{.....(5)}$$

where α is the intercept parameter, $\{\beta_k\}$ are the t regression parameters representing the main effects and interactions, and $\{x_{hijk}\}$ are the t explanatory variables for the hijth cell.

The parameters for logistic regression models are most commonly estimated by the method of maximum likelihood. These can be obtained by iterative numerical procedures such as iteratively weighted least squares. Inference and hypothesis testing regarding the significance of various factors are usually based on the approximate normality of the parameter estimates. Goodness of fit (or lack of fit) of the model is determined using the analysis of deviance technique, which uses the log-likelihood ratio statistics to examine the significance of the difference between models in a hierarchical scheme. (For details on logistic models, see standard texts such as; Hosmer and Lemeshow, 1989; Everitt, 1977; and Cox, 1970.)

In the discussion below, the term "significant interaction" is used when discussing the results of the logistic regression. When examining two factors, such as age and sex, it may be that the effect of age on the result was different in males, than in females. For example, it may be that with increasing age in males there is an effect in one direction but in females, the effect is in the opposite direction. As a result, the effect of one factor is not consistent over the levels of the other factors, so that the results need to be considered within the combination of the factors to correctly understand the effects on the results.

A logistic model also allows testing the estimated coefficients, and linear combinations of these coefficients to identify those groups with significantly different models of predicted probability of response. Identifying these patterns will be important when forming weighting classes, and pooling the cells to form sample weights.

4.2. Results

Probability of Resolved:

In a model containing geographic stratum, age group, sex, season and their interactions, significant interactions were observed between sex and age group as is expected from Fig 3.1 where we see the resolved rate graphs crossing. In the reduced model without significant lack of fit, the geographic region was a significant main effect. Looking at particular results, the probability of being resolved was significantly different between the Metro and Non-Metro, and between Coastal and Non-Metro strata. Within each season, geographic strata and gender, no consistent pattern of significant differences in probability of being resolved was observed between adjacent age group although significant differences ($p<0.05$) were observed for females in isolated cases.

Probability of Refusal:

In a model containing geographic strata, age group, sex, season and their interactions, significant interactions were observed between geographic stratum and age group, and between geographic stratum and gender. In other words, the effects of the age group and gender on the probability of being refused were different in the various the geographic strata. Season was a significant main effect in the reduced model without significant lack of fit. Overall, probability of refusing was significantly different between Metro and Non-metro strata and between seasons. Within each season, geographic stratum and gender group, no consistent patterns of significant differences between adjacent age groups were observed with isolated exceptions in malesn of the male age groups 18-24 and 25-34.

Probability of Response:

In a model containing geographic strata, age group, sex, season and their interactions, a significant interaction was observed between geographic strata and age group and between gender and age group. In other words, the probability of response within each age group varied differently by geographic strata and gender. In the reduced model without significant lack, season and sex were significant main effects. Within each season, geographic stratum and gender group, no consistent pattern of significant contrasts ($p<0.05$) was observed between adjacent age groups even though they were found in some geographic stratum-season-gender groups.

4.3 Discussion

Given the overall low response rate in the BCNS, several geographic stratum-season-age-sex groups have few, if any, individuals. Thus, some pooling may be necessary in order to stabilize the sampling weights. As discussed above, it was determined that several factors influenced the response outcome (indicated through the response rates, refusal rates and resolved rates). These factors included geographic region, age-groups, season, sex and interactions between these factors.

The probability of refusing and responding were significantly different between seasons. The probability of refusing or being resolved varied significantly between geographic regions. Furthermore, the probability of refusing or responding within geographic regions varied by age and gender. The probability of being resolved or responding were varied significantly different between genders. These results indicate that season, geographic strata and sex have fairly heterogenous response mechanisms which, if combined, may contribute to bias.

Within each geographic strata-sex-season group probability of being resolved, refusing or responding there were some significant differences between several adjacent age groups but no consistent patterns of those differences were found across the geographic-sex-season group. Some repeated exceptions to this occured for refusal and response rates in adjacent male age groups 18-24 and 25-34: this suggests that there may be some underlying heterogeneity of response mechansim which may contribute to bias. This is balanced by the small likelihood that consistent bias is being added to the analysis over the whole study, and (2) by the by the gain in stability of the sample

weights through pooling.

5. Analysis of Extra Questions

5.1 Background

As discussed in section 1, bias from non-response is substantial when (1) the probability of non-response is high or (2) if there is a large difference between respondents and nonrespondents with respect to a particular variable of interest. With respect to the first component, the overall response rate for BCNS was estimated lying between 42% to 52%. The next step of the analysis is to examine the second component: how respondents and nonrespondents differ in terms of characteristics related to nutrition. If the respondents and nonrespondents are very similar with respect to their nutritional variables, then the impact of the non-response will be very small. In an attempt to quantify potential differences between the two groups, a few short "extra questions" related to smoking and bread, milk and supplement consumption, education, marital status were asked of respondents and those who refused to participate in the BCNS. Their responses to these extra questions were compared and are discussed below.

5.2 Results

Of the 1373 people who were categorized as refusing to participate in the BC Nutrition Survey, 878 (approximately 66%) answered the 'non-response' question. In the tables below, the number of indiviudals providing answers can appear confusing. There were a number of question specific refusals so that for each of the extra questions, the number of individuals in the estimates will appear to range: in the refuser group the number of responses to the extra questions ranges from 861 to 876; in the responding group, between 15 and 17 individuals did not provide answers to these questions so the number of responses in this group ranges between 1806 - 1808.

5.2.1 Cigarette Smoking

Three specific questions pertaining to cigarette smoking habits were asked of the non-respondents in sequence. The questioning was streamlined in that it stopped at the first 'No' or 'Refusal'. The questions are asked as follows:

Have you ever smoked 100 or more cigarettes in your life?
Do usually smoke cigarettes every day?
How many cigarettes do you smoke a day?

The same questions were asked of respondents in the Demographic Questionnaire. Refusers' responses are compared to those for respondents in Tables 5.1 and 5.2.

Multiple logistic regression models were used to determine whether daily smoking significantly affected the probability of responding taking into account age and sex. Models without

significant lack of fit were obtained using the backward elimination of predictors method. No significant interaction terms between daily smokers and age or sex were found, but a significant main effect of daily smokers was observed in the reduced models. In other words, over all probability of response status was significantly different between daily smoker and non-daily smokers and the pattern of this effect did not vary over age-sex groups. Overall 18% of responders and 23% of refusers reported smoking daily. (refer table 5.1).

Among daily smokers, the amount of cigarettes smoked per day by responders and refusers was compared using a standard "t-test". Normal plots for the number of cigarettes smoked per day in both of the responding and the refusing populations indicated that the distributions of these populations were roughly normal. The average number cigarettes smoked per day among responders and refusers were 15.4 and 15.9 cigarettes, respectively which was not significantly different.

These results suggest that over all, the two populations (responders and refusers answering the extra questions) appeared to differ in regard to current daily smoking prevalence however, among daily smokers, the number of cigarettes smoked per day did not differ between the two populations.

Table 5.1
Proportion of Daily Smokers
Responders vs. Refusers

	RESPONSE CATEGORY			
	Responder		Refuser	
	DAILY SMOKERS		DAILY SMOKERS	
	Percent	N	Percent	N
ALL	16.7	1806	23.4	863
SEX				
Male	16.7	860	24.8	427
Female	16.7	946	22.0	436
AGE SEX GROUP				
M 18-24 yrs	20.0	85	25.5	47
M 25-34 yrs	29.7	101	25.4	59
M 35-44 yrs	21.2	104	26.7	60
M 45-54 yrs	17.0	88	33.9	59
M 55-64 yrs	19.1	94	28.9	45
M 65-74 yrs	14.1	192	22.1	77
M 75-84 yrs	7.7	196	16.3	80
F 18-24 yrs	21.0	100	22.5	40
F 25-34 yrs	25.4	126	32.6	46
F 35-44 yrs	25.2	131	27.7	47
F 45-54 yrs	16.3	123	27.8	54
F 55-64 yrs	17.1	129	25.5	47
F 65-74 yrs	12.7	166	21.3	94
F 75-84 yrs	5.3	171	11.1	108

Note: ‘N’ is total number of individuals providing response to the smoking question.

Table 5.2

Average Number of Cigarette Smoked Per Day Among Daily Smokers
Responders vs. Refusers

Those Who Smoke Daily	Mean	Standard Error of Mean
Responders	15.4	0.52
Refusers	15.9	0.63

5.2.2 Bread Consumption

For bread consumption, both refusers and responders were asked as the following questions:

(1) During the past month did you eat bread?
(2) If yes, what type of bread did you usually eat?
(Note, only one type of bread could be selected per person.)

Responders and refusers answering these two questions were directly compared and the results are listed in table 5.3. More details by age and sex groups is found in Appendix Table A 5.1

Multiple logistic regression was used to model response status (responder or refuser) as a function of bread consumption and bread type while taking into account age and sex. Final models without significant lack of fit were obtained using backward elimination of predictors method.

In the BCNS, almost all of the responders and refusers (who answered the extra questions) reported consuming bread, 98.9 % of responders and 98.5 % of refusers. No significant difference was observed in the proportion of responders and refusers who reported consuming bread (overall or within age and sex groups).

To test bread type, pumpernickel and other breads were grouped together, and those not knowing their bread type (1 responder and 8 refusers) were not included in the analysis. No significant differences in the proportion of responders and refusers who reported consuming a specific bread type were observed. In separate analysis comparing white bread versus non white bread consumption, again there were no significant differences in the proportion of responders and refusers.

These results suggest that the two populations (once again, responders and refusers who answered the extra questions) did not differ in regards to their bread consumption or their reported bread preference.

Table 5.3

Bread Consumption for Responders and Refusers

	Proportion Bread Consumers by Bread Type	
	Responders (1790 Bread Consumers)	**Refusers (861 Bread Consumers)**
Whole Wheat	49.7	51.0
Multi grain	23.7	24.4
White bread	17.5	13.7
Rye, pumpernickel	4.8	4.6
Other	4.1	5.2
Don't know	0.1	0.8

Note: 1809 responders and 874 refusers provided answers to the bread and bread type questions.

5.2.3 Milk Consumption

Two extra questions asked of refusers pertained to their milk consumption. The questions were as follows:

(1) During the past month, did you use milk?
(2) If yes, what type of milk did you usually use?
(Note: only one type of milk could be selected per person.)

The same information was collected from responders in the Demographic Questionnaire. Responders and refusers answering these two questions were directly compared and their responses are outlined in table 5.4.

Multiple logistic regression was used to model response status (responder vs. refuser) as a function of milk consumption and type of milk consumed (whole, 2%, 1%, skim, condensed or other types of milk) accounting for age and sex.. Final models without significant lack of fit were obtained using backward elimination of predictors method.

Consider the results for the proportion drinking milk. Overall, 94.6% of responders and 89.4% of refusers reported drinking milk. (See Table 5.4) From the logistic regression, the probability of responding was significantly effected by milk drinking status, but this effect varied both over sex and over age group. In separate analyses by sex responders reported being milk drinkers significantly more often than refusers, however the difference was greater for females (96% responders, 90% refusers) than for males (93% responders, 89% refusers). Looking at the age groups, the responders reported

milk consumption more often than the refusers for those 45 years and older. (This same pattern was evident for 18-24 year olds but was not statistically significant)

Considering the type of milk consumed, the analysis considered skim milk and powdered skim milk as one group, evaporated and other milk as one group, and did not include those who did not know the type of milk (1 responder, 2 refusers). The probability of responding was significantly affected by type of milk and this was found to be consistent over age and sex groups. Further analysis indicates that this is primarily the result of differences in the reporting of evaporated & other types of milk. A Cochran- Mantel- Haenszel statistic based on table scores indicates slight trend for responders report lower fat milk than refusers. Table 5.5 provides percentages for each milk type overall. (More detailed breakdown of responses in Appendix A5)

Table 5.4
Proportion Milk Consumers

	RESPONSE CATEGORY			
	Responder		Refuser	
	N	DRK MILK Percent	N	DRK MILK Percent
ALL	1809	94.6	876	89.4
SEX				
Male	860	92.7	432	88.9
Female	949	96.3	444	89.9
AGE GROUP				
18-24 yrs	185	94.6	87	89.7
25-34 yrs	227	93.0	109	94.5
35-44 yrs	235	93.2	107	95.3
45-54 yrs	211	95.3	114	87.7
55-64 yrs	224	93.8	93	84.9
65-74 yrs	358	95.8	174	86.8
75-84 yrs	369	95.4	192	88.5

Table 5.5
Type of Milk Consumed

Milk Type	Proportion Milk Consumers by Milk Type	
	Responders (1711 Milk Consumers)	**Refusers (783 Milk Consumers)**
	Proportion (%)	**Proportion (%)**
Whole milk	10.5	13.2
2 %	43.0	44.4
1%	24.3	23.8
Skim milk	16.2	14.2
Powdered skim	0.8	1.2
Evaporated milk	1.2	0.6
Other	4.0	2.3
Don't know	<0.1	0.3

5.2.4 Use of Vitamin-Mineral Supplements

Refusers who agreed to complete this question were asked the following:

"During the past month, did you take any vitamin-mineral supplements?"

The same information was collected from responders in the Demographic Questionnaire. Responders and refusers answering this extra question were directly compared using multiple logistic regression which modelled response status (responder vs. refuser) as a function of supplement use taking into account age and sex. Their responses to these questions are outlined in Table 5.6.

Overall, 66% of responders and 60% of refusers reported vitamin supplement use. The reduced logistic model without a significant lack of fit indicated that the significant main effect of vitamin-mineral consumption was observed and this effect was consistent over age and sex Responders were more likely to report consuming supplements in the past month than refusers who answered the extra questions.

Table 5.5

Vitamin and Mineral usage Among Responders vs. Refusers

	RESPONSE CATEGORY			
	Responder		Refuser	
	N	SUPP USE Percent	N	SUPP USE Percent
ALL	1809	66.2	874	59.8
SEX				
Male	860	60.2	431	53.1
Female	949	71.7	443	66.4
AGE GROUP				
18-24 yrs	185	55.1	87	49.4
25-34 yrs	227	58.1	109	48.6
35-44 yrs	235	59.6	107	59.8
45-54 yrs	211	64.9	113	47.8
55-64 yrs	224	67.9	94	72.3
65-74 yrs	358	72.3	172	64.5
75-84 yrs	369	74.8	192	67.7

5.2.5 Education

Both refusers and responders were asked to provide the highest level of education. This was categorized by the interviewer into one of 10 categories, ranging from no school to bachelors degree or above. Miss classification of educational attainment can make the comparisons difficult: the comparison of Bachelor's degree or above versus all other categories was used as one of the "cleanest" to study. Table 5.6 below provides the summary results for education.

Overall, 14% of responders and 9% of refusers reported bachelor degree or above. Multiple logistic regression was used to model response status (responder vs. refuser) as a function of education accounting for age and sex. This analysis found that education was a significant factor in the model of the probability of responding. There were no interactions between education and sex or age.

Table 5.6
Bachelor Degree and Above
Responders vs Refusers

	RESPONSE CATEGORY			
	Responder		Refuser	
	N	BACH+ DEGREE Percent	N	BACH+ DEGREE Percent
ALL	1808	14.4	861	9.2
SEX				
Male	860	16.2	423	11.8
Female	948	12.9	438	6.6
AGE GROUP				
18-24 yrs	185	8.1	87	3.4
25-34 yrs	227	19.8	109	22.9
35-44 yrs	235	19.6	105	12.4
45-54 yrs	211	19.4	113	9.7
55-64 yrs	224	11.6	92	7.6
65-74 yrs	358	12.8	169	4.1
75-84 yrs	368	11.4	186	7.0

5.2.6 Marital Status

Both refusers and responders were asked to provide the marital status: married or living common law; divorced; separated; widowed; never married.

Multiple logistic regression was used to model response status (responder vs. refuser) as a function of marital status accounting for age and sex. This analysis found that after accounting for age and sex, there was no significant of marital status in the model. Table 5.7 below provides the summary comparison for marital status between the two groups.

Table 5.6
Marital Status
Responders vs Refusers

	RESPONSE CATEGORY											
	Responder						Refuser					
	N	SINGLE Percent	MARRIED Percent	WIDOWED Percent	DIVORCED Percent	SEPARATED Percent	N	SINGLE Percent	MARRIED Percent	WIDOWED Percent	DIVORCED Percent	SEPARATED Percent
ALL	1806	15.1	65.2	10.2	6.4	3.2	861	16.5	64.1	11.7	5.1	2.6
SEX												
Male	858	16.9	70.0	5.6	4.1	3.4	422	19.2	69.2	4.5	4.7	2.4
Female	948	13.5	60.8	14.3	8.4	3.0	439	13.9	59.2	18.7	5.5	2.7
AGE GROUP												
18-24 yrs	185	78.9	19.5	0.0	0.5	1.1	87	75.9	21.8	0.0	0.0	2.3
25-34 yrs	225	32.9	59.6	0.0	2.7	4.9	109	33.9	59.6	0.9	3.7	1.8
35-44 yrs	235	12.3	73.6	0.4	7.7	6.0	104	11.5	78.8	1.0	5.8	2.9
45-54 yrs	209	2.4	82.3	1.4	10.0	3.8	112	11.6	69.6	2.7	9.8	6.3
55-64 yrs	224	3.1	76.3	5.8	12.1	2.7	93	4.3	80.6	6.5	6.5	2.2
65-74 yrs	359	2.2	75.5	13.6	5.6	3.1	169	3.6	74.0	14.2	6.5	1.8
75-84 yrs	369	1.1	59.6	32.0	6.0	1.4	187	2.1	57.8	35.3	3.2	1.6

5.3 Discussion

Of the total refusers in the BCNS, about 66% were willing to answer questions on smoking, bread, milk, and vitamin/mineral consumption, education and marital status. Of the 1320 refusers, 117 (9%) were never approached to answer the A2 because they refused by virtue either of cancelling and not being willing to rebook, or by not showing up to the interview and never agreeing to another time. Of the 1195 refusers asked to complete the A2, 878 (73%) did agree. (Additional analysis found slightly higher rates of this further refusals in males, in the 75-84 year group, and in strata 1.) This is a relatively good response rate however, it is possible that the further refusers are not represented by the results below.

Summarizing the results above we find significantly fewer smokers, more vitamin supplement users, more bachelor or higher degrees in the responding group, and these findings are consistent over age and sex groups. Responders reported higher proportion of milk consumers for both sexes, and for those 45 years and over (same pattern in 18-24 years but not significant). There was little effect of type of milk consumed, but a slight trend to lower fat milk in responders. There were no effects from marital status or bread consumption (neither proportion consuming nor bread choices).

While these results reflect statistical significance, the results need to be reviewed for practical and nutritional significance. The general direction of the differences found suggest that nutritional results may be biased towards recommendations where substantial bias is present. (See Section 8 for further discussion)

§6. Sampling Weights

6.1 Methodology

To ensure that estimates reflect population parameters correctly, sample weights are used during analysis of survey data. Sample weights account for probabilities of selection, non-response rates, and any over/under representation in the sampling frame. Statistics Canada provided information on sampling design and general instructions on sampling weights in *British Columbia Nutrition Survey - Sample design specifications, by France Bilocq, March 1999* and *British Columbia Nutrition Survey - Computing Estimation Weights, by Francois Laflamme, November 2000* (refer to Appendix B1 and B2 respectively.)

The basic weighting calculation from Appendix B is discussed in the below paragraphs. Weights for the first recall and the questionnaire forms will be developed, so the notation referring to the repeat recalls will not be included here to help simplify the formulas. Minor modifications were made to this document in order to make the weight calculations in the BCNS reflecting the different number of respondents in each season. While the 1996 post census was used to calculate the first stage selection factors, the 1999 post census for BC was used to estimate the weights to adjust for coverage problems (over/under representation of the frame).

s:	season	s=1,2
h:	stratum	h= 1 (Metro), 2 (Coaster), 3 (Non-Metro)
a:	Geographic groups within the 3 strata	a=1, 2, ..., 11.
i:	age/gender sampling group	i=1, 2, ...,7 for males i=8, 9, ..., 14 for females

M_{ha} : Number of individuals in strata "h" and geographic group "a" 1996 census

M_h: Total number of individual in BC in strata "h" 1996 census

m_h: Number of geographic group sampled in strata "h"

α_a: First stage selection factor

* for strata selected with certainty, h=1,2

$\alpha_a = 1$ ..... a=1,2, ...7

* for strata selected with probability proportional to population size, h=3

$$\alpha_a = \frac{M_h}{M_{ha} \times m_h} \quad \ldots\ldots a = 8,\ldots,11$$

N_{hai}: Number of individuals on the British Columbia Health Register (BCHR) at time of population selection in stratum *h*, geographic group *a*, age/gender group i

n_{shai}: Number of respondents in season *s,* stratum *h*, area *a*, age/gender group i

$\hat{P}_i$: Estimated size for age/gender group i.

P_i: Post census estimate of the total number individuals in age/gender group i in BC 1999 provided by Statistics Canada

(The values for stratum sizes, area sizes, α_a, and P_i can be found in Appendix B)

In general, the weights are constructed by estimating first what can be referred to as an unadjusted weight, which incorporates the first stage selection factor and the second stage weights for the respondents:

$$w^*_{shai} = \alpha_a \times \frac{N_{hai}}{n_{shai}} \qquad \ldots\ldots (6)$$

Using post stratification to adjust with independently known totals can help reduce the bias. Hence, a second step requires that we estimate from the survey data, the total number of individuals in the age/gender group i, say $\hat{P}_i$, and the adjust with the actual known population totals P_i. It can be shown that:

$$\hat{P}_i = \sum_a n_{hai}\ w^*_{shai} = \sum_a \alpha_a N_{hai} \quad .....(7)$$

The final post stratified weights are:

$$w^{post}_{shai} = w^*_{shai} \times \frac{P_i}{\hat{P}_i} \quad .....(8)$$

In this document, the post stratified weight will be referred to simply as the "weight", and denoted by W_{shai}.

Some issues become apparent with respect to the weights. Calculating the weights assumes in (6) that $n_{shai}>0$ for all *s*, *h, a* and *i*. From Appendix A.2, it is seen that there are many regions and age/gender groups having only one, two or no respondents at all . When numbers of respondents are small (that is n_{shai} is small in (6)), the weights can become very large, which in turn can cause a number of problems. First, it means that a few individuals will be very influential in the analysis: in light of the nonresponse rates, this may result in further distortion of the results by emphasis on a few nonrepresentative respondents. Second, large weights will add to the variability of the estimators.

As a result, we need to pool to try and keep (6) defined, and minimize the component of the variance coming from the weights. We would also like to try to minimize the bias in the estimates through construction of the weights.

There are competing issues at play in defining the pooling, or the adjustment classes. We wish to keep the groups which are going to be pooled (for the purpose of calculating weights*)*, as homogeneous as possible with respect to their probabilities of response: this encourages many small adjustment classes. However, this can lead to large variances if the number of respondents is still so small that it leads to weights that are highly variable (one of the reasons we want to pool in the first place). It has been suggested that there should be at least 20 respondents in an adjustment class (Madow et.al. ,1983, page 45).

Another consideration when considering adjustment classes is how similar, or homogeneous, with respect to the variables of interest (Oh & Scheuren (1983) pg 155). If groups are pooled for the purpose of calculating weights where the means (or other estimates) are similar, then any differences in response probabilities that there may be, will have a smaller effect on bias (and yield a smaller mean square error).

With these issues in mind, the BCNS were examined to determine what might be sensible groups to pool. Looking at the design variables, the decision is restricted to discovering which age/gender/region groups can be pooled and still observe the above criteria. The point was to find groups with similar response probabilities.

6.2 Results

Using logistic models with the explanatory factors of season, age, sex and regions to look at the significant differences in probability of response, refused or resolved between the adjacent age

groups within each season, geographic stratum and gender, it appeared that the model coefficients in adjacent age groups were sporadic and did not exhibit a consistent pattern of significant differences (refers to sections 4.2 and 4.3) . Thus, it was felt that pooling of adjacent age groups within a geographic region, season and gender would not lead to consistent bias in the estimates.

Even after pooling by adjacent age groups within a season, geographic region and sex, there were several large sample weights (>4) which are listed on table 6.1. Further collapsing of the groups was considered inappropriate so trimming was employed to reduce the size of these weights. This was accomplished by setting the large sample weights to <= 4 and adjusting the remaining weights within a season and pooled age/sex group by a common factor so that the sum of the weights remained the same. Since setting the largest sample weights to 3.6 would avoid a result of the males 18 to 39 in season 1, Coaster stratum being adjusted to a weight greater than 4, this number was thus used to adjust all weights to a value less than or equal to 3.6.

Table 6.1

LARGE SAMPLE WEIGHTS

Season	Strata	Geographic group	Age-sex group	Sample weight >4
1	Metro	Vancouver	Male 35-54	6.7332
2	Coastal	Vancouver	Male 35-54	4.3092
1	Metro	Vancouver	Female 18-34	5.9919
1	Metro	Vancouver	Female 35-54	4.9551
2	Coastal	Vancouver	Female 35-54	5.4506

§7. Comparison of Responders to Population Profiles

In section 1, it was noted that bias will be large if (1) the probability of non-response is high, or if (2) there is a large difference between the responders and nonresponders with respect to the variable of interest. Section 4 looked at the first of these component, the probability of non-response. Section 6 developed sampling weights to ensure that the responders contribute to estimates proportionally to their representation in the population (i.e., proportionally with respect to age, sex, geographic region and season). Note that weighting does not remove bias from the results.

To address the second factors, differences between the responders and refusers, ideally one would like to sample some non-responders and obtain interviews. Another option to help assess comparability, is to ask refusers at the time of recruitment some information linked to nutrition as was done in the survey and discussed in section 5 (i.e. analysis of extra questions on smoking status, milk, bread and vitamin/mineral consumption, education, marital status). This extra information was used to compare responders and refusers who would participate in the 'non-response' questions to try and get some idea of potential magnitude and direction of bias.

A third option is to look at aspects of responders which are linked to nutrition/food, and see if the responders match the general population with respect to these characteristics. Discrepancies can indicate direction and magnitude of potential bias. However, the absence of differences does not guarantee absence of bias.

In the survey, we are limited to those questions, for which population profiles are reliably available, and which have a link to nutritional status. The literature discusses many variables and factors which may be considered, but given the above constraints, analysis will focus on smoking, educational status and marital status.

Ideally, when comparing to the general population of British Columbia, data from the Census are most useful. The 1996 Census collected detailed information on education and marital status which can be directly compared to the BCNS. Unfortunately, the Census did not collect information on smoking. For comparative purposes, the 1999 Canadian Tobacco Use Monitoring Survey can be used to look at smoking prevalence in BC.

In the analysis which follows, all survey estimates are weighted by sample weights to ensure that responders contribute to estimates proportionally (with respect to age, sex) to their representation in the general population.

7.1 Smoking Status

The Canadian Tobacco Use Monitoring Survey (CTUMS) is a national survey sponsored by Health Canada, conducted by Statistics Canada to track changes in smoking status. It focuses on young adults by oversampling 15-24 year olds, though all ages15 years and up are sampled. Recruitment is carried out over the telephone, and a computer assisted interview conducted. In the Feb - Sept 1999 collection, the overall response rate was 82%. (For more information about CTUMS see http://www.hc-sc.gc.ca/hppb/tobacoo/ctums/survey.html).
In CTUMS looking only at the BC component, there were 1722 respondents ages 18 to 84, with over 40% of these respondents in the 18-24 year range. The sample allocation will limit the degree of age-specific comparisons that will be possible since there are some small sample sizes in the older groups (58 individuals 75-84 for example).

7.1.1 Results

The weighted proportions in each survey are presented in Table 7.1.[1]

Table 7.1
Population Daily Smoking Rates
Comparison of CTUMS 1999 and BCNS

Group	BC Nutrition Survey Responders		CTUMS 1999 - BC	
	Wted Proportion	N	Wted Proportion	N
All	16.9	1806	17.3	1722
Males	17.3	860	17.9	790
Females	16.5	946	16.8	932
M 18-24	17.8	85	23.9	350
M 25-44	18.7	205	20.6	213
M 45- 84	15.9	570	13.7	227
F 18-24	11.8	100	16.2	351
F 25-44	19.5	257	21.9	284
F 45-84	15.7	589	12.1	297

With these sample sizes there were no significant differences in proportion of daily smokers in the two surveys.

7.2 Marital Status

Proportions of individuals in various marital status categories from the 1996 Census were directly compared to weighted proportions for the same categories in the BCNS and tested using a chi-square test. The results are described in Tables 7.2.

In males, there were significantly higher proportion of married and single in the BCNS compared to the Census and fewer widowed, however this pattern was not consistent over all ages. Between 25-44 the key difference was in higher proportion of single men and lower proportion separated/divorced. In men 45- 84 more married and fewer widowed status dominate.

In females, a higher proportion of married women and lower proportion of single women are

[1] The BC specific CTUMS results have been generously provided through personal communication from M. de Groh, Health Canada, Jan 2002.

found from 18-54 years. In older ages, there is a lower proportion of married women than expected and higher proipotion of widows.

Table 7.2
Comparison of Proportions - Marital Status
1999 BCNS vs. 1996 Census

Age group	Males			Females		
	1996 Census Proportion	1999 BCNS		1996 Census Proportion	1999 BCNS	
		Proportion	Sample size		Proportion	Sample Size
18-24 years			85			100
Married	0.12	0.13		0.05	0.22	
Single	0.86	0.87		0.94	0.75	
Separated/divorced	0.02	0.00		0.01	0.03	
Widowed	0.00	0.00		0.00	0.00	
25-34 years			99			126
Married	0.51	0.52		0.43	0.57	
Single	0.38	0.45		0.51	0.33	
Separated/divorced	0.11	0.03		0.06	0.09	
Widowed	0.00	0.00		0.00	0.00	
35-44 years			104			131
Married	0.67	0.70		0.64	0.74	
Single	0.14	0.21		0.21	0.11	
Separated/divorced	0.18	0.09		0.14	0.15	
Widowed	0.01	0.00		0.00	0.00	
45-54 years			87			122
Married	0.68	0.87		0.73	0.78	
Single	0.07	0.03		0.09	0.01	
Separated/divorced	0.21	0.10		0.17	0.17	
Widowed	0.03	0.01		0.01	0.05	
55-64 years			94			130
Married	0.70	0.79		0.78	0.59	
Single	0.03	0.07		0.06	0.03	
Separated/divorced	0.16	0.13		0.13	0.23	
Widowed	0.11	0.01		0.03	0.15	
65-74 years			193			166
Married	0.58	0.87		0.79	0.60	
Single	0.03	0.02		0.05	0.01	
Separated/divorced	0.10	0.07		0.09	0.07	
Widowed	0.28	0.04		0.07	0.31	
75-84 years			196			173
Married	0.33	0.72		0.72	0.56	
Single	0.04	0.02		0.04	0.02	
Separated/divorced	0.06	0.06		0.06	0.04	
Widowed	0.57	0.20		0.18	0.38	
All ages			858			948
Married	0.55	0.64		0.58	0.60	
Single	0.23	0.28		0.30	0.20	
Separated/divorced	0.13	0.07		0.10	0.12	
Widowed	0.09	0.02		0.02	0.09	

7.3 Education

For each education category (secondary school; trade school or community college; some university education; and completed a bachelors degree) proportions were calculated for the Census and directly compared to weighted proportions for the same categories in BCNS and tested with chi-square tests. The results are described in Table 7.3.

The results indicate that overall, and among males and females, significant differences exist between the educational levels of respondents in the BCNS and the Census. The BCNS had a significantly lower proportion of respondents with some secondary and some trade/college education (refer to Table 7.3) and higher proportion of respondents with at least some university education. This was consistent across the age-sex groups. They all have a significantly lower proportion of respondents with secondary or some trade/college and higher proportion of respondents with at least some university education. Of particularly concern are substantial differences in the proportions of respondents with secondary and some university education (refer to table 7.3).

Looking at individuals who had completed a university degree with a bachelor degree or higher, overall, there was a significantly higher proportion of male respondents in the BCNS than expected from the Census but no statistically significant difference was observed among females (though the pattern of higher proportion was similar). These patterns were consistent across all male age groups though statistical significance was not achieved for all. For younger female age groups, there is also the trend of higher proportion with bachelor's degree or above, but statistically significance was observed for only the youngest age group 18-24.

These results lead to suggest that there is a trend towards higher education for the respondents in the BCNS compared to the Census.

Table 7.3
Comparison of Proportions - Education Level
1996 BCNS vs. 1996 Census

Age group	Males			Females		
	1996 Census Proportion	1999 BCNS Proportion	Sample Size	1996 Census	1999 BCNS	Sample Size
18-24 years			85			100
Secondary School	0.73	0.26		0.80	0.35	
Trade or College	0.17	0.17		0.13	0.14	
Some University	0.02	0.46		0.02	0.38	
Completed University	0.08	0.11		0.05	0.13	
25-34 years			101			126
Secondary School	0.44	0.27		0.47	0.25	
Trade or College	0.33	0.17		0.32	0.23	
Some University	0.03	0.27		0.02	0.27	
Completed University	0.20	0.29		0.19	0.25	
35-44 years			104			131
Secondary School	0.48	0.26		0.43	0.26	
Trade or College	0.33	0.30		0.36	0.20	
Some University	0.03	0.19		0.02	0.30	
Completed University	0.16	0.25		0.18	0.24	
45-54 years			88			123
Secondary School	0.49	0.27		0.41	0.31	
Trade or College	0.30	0.21		0.35	0.22	
Some University	0.04	0.29		0.03	0.29	
Completed University	0.16	0.24		0.21	0.18	
55-64 years			94			130
Secondary School	0.63	0.56		0.51	0.32	
Trade or College	0.25	0.16		0.32	0.22	
Some University	0.04	0.17		0.02	0.31	
Completed University	0.09	0.11		0.16	0.14	
65-74 years			192			166
Secondary School	0.73	0.48		0.61	0.53	
Trade or College	0.19	0.21		0.25	0.20	
Some University	0.03	0.14		0.03	0.17	
Completed University	0.05	0.17		0.11	0.10	
75-84 years			196			172
Secondary School	0.78	0.50		0.68	0.53	
Trade or College	0.15	0.17		0.20	0.13	
Some University	0.03	0.15		0.02	0.20	
Completed University	0.05	0.17		0.09	0.13	
All ages			860			948
Secondary School	0.57	0.33		0.52	0.34	
Trade or College	0.27	0.21		0.30	0.20	
Some University	0.03	0.26		0.02	0.28	
Completed University	0.13	0.21		0.16	0.18	

Please note: Completed University=respondents with “at least” a Bachelor’s Degree

7.4. Discussion

There is a growing body of literature which links smoking behaviour and trends in nutrient and food intakes (Subar et al. 1990, Larkin et al., 1990, Morabia and Wyder 1990, McPhillips et al, 1994). In general, it is reported that daily smokers tend to have intakes of food and nutrients in the direction away from recommendations relative to nonsmokers. As a result, smoking prevalence can be a key indicator of bias in the nutritional data from the responders. The complex correlation of epidemilogical variables such as education, smoking, age, supplement use with food intake intake, suggests these as useful indicator variables (Berger and Wynder (1994)). [2]

While there was a slightly lower proportion of smokers in the BCNS than in CTUMS, none of the differences reached statistical significance. In section 5, it was noted that there were significantly fewer smokers in the responding population than in the refusing group: the impact of this pattern is likely reflected in the statistically nonsignificant but consistent pattern of slightly lower proportion of smokers in BCNS than CTUMS. This suggests that any related bias in the nutritional results likely will be small and hard to detect.

The over-representation of university education consistently in all ages and both sexes may introduce significant bias in the results of attitude, behaviour and awareness questions, particularly if they are linked to literacy. It has been reported that groups with a higher educational attainment will have lower smoking rates, lower alcohol and meat consumption but higher fruit, vegetable and supplement consumption (Berger and Wynder (1994)). In regards to educational levels, smoking patterns and supplement usage, the BCNS seemed to follow this general trend. While it was not possible to compare supplement consumption in the BCNS to the BC population, we have found that responders were more likely to report consuming supplements in the past month than refusers who filled out the 'non-response' questions (refer to section 5.4).

The distribution of marital status in the BCNS was generally not comparable to the Census. However, the nutritional significance of this departure is not clear: there is little literature in this area and study of this factor is part of the active investigation at HC noted above.

§8. Summary Discussion

The overall response rate of the BCNS lies between 42% - 52%. The lower bound rate varied from 29% for males 25-34 years to 54% for females 55-64 years. The upper bound rate varied from 44% for males 25-34 years to 60 % for females 55-64 years. Generally, lower response rates were observed among younger and oldest people, specially in the male age group 25-34 (29%), and the Prince George region (31%). Compare to other Federal-Provincial nutrition surveys in which 46% - 85% of located and eligible respondents [2], the BCNS rates are quite comparable. However, the representativeness of the younger and oldest people, and specific geographic regions (for example Prince George (31%); Terrace (37%); Nanaimo (39%)) need to be considered carefully in light of this particularly high non-response.

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[2] Very early work in Health Canada examining the relationship of these variables with nutrient intake using earlier Federal Provincial surveys seems to confirm the published literature that the indicators examined (plus the milk consumption variable) are significant factors related to intakes of many nutrients. Personal communication B. Junkins Jan 2002.

Approximately 73% of refusers who were approached, (and 66% of all classed as refusals) completed extra questions, which allowed for comparisons among responders and refusers but does not provide a complete picture of the actual potential difference or bias.

Cigarette smoking was of particular interest because of the link between smoking and nutrition behaviour (ie., daily smokers tend to have food/nutrition intakes that differ from recommended nutrition levels [4]). The proportion of daily smokers was significantly different between responders and refusers who completed the extra questions. Among daily smokers, the average number of cigarettes smoked per day between responders and refusers were similar. Smoking information collected from the BCNS survey was also compared with smoking information CTUMS. While BCNS had slightly lower smoking rates, none reached statistical significance. This suggests that any related bias in the nutritional results likely will be small and hard to detect.

Bread, milk and vitamin-mineral consumption habits were examined via extra questions posed to respondents and refusers. There were no significantly differences in the proportion of responders and refusers relating to prevalence of bread consumption or type of bread consumed. A significantly larger proportion of responders were milk consumers and there was a slight trend to lower fat milks in responders. The proportion consuming vitamin - mineral supplements was also significantly higher in the responding population. These results suggest that prevalence of milk and vitamin consumption may be slightly high from the survey, and nutrients related to milk consumption may be biased towards lower fat intakes.

The distribution of marital status was significantly different between the BCNS and the population data but the nutritional significance of this departure is not clear. The proportion of university educated people in the survey was significantly higher than the Census (refer to section 7.3), especially among men and younger women. The education profile may bias nutritional results toward the recommendations, and may effect attitude, behaviour and awareness questions, particularly if they are linked to literacy.

All of the results that reach statistical significance should be assessed for nutritional and biological significance. When comparing to other surveys, or historical data, these characteristics of the responding population should be kept in mind.

There is no acceptable or unacceptable level of non-response: the actual percent deemed acceptable depends on the survey objectives. As noted by the National Research Council, National Academy of Science, even in a specific survey such a level would be difficult to specify. (Madow et al, 1983 pg5-6). In general, rates should be kept low, and as noted by the NRC, non-response must be planned for and dealt with, measured and reported.

There is no weighting scheme which will remove systematic non-response biases if they are present. When publishing or releasing data from the BCNS, it will be important to disclose fully to all users the various rates and instruct researchers to interpret the data keeping in mind the potential effects of non-response bias.

9. References

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Appendix A

Detailed Tables

§A1 Definition of Response Categories

The detailed entries on the questionnaires were considered for classification into one of the categories below. The Statistics Canada "Standards Guidelines" for each of the response categories was used as the basis for the classification.

1. Response
    a) Responds and usable record
    b) Responds and unuseable

2. Nonresponding Units
    a) Refusals
        ~ refused, no information
        ~ direct "NO"
        ~ indirect, "too busy", "I will call later", respondent later cancelled, respondent not show up, "not available"
    b) No Contact
        ~ verified location but not able to contact
    c) Residual
        ~ respondent drunk
        ~ not accessible during appointment time
        ~ language
        ~ interviewer had to cancel due to illness or weather
        ~ one of the interviewers drawn in the sample
        ~ sibling completed the interview
        ~ not safe for interviewer
        ~ ill, handicapped
        ~ third party refuse
    d) Incomplete/Unreliable/Unusable Recall

3. Out of Scope
    a) Nonexistent units ~ dead
    b) Temporarily out of scope
        ~ pregnant or nursing
        ~ hospitalized
        ~ seasonally nonresident (during interview period)
        ~ military base
    c) Permanently out of scope
        ~ Moved out of province
        ~ Institution or reserve
        ~ moved within province but not in any sampling areas
        ~ over 85 years old
        ~ disabled

4. Unresolved
    a) Moved within the province, within the sampling areas but not tracked down further
    b) Letter returned, no answer after 6 calls, cannot locate by phone or home visit
    c) Unresolved after less than 6 tries, insufficient time to continue follow up

5. Never attempted to contact ~ ran out of time
6. Removed from frame - special

A2.2: Fall 1999 - first and second reliable interviews by age, sex and geographic area.

Sampling Geographic Region	Age-Sex Group																										All	
	M 18-24		M 25-34		M 35-44		M 45-54		M 55-54		M 65-74		M 75-84		F 18-24		F 25-34		F 35-44		F 45-54		F 55-54		F 65-74		F 75-84			
	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat
Vancouver	14	4	9	3	9	1	7	1	9	2	18	7	15	6	5	2	9	5	8	1	14	3	11	4	14	4	15	3	157	46
Victoria	5	0	4	0	2	0	2	0	3	1	6	3	9	2	3	1	4	0	3	0	4	1	7	0	8	1	7	2	67	11
Nanaimo	1	0	3	1	3	1	1	0	5	3	5	1	4	1	2	0	1	0	5	1	2	1	2	0	4	1	3	0	41	10
Kamloops	1	0	1	0	4	1	3	1	1	0	6	3	6	2	2	1	4	0	5	1	4	0	2	1	1	0	4	2	44	12
Kelowna	1	0	1	0	4	0	3	1	.	.	8	1	7	2	2	0	3	1	2	0	7	2	6	2	6	1	3	1	53	11
Prince George	3	2	5	2	1	0	3	1	2	0	5	0	5	2	1	0	4	2	6	2	3	0	1	1	4	2	3	0	46	14
Coastal	10	1	4	0	3	1	10	3	8	3	19	4	25	8	14	4	14	5	13	3	14	3	14	3	16	4	21	9	185	51
Kootenay	2	1	7	1	3	2	3	1	4	0	9	2	12	1	2	1	5	1	5	2	4	1	4	0	6	3	7	3	73	19
Chilliwack	1	0	4	1	6	1	2	1	2	1	7	2	3	1	3	1	4	0	5	0	3	1	4	1	2	0	7	1	53	11
Vernon	2	2	6	1	5	1	5	3	4	1	9	4	8	2	5	0	12	4	4	2	5	2	8	2	5	0	8	2	86	26
Terrace	4	2	4	0	5	1	3	0	6	1	3	2	4	2	2	0	5	1	6	1	4	1	4	1	5	4	8	2	63	18
All Regions	44	12	48	9	45	9	42	12	44	12	95	29	98	29	41	10	65	19	62	13	64	15	63	15	71	20	86	25	868	229

A.2.1 Spring 1999 - first and second reliable interviews by age, sex and geographic area.

	Age-Sex Group																													
	M 18-24		M 25-34		M 35-44		M 45-54		M 55-54		M 65-74		M 75-84		F 18-24		F 25-34		F 35-44		F 45-54		F 55-54		F 65-74		F 75-84		All	
	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat	first	repeat
Sampling Geographic Region																														
Vancouver	12	3	10	1	17	4	8	3	10	2	14	3	13	4	16	3	9	1	12	3	8	2	9	6	18	4	9	2	165	41
Victoria	6	4	3	1	6	1	4	1	5	2	9	2	10	2	6	1	5	0	5	1	4	1	5	3	8	0	7	1	83	20
Nanaimo	2	1	4	0	3	0	2	0	2	0	4	2	6	2	2	0	4	0	2	0	3	1	5	2	7	1	8	2	54	11
Kamloops	2	0	5	2	4	1	5	1	2	1	8	2	3	1	3	1	2	0	4	0	5	2	5	2	10	1	5	1	63	15
Kelowna	1	0	4	1	4	1	5	1	3	1	8	1	5	2	3	1	5	1	5	2	3	1	2	0	6	1	6	0	60	13
Prince George	2	0	1	0	.	.	2	1	2	1	6	1	4	0	5	2	1	0	4	0	1	0	4	1	2	1	3	2	37	9
Coastal	10	3	14	4	10	4	9	1	13	5	24	8	27	7	11	4	22	10	19	6	22	5	12	6	21	5	23	8	237	76
Kootenay	2	1	4	0	2	1	3	1	2	0	5	2	4	2	2	0	2	1	5	1	2	1	4	2	5	0	5	2	47	14
Chilliwack	2	0	2	0	6	3	4	1	3	0	8	1	7	2	4	1	2	1	2	0	5	2	9	4	7	1	8	1	69	17
Vernon	2	0	3	1	5	2	3	2	8	0	6	2	12	3	6	1	4	2	5	1	6	1	7	2	10	0	8	3	85	20
Terrace	.	.	4	1	3	0	1	0	1	0	7	3	10	3	1	1	7	1	6	2	1	1	5	1	4	1	5	0	55	14
All Regions	41	12	54	11	60	17	46	12	51	12	99	27	101	28	59	15	63	17	69	16	60	17	67	29	98	15	87	22	955	250

A3.1: Accountability table by age and sex group

		sampling age-sex groups													
		M 18-24	M 25-34	M 35-44	M 45-54	M 55-54	M 65-74	M 75-84	F 18-24	F 25-34	F 35-44	F 45-54	F 55-54	F 65-74	F 75-84	Total
Number drawn	sum	352	429	354	293	273	429	505	358	442	349	284	261	430	514	5273
Attempted	sum	329	390	317	262	247	410	480	331	411	319	261	249	409	484	4899
Resolved	sum	236	276	229	211	200	372	440	245	294	253	229	223	360	441	4009
In scope	sum	186	232	211	192	185	345	373	183	222	227	216	215	324	377	3488
Interviewed	sum	85	102	105	89	95	194	201	100	128	131	124	130	169	173	1826
Reliable complete response	sum	85	99	103	88	93	190	196	100	126	130	123	130	165	170	1798
Reliable partial response	sum	0	3	2	0	2	4	3	0	2	1	1	0	4	3	25

A3.2: Accountability table by geographic area

		Sampling region											
		Vancouver	Victoria	Nanaimo	Kamloops	Kelowna	Prince George	Coastal	Kootenay	Chilliwack	Vernon	Terrace	Total
Number drawn	sum	897	469	269	295	327	303	1221	372	371	380	369	5273
Attempted	sum	851	413	268	289	260	293	1134	278	365	379	369	4899
resolved	sum	683	329	204	222	229	214	921	245	319	337	306	4009
in scope	sum	610	284	182	194	208	185	814	211	253	290	257	3488
Interviewed	sum	322	150	95	108	113	83	423	120	122	172	118	1826
Reliable complete response	sum	313	148	95	107	112	82	419	117	120	169	116	1798
Reliable partial response	sum	9	2	0	0	1	1	3	3	2	2	2	25

A4.1.1: Resolved rates by geographic area

	season					
	Spring 99		Fall 99		Both	
	Resolved Rate	n	Resolved Rate	n	Resolved Rate	n
Geographic region						
Vancouver	0.78	405	0.83	446	0.80	851
Victoria	0.80	194	0.79	219	0.80	413
Nanaimo	0.78	134	0.74	134	0.76	268
Kamloops	0.77	143	0.77	146	0.77	289
Kelowna	0.96	98	0.83	162	0.88	260
Prince George	0.75	147	0.71	146	0.73	293
Coastal	0.81	541	0.81	593	0.81	1134
Kootenay	0.90	171	0.85	107	0.88	278
Chilliwack	0.85	185	0.89	180	0.87	365
Vernon	0.88	191	0.89	188	0.89	379
Terrace	0.83	188	0.83	181	0.83	369
All regions	0.82	2397	0.82	2502	0.82	4899

Note: “n” reflects the number in the denominator for the equations in §3.1.2

A4.1.2: Resolved rates by age and sex group

	season					
	Spring 99		Fall 99		Both	
	Resolved Rate	n	Resolved Rate	n	Resolved Rate	n
Sampling Age Sex Group						
M 18-24	0.74	160	0.69	169	0.72	329
M 25-34	0.72	196	0.69	194	0.71	390
M 35-44	0.73	150	0.71	167	0.72	317
M 45-54	0.82	123	0.79	139	0.81	262
M 55-54	0.79	112	0.82	135	0.81	247
M 65-74	0.91	208	0.91	202	0.91	410
M 75-84	0.91	238	0.92	242	0.92	480
F 18-24	0.72	159	0.76	172	0.74	331
F 25-34	0.71	205	0.72	206	0.72	411
F 35-44	0.81	159	0.78	160	0.79	319
F 45-54	0.90	125	0.86	136	0.88	261
F 55-64	0.88	131	0.92	118	0.90	249
F 65-74	0.87	194	0.89	215	0.88	409
F 75-84	0.90	237	0.92	247	0.91	484
Total	0.82	2397	0.82	2502	0.82	4899

Note: “n” reflects the number in the denominator for the equations in §3.1.2

A4.2.1: In scope rates by geographic area.

	season					
	Spring 99		Fall 99		Both	
	In Scope Rate	n	In Scope Rate	n	In Scope Rate	n
Geographic region						
Vancouver	0.90	315	0.89	368	0.89	683
Victoria	0.87	156	0.86	173	0.86	329
Nanaimo	0.90	105	0.89	99	0.89	204
Kamloops	0.87	110	0.88	112	0.87	222
Kelowna	0.91	94	0.90	135	0.91	229
Prince George	0.87	110	0.86	104	0.86	214
Coastal	0.88	438	0.89	483	0.88	921
Kootenay	0.87	154	0.85	91	0.86	245
Chilliwack	0.81	158	0.78	161	0.79	319
Vernon	0.89	169	0.83	168	0.86	337
Terrace	0.83	156	0.85	150	0.84	306
All regions	0.87	1965	0.87	2044	0.87	4009

Note: “n” reflects the number in the denominator for the equations in §3.1.2

A4.2.2: In scope rates by age-sex group

	season					
	Spring 99		Fall 99		Both	
	In Scope Rate	n	In Scope Rate	n	In Scope Rate	n
Sampling Age Sex Group						
M 18-24	0.81	119	0.77	117	0.79	236
M 25-34	0.84	142	0.84	134	0.84	276
M 35-44	0.93	110	0.92	119	0.92	229
M 45-54	0.92	101	0.90	110	0.91	211
M 55-54	0.90	89	0.95	111	0.93	200
M 65-74	0.92	189	0.93	183	0.93	372
M 75-84	0.85	217	0.84	223	0.85	440
F 18-24	0.74	114	0.76	131	0.75	245
F 25-34	0.79	146	0.72	148	0.76	294
F 35-44	0.88	128	0.92	125	0.90	253
F 45-54	0.96	112	0.93	117	0.94	229
F 55-64	0.99	115	0.94	108	0.96	223
F 65-74	0.88	169	0.92	191	0.90	360
F 75-84	0.86	214	0.85	227	0.85	441
Total	0.87	1965	0.87	2044	0.87	4009

Note: “n” reflects the number in the denominator for the equations in §3.1.2

A.4.3.1: Refusal rates by geographic region.

	season					
	Spring 99		Fall 99		Both	
	Refusal Rate	n	Refusal Rate	n	Refusal Rate	n
Geographic region						
Vancouver	0.34	283	0.31	327	0.32	610
Victoria	0.39	136	0.33	148	0.36	284
Nanaimo	0.49	94	0.32	88	0.41	182
Kamloops	0.42	96	0.29	98	0.35	194
Kelowna	0.35	86	0.43	122	0.40	208
Prince George	0.43	96	0.39	89	0.41	185
Coastal	0.41	384	0.35	430	0.38	814
Kootenay	0.38	134	0.32	77	0.36	211
Chilliwack	0.53	128	0.39	125	0.46	253
Vernon	0.40	150	0.32	140	0.36	290
Terrace	0.41	129	0.46	128	0.44	257
All regions	0.41	1716	0.35	1772	0.38	3488

Note: “n” reflects the number in the denominator for the equations in §3.1.2

A.4.3.2: Refusal rates by age and sex groups.

	season					
	Spring 99		Fall 99		Both	
	Refusal Rate	n	Refusal Rate	n	Refusal Rate	n
Sampling Age Sex Groups						
M 18-24	0.39	96	0.43	90	0.41	186
M 25-34	0.50	119	0.32	113	0.41	232
M 35-44	0.46	102	0.37	109	0.41	211
M 45-54	0.45	93	0.42	99	0.44	192
M 55-54	0.40	80	0.37	105	0.38	185
M 65-74	0.38	174	0.32	171	0.35	345
M 75-84	0.41	185	0.33	188	0.37	373
F 18-24	0.44	84	0.28	99	0.36	183
F 25-34	0.34	116	0.35	106	0.35	222
F 35-44	0.41	112	0.33	115	0.37	227
F 45-54	0.34	107	0.39	109	0.37	216
F 55-64	0.32	114	0.29	101	0.31	215
F 65-74	0.42	149	0.34	175	0.38	324
F 75-84	0.44	185	0.40	192	0.42	377
Total	0.41	1716	0.35	1772	0.38	3488

Note: “n” reflects the number in the denominator for the equations in §3.1.2

A.4.4.1: Response rates by geographic area

	season					
	Spring 99		Fall 99		Both	
	Response Rate	n	Response Rate	n	Response Rate	n
Geographic region						
Vancouver	0.42	373	0.41	405	0.41	778
Victoria	0.39	174	0.43	194	0.41	368
Nanaimo	0.33	123	0.44	123	0.39	246
Kamloops	0.34	129	0.48	132	0.41	261
Kelowna	0.59	90	0.40	149	0.47	239
Prince George	0.35	133	0.28	131	0.31	264
Coastal	0.38	487	0.44	540	0.41	1027
Kootenay	0.48	151	0.51	93	0.49	244
Chilliwack	0.34	155	0.48	144	0.41	299
Vernon	0.50	172	0.54	160	0.52	332
Terrace	0.39	161	0.35	159	0.37	320
All regions	0.40	2148	0.43	2230	0.42	4378

Note: “n” reflects the number in the denominator for the equations in §3.1.2

A.4.4.2: Response rates by age-sex group

	season					
	Spring 99		Fall 99		Both	
	Response Rate	n	Response Rate	n	Response Rate	n
Sampling Age Sex Groups						
M 18-24	0.32	137	0.29	142	0.30	279
M 25-34	0.28	173	0.31	173	0.29	346
M 35-44	0.32	142	0.38	157	0.35	299
M 45-54	0.37	115	0.36	128	0.37	243
M 55-54	0.43	103	0.40	129	0.41	232
M 65-74	0.49	193	0.52	190	0.51	383
M 75-84	0.48	206	0.50	207	0.49	413
F 18-24	0.32	129	0.42	140	0.37	269
F 25-34	0.37	175	0.38	164	0.38	339
F 35-44	0.43	143	0.46	150	0.45	293
F 45-54	0.53	120	0.47	128	0.50	248
F 55-64	0.48	130	0.60	111	0.54	241
F 65-74	0.41	174	0.49	199	0.45	373
F 75-84	0.41	208	0.41	212	0.41	420
Total	0.40	2148	0.43	2230	0.42	4378

Note: “n” reflects the number in the denominator for the equations in §3.1.2

A.4.4.3 : Response Rates ~ Lower Bound on Analysis Geographic region summary

	season					
	Spring 99		Fall 99		Both	
	Response Rate	n	Response Rate	n	Response Rate	n
Geographic region						
Vancouver	0.42	373	0.41	405	0.41	778
Victoria	0.39	174	0.43	194	0.41	368
Nanaimo	0.33	123	0.44	123	0.39	246
Kamloops	0.34	129	0.48	132	0.41	261
Kelowna	0.59	90	0.40	149	0.47	239
Prince George	0.35	133	0.28	131	0.31	264
Coastal	0.38	487	0.44	540	0.41	1027
Kootenay	0.48	151	0.51	93	0.49	244
Chilliwack	0.34	155	0.48	144	0.41	299
Vernon	0.50	172	0.53	160	0.52	332
Terrace	0.39	161	0.35	159	0.37	320
All regions	0.40	2148	0.43	2230	0.42	4378

Note: “n” reflects the number in the denominator for the equations in §3.1.2

A.4.4.4: Response Rates ~ Lower Bound on Analysis Age-Sex Summary

	season					
	Spring 99		Fall 99		Both	
	Response Rate	n	Response Rate	n	Response Rate	n
Sampling Age Sex Groups						
M 18-24	0.32	137	0.29	142	0.30	279
M 25-34	0.28	173	0.31	173	0.29	346
M 35-44	0.32	142	0.38	157	0.35	299
M 45-54	0.37	115	0.36	128	0.36	243
M 55-54	0.43	103	0.40	129	0.41	232
M 65-74	0.49	193	0.52	190	0.51	383
M 75-84	0.48	206	0.49	207	0.48	413
F 18-24	0.32	129	0.42	140	0.37	269
F 25-34	0.37	175	0.38	164	0.38	339
F 35-44	0.43	143	0.46	150	0.45	293
F 45-54	0.53	120	0.47	128	0.50	248
F 55-64	0.48	130	0.60	111	0.54	241
F 65-74	0.41	174	0.49	199	0.45	373
F 75-84	0.41	208	0.41	212	0.41	420
Total	0.40	2148	0.43	2230	0.42	4378

Note: “n” reflects the number in the denominator for the equations in §3.1.2

A.4.4.5: Response Rates ~ Upper Bound on Analysis Geographic region summary

	season					
	Spring 99		Fall 99		Both	
	Response Rate	n	Response Rate	n	Response Rate	n
Geographic region						
Vancouver	0.55	283	0.50	327	0.53	610
Victoria	0.49	136	0.56	148	0.53	284
Nanaimo	0.44	94	0.61	88	0.52	182
Kamloops	0.46	96	0.64	98	0.55	194
Kelowna	0.62	86	0.49	122	0.54	208
Prince George	0.48	96	0.42	89	0.45	185
Coastal	0.48	384	0.55	430	0.52	814
Kootenay	0.54	134	0.61	77	0.57	211
Chilliwack	0.41	128	0.55	125	0.48	253
Vernon	0.57	150	0.61	140	0.59	290
Terrace	0.49	129	0.43	128	0.46	257
All regions	0.51	1716	0.54	1772	0.52	3488

Note: “n” reflects the number in the denominator for the equations in §3.1.2

A.4.4.6: Response Rates ~ Upper Bound on Analysis Age-Sex Summary

	season					
	Spring 99		Fall 99		Both	
	Response Rate	n	Response Rate	n	Response Rate	n
Sampling Age Sex Groups						
M 18-24	0.46	96	0.46	90	0.46	186
M 25-34	0.40	119	0.48	113	0.44	232
M 35-44	0.44	102	0.55	109	0.50	211
M 45-54	0.45	93	0.46	99	0.46	192
M 55-54	0.55	80	0.49	105	0.51	185
M 65-74	0.55	174	0.58	171	0.56	345
M 75-84	0.53	185	0.54	188	0.53	373
F 18-24	0.49	84	0.60	99	0.55	183
F 25-34	0.56	116	0.59	106	0.58	222
F 35-44	0.55	112	0.60	115	0.58	227
F 45-54	0.60	107	0.55	109	0.57	216
F 55-64	0.55	114	0.66	101	0.60	215
F 65-74	0.48	149	0.56	175	0.52	324
F 75-84	0.46	185	0.45	192	0.46	377
Total	0.51	1716	0.54	1772	0.52	3488

Note: “n” reflects the number in the denominator for the equations in §3.1.2

Appendix A5 Detailed Extra Question Results

Table A5.1
Proportion Reporting Bread Consumption

	RESPONSE CATEGORY			
	Responder		Refuser	
	N	EAT BRD Percent	N	EAT BRD Percent
ALL	1809	98.9	874	98.5
SEX				
Male	860	99.2	431	98.6
Female	949	98.7	443	98.4
AGE SEX GROUP				
M 18-24 yrs	85	98.8	46	100.0
M 25-34 yrs	101	99.0	61	98.4
M 35-44 yrs	104	100.0	60	100.0
M 45-54 yrs	88	98.9	60	98.3
M 55-64 yrs	94	98.9	46	97.8
M 65-74 yrs	192	99.0	78	98.7
M 75-84 yrs	196	99.5	80	97.5
F 18-24 yrs	100	100.0	40	100.0
F 25-34 yrs	126	97.6	48	97.9
F 35-44 yrs	131	96.9	47	100.0
F 45-54 yrs	123	99.2	53	100.0
F 55-64 yrs	130	99.2	48	100.0
F 65-74 yrs	166	100.0	96	95.8
F 75-84 yrs	173	98.3	111	98.2

Table A5.2
Proportion Reporting by Bread Type

	RESPONSE CATEGORY													
	Responder							Refuser						
	N	WHOLE WHEAT	WHITE	MULTIGR-AIN	RYE-PUMP	OTH	NOT KNOW	N	WHOLE WHEAT	WHITE	MULTIGR-AIN	RYE-PUMP	OTH	NOT KNOW
		Percent	Percent	Percent	Percent	Percent	Percent		Percent	Percent	Percent	Percent	Percent	Percent
ALL	1790	49.7	23.7	17.5	4.8	4.1	0.1	861	51.0	24.4	13.7	4.6	5.2	0.8
SEX														
Male	853	51.1	25.6	13.6	5.5	4.1	0.1	425	51.3	28.2	11.1	4.2	4.0	1.2
Female	937	48.5	22.1	21.1	4.2	4.2	0.0	436	50.7	20.6	16.3	5.0	6.4	0.5
AGE SEX GROUP														
M 18-24 yrs	84	46.4	34.5	11.9	2.4	4.8	0.0	46	45.7	41.3	6.5	4.3	2.2	0.0
M 25-34 yrs	100	49.0	33.0	13.0	1.0	3.0	1.0	60	56.7	26.7	13.3	0.0	3.3	0.0
M 35-44 yrs	104	51.9	28.8	13.5	3.8	1.9	0.0	60	51.7	33.3	8.3	1.7	5.0	0.0
M 45-54 yrs	87	44.8	26.4	18.4	8.0	2.3	0.0	59	37.3	37.3	20.3	1.7	1.7	1.7
M 55-64 yrs	93	49.5	22.6	14.0	6.5	7.5	0.0	45	57.8	31.1	11.1	0.0	0.0	0.0
M 65-74 yrs	190	53.7	20.5	14.7	6.3	4.7	0.0	77	50.6	20.8	10.4	10.4	6.5	1.3
M 75-84 yrs	195	54.9	22.1	11.3	7.7	4.1	0.0	78	57.7	16.7	7.7	7.7	6.4	3.8
F 18-24 yrs	100	42.0	35.0	17.0	2.0	4.0	0.0	40	35.0	40.0	15.0	2.5	5.0	0.0
F 25-34 yrs	123	43.9	30.1	20.3	1.6	4.1	0.0	47	53.2	19.1	19.1	2.1	4.3	2.1
F 35-44 yrs	127	39.4	24.4	26.8	2.4	7.1	0.0	47	48.9	23.4	19.1	4.3	2.1	0.0
F 45-54 yrs	122	48.4	18.9	23.8	5.7	3.3	0.0	53	50.9	26.4	15.1	5.7	1.9	0.0

F 55-64 yrs	129	41.1	18.6	26.4	7.0	7.0	0.0	48	45.8	12.5	18.8	8.3	14.6	0.0
F 65-74 yrs	166	51.8	15.1	24.1	6.0	3.0	0.0	92	53.3	16.3	14.1	6.5	9.8	0.0
F 75-84 yrs	170	64.7	18.8	11.2	3.5	1.8	0.0	109	56.0	17.4	15.6	4.6	5.5	0.9

Table A5.3
Proportion Reporting Milk Consumption

	RESPONSE CATEGORY			
	Responder		Refuser	
	N	DRK MILK Percent	N	DRK MILK Percent
ALL	1809	94.6	876	89.4
SEX				
Male	860	92.7	432	88.9
Female	949	96.3	444	89.9
AGE SEX GROUP				
M 18-24 yrs	85	91.8	47	93.6
M 25-34 yrs	101	90.1	61	93.4
M 35-44 yrs	104	94.2	60	95.0
M 45-54 yrs	88	94.3	60	86.7
M 55-64 yrs	94	89.4	45	80.0
M 65-74 yrs	192	93.2	78	84.6
M 75-84 yrs	196	93.9	81	88.9
F 18-24 yrs	100	97.0	40	85.0
F 25-34 yrs	126	95.2	48	95.8
F 35-44 yrs	131	92.4	47	95.7
F 45-54 yrs	123	95.9	54	88.9
F 55-64 yrs	130	96.9	48	89.6
F 65-74 yrs	166	98.8	96	88.5
F 75-84 yrs	173	97.1	111	88.3

Table A5.4
Proportion Reporting by Milk Type

	RESPONSE CATEGORY													
	Responder						Refuser							
		SKIM	1 %	2 %	WHOLE	OTH	NOT KNOW		SKIM	1 %	2 %	WHOLE	OTH	NOT KNOW
	N	Percent	Percent	Percent	Percent	Percent	Percent	N	Percent	Percent	Percent	Percent	Percent	Percent
ALL	1711	17.0	24.3	43.0	10.5	5.1	0.1	783	15.3	23.8	44.4	13.3	2.9	0.3
SEX														
Male	797	13.4	23.0	46.9	11.5	5.1	0.0	384	11.5	22.7	47.1	15.4	3.4	0.0
Female	914	20.1	25.5	39.6	9.5	5.1	0.1	399	19.0	24.8	41.9	11.3	2.5	0.5
AGE SEX GROUP														
M 18-24 yrs	78	2.6	30.8	50.0	10.3	6.4	0.0	44	9.1	34.1	40.9	15.9	0.0	0.0
M 25-34 yrs	91	14.3	26.4	48.4	8.8	2.2	0.0	57	19.3	22.8	36.8	19.3	1.8	0.0
M 35-44 yrs	98	17.3	33.7	36.7	9.2	3.1	0.0	57	10.5	29.8	42.1	17.5	0.0	0.0
M 45-54 yrs	83	20.5	21.7	48.2	4.8	4.8	0.0	52	9.6	9.6	63.5	15.4	1.9	0.0
M 55-64 yrs	84	8.3	21.4	53.6	10.7	6.0	0.0	36	13.9	19.4	52.8	5.6	8.3	0.0
M 65-74 yrs	179	15.6	21.2	42.5	15.1	5.6	0.0	66	10.6	25.8	37.9	21.2	4.5	0.0
M 75-84 yrs	184	12.5	15.2	51.1	14.7	6.5	0.0	72	8.3	18.1	56.9	9.7	6.9	0.0
F 18-24 yrs	97	27.8	26.8	35.1	6.2	4.1	0.0	34	17.6	29.4	47.1	5.9	0.0	0.0
F 25-34 yrs	120	22.5	29.2	32.5	13.3	2.5	0.0	46	28.3	28.3	32.6	10.9	0.0	0.0
F 35-44 yrs	121	16.5	32.2	32.2	11.6	7.4	0.0	45	17.8	22.2	46.7	11.1	2.2	0.0
F 45-54 yrs	118	16.1	25.4	47.5	5.9	4.2	0.8	48	12.5	35.4	45.8	6.3	0.0	0.0
F 55-64 yrs	126	23.0	26.2	34.9	9.5	6.3	0.0	43	25.6	34.9	30.2	4.7	4.7	0.0
F 65-74 yrs	164	21.3	22.0	43.9	7.9	4.9	0.0	85	20.0	22.4	42.4	11.8	3.5	0.0
F 75-84 yrs	168	16.1	20.2	46.4	11.3	6.0	0.0	98	15.3	15.3	44.9	18.4	4.1	2.0

Appendix Q

Criteria Used to Establish the Estimated Average Requirement (EAR), Adequate Intake (AI), and the Tolerable Upper Intake Level (UL) for the Adult Non-pregnant, Non-lactating Population

Appendix Q: Criteria used to Establish the Estimated Average Requirement (EAR), Adequate Intake (AI) and the Tolerable Upper Intake Level (UL) for the Adult, Non-pregnant, Non-lactating Population

Nutrient	Criterion EAR	Criterion AI	Criterion UL
Carbohydrate	Brain glucose utilization	————-	————-
α-Linolenic Acid	————-	Median intake from Continuing Food Survey II	————-
Linoleic Acid	————-	Median intake from Continuing Food Survey II	————-
Protein	Nitrogen equilibrium	————-	————-
Folate	Intake needed to maintain red blood cell folate levels.	————-	Applies to synthetic forms of folic acid and is based on the examination of case reports of progression of neurological effects in vitamin B12 deficient patients taking folate supplements.
Niacin	Relates intake to urinary excretion of niacin metabolites.	————-	Based on the adverse affect of flushing.
Panothenic Acid	————-	Intake sufficient to replace urinary output.	————-
Riboflavin	Indicators include urinary output of riboflavin and its metabolites, blood levels of riboflavin, and erythrocyte glutathione reductase activity coefficient.	————-	————-
Thiamin	Maintain normal erythrocyte transketolase activity.	————-	————-
Vitamin B6	Intake needed for maintenance of plasma pyridoxal phosphate levels.	————-	Based on the adverse affect of sensory neuropathy.
Vitamin B12	Intake needed for maintenance of hematological status and serum B12 levels.	————-	————-
Vitamin C	Ages 19-30 years: Near maximal neutrophil concentration. Ages 31 plus: extrapolation of near maximal neutrophil concentrations from 19-30 years.	————-	Applies to intakes from food and supplements and based on adverse effect of osmotic diarrhea.

Appendix Q: Continued

Nutrient	Criterion EAR	Criterion AI	Criterion UL
Calcium	————-	Ages 19-30 years: Desirable calcium retention/factorial. Ages 31-50 years: Calcium balance. Ages 51-70 years: Desirable calcium retention/factorial/change in bone mineral density. Ages 71 plus: Extrapolation of desirable calcium retention from 51 to 70/change in bone mineral density/fracture rate.	————-
Iron	Factorial modelling	————	Based on gastrointestinal distress
Magnesium	Ages 19-70 years: Balance studies. Ages 71 plus: Intracellular studies/ decreases in absorption.	————-	Applies to pharmacological sources only.
Phosphorus	Ages 19-50 years: serum inorganic phosphate levels. Ages 51 plus: Extrapolation of serum inorganic phosphate levels from 19-50 years.	————-	Based on the effects of hyperphosphatemia
Zinc	Factorial approach-minimal quantity of absorbed zinc adequate to replace endogenous losses.	————-	Reduction in erythrocyte copper-zinc superoxide dismutase activity
Fibre	————	Based on the greatest reduction in risk for coronary heart disease and set at 14 g/1000kcal x median energy intake [kcal/1000 kcal/d] for each age and gender group.	————

Appendix R

Median Usual Intakes of United States Population

Appendix R (a): Median Usual Intakes from Food Alone, United States (NHANES III or CSFII)

	Men				Women			
	19-30	**31-50**	**51-70**	**≥71**	**19-30**	**31-50**	**51-70**	**≥71**
Energy (kcal)*	2718	2476	2109	1773	1757	1659	1507	1356
Protein (g)*	101.0	97.0	85.0	71.0	62.0	64.0	60.8	55.2
(% energy)*	15.1	15.8	16.3	16.2	14.4	15.6	16.4	16.5
Carbohydrate (g)*	331	297	255	222	229	210	191	178
(% energy)*	49.8	48.9	49.0	50.9	52.8	51.3	51.5	53.1
Fibre (g)*	17.4	17.9	17.5	16.5	12.1	13.1	13.8	13.3
Fat (g)*	100.0	93.0	79.0	65.0	63.0	61.0	55.0	48.0
(% energy)*	32.6	33.7	33.7	33.0	32.1	32.8	32.2	31.6
Saturates (g)*	34.2	31.4	25.6	21.3	20.9	20.3	17.3	15.4
Monounsaturates (g)*	38.7	36.0	30.4	25.0	24.0	23.2	20.5	18.2
n-6 polyunsaturates (g)*	16.7	16.1	14.5	11.6	11.2	11.1	10.5	8.9
n-3 polyunsaturates (g)*	1.69	1.77	1.63	1.33	1.20	1.22	1.19	1.02
α-linoleic acid (g)*	1.59	1.63	1.47	1.19	1.11	1.13	1.08	0.91
Cholesterol (mg)*	323	324	295	248	199	206	195	178
Thiamin (mg)	1.78	1.75	1.63	1.56	1.45	1.41	1.38	1.38
Riboflavin (mg)	2.09	2.03	1.87	1.84	1.63	1.60	1.58	1.60
Niacin (mg)	25.3	25.12	22.56	20.79	19.69	19.84	19.20	18.78
Vitamin B6 (mg)	2.02	1.96	1.77	1.72	1.54	1.53	1.51	1.53
Vitamin B12 (μg)	5.22	5.20	5.10	4.99	4.77	4.84	4.80	4.74
Vitamin C (mg)	114	108	103	99	79	85	97	100
Calcium (mg)**	954	857	708	702	612	606	571	517
Iron (mg)	17.90	17.90	16.80	15.50	12.20	12.10	12.00	12.30
Magnesium (mg)**	328	329	295	275	205	229	231	206
Phosphorus (mg)**	1613	1484	1274	1176	1005	990	966	859
Zinc (mg)	14.80	14.20	13.10	11.40	9.20	9.30	8.80	8.20

1. All data were originally presented in the Dietary Reference Intake nutrient reports (IOM, 1997, 1998, 2000, 2001, 2002). Data were adjusted using the Iowa State University Method to obtain usual intake distributions. Data on folate are not shown because U.S. data were collected prior to the fortification of the food supply with folic acid. Note that niacin data are expressed in mg rather than Niacin Equivalents.

* CSFII data, 1994-6, 1998

** CSFII data, 1994

Appendix R (b): Median Usual Intakes from Food Plus Supplements, United States (NHANES III or CSFII)[1]

	Men				Women			
	19-30	**31-50**	**51-70**	**≥71**	**19-30**	**31-50**	**51-70**	**≥71**
Thiamin (mg)	1.87	1.89	1.78	1.69	1.56	1.58	1.54	1.53
Riboflavin (mg)	2.21	2.17	2.03	1.97	1.75	1.77	1.77	1.77
Niacin (mg)	26.52	27.37	24.26	22.43	21.09	21.70	21.15	20.54
Vitamin B6 (mg)	2.13	2.16	1.97	1.87	1.68	1.73	1.75	1.77
Vitamin B12 (μg)	5.40	5.45	5.48	5.19	5.04	5.20	5.12	4.97
Vitamin C (mg)	127.1	121.3	123.5	118.0	90.1	102.3	123.7	119.2
Iron (mg)	18.55	18.90	17.89	16.74	12.97	13.08	13.06	13.21
Zinc (mg)	15.34	14.77	13.90	12.12	9.64	10.08	9.52	8.92

1. All data were originally presented in appendices of the dietary Reference Intake nutrient report (IOM, 1997, 1998, 2000, 2001, 2002). Data were adjusted using the Iowa State University Method to obtain usual intake distribution. Data on folate are not shown because U.S. data were collected prior to the fortification of the food supply with folic acid. Usual intake data were not available from the combination of food plus supplements for calcium, magnesium or phosphorus.

Appendix S

Food Sources of Selected Nutrients

Appendix S: Food Sources of Selected Nutrients

Nutrient	Meat and Alternates	Milk Products	Vegetables & Fruit	Grain Products	Other Foods
Vitamin B6 (Pyridoxine)	Meats, especially organ meats, fish, legumes		Green leafy vegetables, banana, carrot, potato, sweet peppers	Whole grains, wheat germ	Nutritional yeast
Vitamin B12	Meats, especially organ meats, eggs, fish, shellfish	Cheese, yogurt			Separable meat, meat fats, meat gravies, malted milk, meat broth soups
Vitamin C (Ascorbic Acid)			Fruits, especially citrus fruits & juices, kiwi strawberries, cabbage, tomato, potato, broccoli sweet peppers		
Folic Acid	Liver legumes		Green leafy vegetables, asparagus, banana, strawberries, orange juice	Whole grains, fortified flours, breads, pasta, rice, fortified cereals	Nutritional yeast
Calcium	Oysters, scallops, salmon and sardines with bones, tofu made with calcium, almonds	All	Green leafy vegetables, broccoli, figs, fortified orange juice		Blackstrap molasses
Iron	Meats, liver, eggs, shell-fish, nuts, sardines, legumes		Broccoli, peas, prunes, raisins, dates, figs	Enriched cereals wheat germ	Blackstrap molasses
Magnesium	Nuts, legumes	Yoghurt	Peas, spinach	Whole grains, brown rice	
Zinc	Meat, liver, eggs, shellfish, legumes nuts, peanut butter	Cheese		Whole grains, wheat germ	

Source: Adapted from B.C. Dietitian's and Nutritionists' Association. Manual of Nutritional Care, 4th Edition, 1992