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Impact of Telephone versus Face to Face Repeat 24 Hour Recall Interviews on Food and Nutrition Surveys

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Abstract

Many population surveys collecting food consumption data use 24 hour recall methodology to capture detailed one day intakes. In order to estimate longer term intakes of foods and nutrients from these data, methods have been developed that required a repeat recall to be collected from at least a subset of responders in order to estimate day to day variability. During the Canadian Community Health Survey Cycle 2.2 Nutrition Focus Survey, most first interviews were collected in person and most repeat interviews were conducted by telephone. This paper looks at the impact of the mode of interview on the reported foods and nutrients on both the first day and the repeat day and on the estimation of intra individual variability between the first and the second interviews.

KEY WORDS: Mode of Interview, Nutrition Survey, Food Recall, Telephone, In person

1. Introduction

The Canadian Community Health Survey 2.2 (2004) was run with a nutrition component, which among other tools, included a 24 hour recall of food intakes. This involved a complex interview process that was administered in person or by telephone, and sometimes by both modes of interview within a single interview, although this was not common.

Table 1. Number of Respondents by Mode of Interview.

		Recall Day 1			Recall Day 2	
age group	sex	In Person	On Telephone	Both	In Person	On Telephone
9 TO 13	male	1958	104	18	56	708
	female	1871	89	20	61	633
14 TO 18	male	2070	175	42	68	677
	female	2091	148	38	67	654
19 TO 30	male	1584	185	35	90	489
	female	1847	144	26	101	687
31 TO 50	male	2336	206	53	55	586
	female	2517	203	35	66	692
51 TO 70	male	2368	151	31	92	563
	female	2978	173	50	122	715
71 +	male	1435	73	12	125	395
	female	2437	147	26	180	675

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For a subset of the interviewees a repeat interview was administered which allows for the estimation of distributions of usual intakes of food related intakes. However, if the mode of interview has an effect on the way that subjects report their food intake then these effects need to be considered when assessing the distribution of single day intakes and whether they impact the estimation of usual intake. The nutrient intakes rolled up by person and recalll day were the data that were available to me at the time of analysis so examples used to illustrate the discussion are taken from this file.

1.1 Interview Numbers

Table 1 lists the number of respondents by mode of interview for each of recall day one and recall day two. It was expected that the first interview was to be in person and the majority of the second interviews were to be by telephone. Most interviews fit this pattern but it can be seen from the table that there were a number of telephone interviews on day one and a number of in person interviews on day two. The small number of interviews that used both modes were all on day one.

Table 2. Number of Respondents by Order of Mode of Interviews.

		Order of Interview Mode					
age group	sex	BP	BT	PP	PT	TP	TT
9 TO 13	male	0	10	56	682	0	16
	female	0	2	60	614	1	17
14 TO 18	male	0	8	68	646	0	23
	female	0	6	67	614	0	34
19 TO 30	male	1	8	89	453	0	28
	female	0	8	100	639	1	40
31 TO 50	male	0	11	55	551	0	23
	female	4	5	61	659	1	28
51 TO 70	male	1	7	90	542	1	14
	female	0	8	121	679	1	28
71 +	male	0	4	125	381	0	10
	female	1	5	177	653	1	17

T=on Telephone; P=in Person; B=Both

Table 2 lists the number of respondents by the order of the mode of interview for those respondents who completed both days of recall, and as the survey was designed, there was mostly the in person-telephone order of interview modes, followed by the in person-in person order. Because of the small numbers for the other combinations and for the purposes of the discussion presented in this paper, these are the two orders of interview mode that are considered.

1.2 Issues

There is a concern that the inclusion of telephone interviews could introduce bias in the estimation of nutrient and food intakes or effect the variability of reported intakes. Either of these errors would lead to a mis-specification of population statistics such as means and percentiles. The difference between in person and telephone interview results could also inflate the within person variability of in person-telephone responses. This could have an impact on the estimation of usual intake distributions but this may be offset by the concurrent increase in the between

subject variability introduced when both interview modes are present on the same recall day. Another concern is the effect of the inflation of error on analysis results.

2. Statistical Approach

All analyses were performed by the dietary reference intakes (DRI) age sex groups (Institute of Medicine, 1997) as defined in the Institute of Medicine publications. Nutrient intakes were transformed using a power transformation selected from one of untransformed, square root, quarter root or log transformation, so that the data were reasonably symmetrical and as close to being normal as possible. The transformed results for the first day of recall were subjected to an ANOVA with province and mode of interview as main effects in the model. The difference between day two and day one intakes on the transformed scale were also subjected to an ANOVA with province and mode order (person/person or person/telephone) as main effects. For the estimation of usual intakes, the method as outlined in *Nutrient Adequacy* published by the National Research Council (1986) was used. The estimation of within and between components of variance were pooled across province before deriving the adjustment factor used to remove the within subject variability from the distributions of intake. Since this work was exploratory I initially looked at the results for 36 nutrients and 12 age-sex groups. However, since this paper is intended to be illustrative rather than comprehensive, only a small subset of the results are presented.

3. Results - First Recall

3.1 Examples: Energy, Vitamin C and Monounsaturated Fats

Total energy intake is a good variable to look at first since it in some sense it is a measure of food intake. Table 3 lists the effect of interview mode on total energy intake for each age sex group for the first day of recall. Significant effects of mode of interview were found for all age-sex groups except for females aged 71years plus. Note, that for the CCHS data, the sample size is large so marginally significant results will reflect relatively small shifts in the location of the distributions of intakes. In contrast, for the results for the reported intake of vitamin C, table 4, the only significant effect of mode of interview was found for females 71 years plus.

Table 3. Effect of Mode of Interview on Reported Energy Intake - 1st Recall

	p-value	
Age Group	Male	Female
9-13	0.0021	0.011
14-18	0.0038	0.011
19-30	<0.0001	<0.0001
31-50	0.0002	0.0001
51-70	<0.0001	<0.0001
71+	0.0007	0.12

Table 4. Effect of Mode of Interview on Reported Vitamin C Intake - 1st Recall

Age Group	p-value	
	Male	Female
9-13	0.48	0.34
14-18	0.074	0.93
19-30	0.55	0.63
31-50	0.67	0.16
51-70	0.36	0.79
71+	0.61	0.0003

How does this effect of mode of interview actually translate into observed shifts in the distribution of intake? Figure 1 shows the estimated densities for total energy intake for males 19 to 30 years old in their first recall. There was a shift towards lower reported caloric intake for those subjects who were interviewed by telephone (red) when compared with those who were interviewed in person (blue). This corresponded to a shift of 200 Kcals for the lower percentiles and up to approximately 600 Kcals for the upper percentiles of the distribution. Because of the smaller number of telephone interviews this caused only 10 to 80 Kcal shifts in the combined distribution relative to the in person interview.

Figure 1. Distribution of Energy Intake

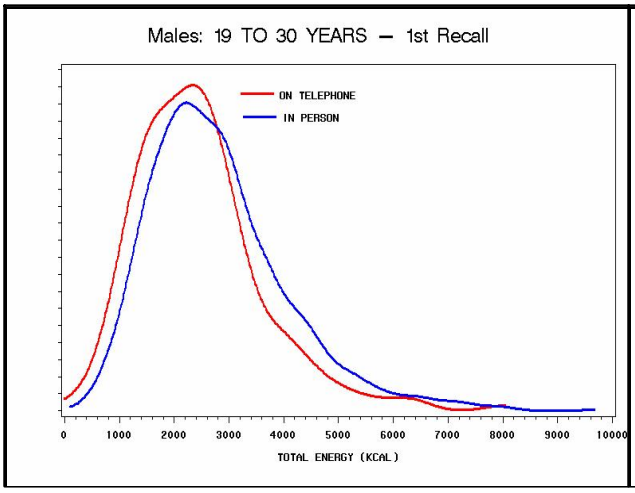
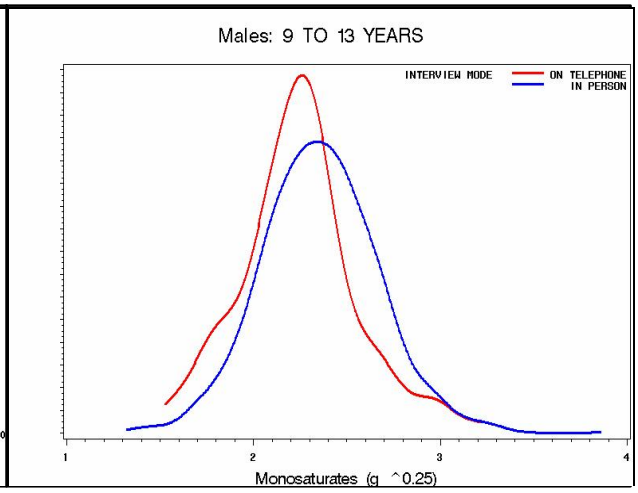


Figure 2. Distribution of Monounsaturate Intake



The next figure, the distribution of monosaturated fat intake for males 9 to 13, also illustrates a shift towards lower reported intakes but I have included this figure as well since it also shows evidence of a change in variability. The effect of mode of interview on variance was not formally tested for in the scope of this investigation, but is another aspect that should be considered when dealing with the effects of mode of interview in any survey with mixed modes.

3.2 The Counter Example That Isn't: Protein

Although I have only illustrated the effects of interview mode for two nutrients, it turns out that almost all nutrients, for which the mode effect was significant, exhibit lower reported intakes when the respondents are

interviewed by telephone. However, consider the results for protein, both total intakes and as a percentage of total energy intake. Table 5 lists the p-values for the effect of mode of interview on these intakes. There is a significant effect of mode of interview on the protein intake as a percentage of total intake for the males in all age groups but not for total protein intake. Curiously, the most significant results for females ($p<0.0005$) are for total protein although the females 71 years plus buck the trend again. Again, for the significant effects of mode of interview on total protein intake (no graph shown) there is a decrease in reported intakes when subjects are interviewed by telephone. However, consider figure 3, the distribution of % total energy from protein for males 19 to 30. The shift in the distribution from in person (blue) to on telephone (red interviews is positive. However, this is not really a counter example. Since the males were consistent in their reported total protein intake, the positive shift in % protein was not because of any shift in reported protein intakes but because of a negative shift in the reported energy intakes from other sources, such as carbohydrates.

Figure 3. Distribution of % Total Energy from Protein

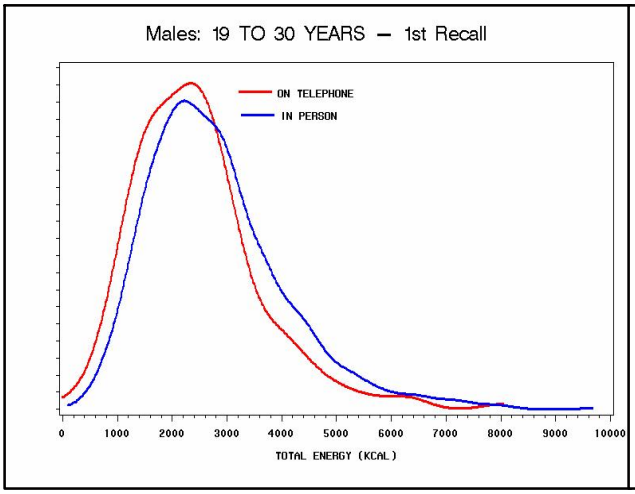


Figure 4. Distribution of Vitamin C Intake

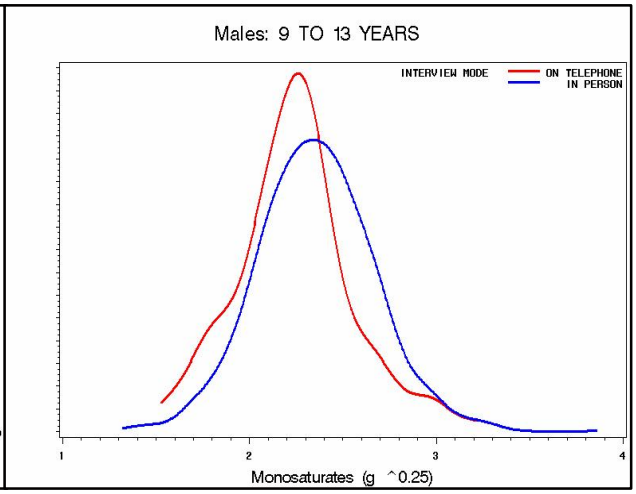


Table 5. Effect of Mode of Interview on Reported Protein Intake

Age Group	Male		Female	
	total protein	% total energy	total protein	% total energy
9-13	0.49	0.0057	0.0003	0.010
14-18	0.87	<0.0001	0.19	0.22
19-30	0.18	<0.0001	<0.0001	0.89
31-50	0.41	0.0005	0.069	0.015
51-70	0.044	0.079	<0.0001	0.99
71+	0.14	0.031	0.35	0.0020

3.3 One More Example: Vitamin C

Lest we get lulled into thinking that the effect of mode of interview is relatively simple lets go back to the one significant result for vitamin C listed in table 4 for the females 71 years plus. The distributions for this age group are presented in figure 4. The distribution of vitamin C intakes for the in person interviews is unimodal but

exhibits a bit of a shoulder on the lower intake side of the distribution. However, the distribution for the on telephone interviews is distinctly bimodal. This suggests that there may be two populations that may have different distributions of vitamin C intake and that differentially respond to the mode of interview. It would be interesting to dig deeper and understand the mechanisms that drive this observation.

3.4 General Results for First Recall

Most nutrients exhibit an effect for some age group. Vitamin C showed the most resistence to the effect of mode of interview but did exhibit an effect for one age group. When mode of interview was significant, there was on average a reduction in reported nutrient intake when the subject was interviewed by telephone. The reasons could be because fewer foods or eating occasions are captured by telephone or that the amounts being reported are less or a combination of the two. This cannot be ascertained from the nutrient intake data, but requires a look at the detailed food intake data.

4. Two Day Results

4.1 Example: Energy Revisited and Saturated Fat

Table 6 lists the results of the analysis of the day one to day two difference in energy intakes. There were a variety of patterns of results depending on the age-sex group. The young males, 9 to 13 years old showed a difference in reported energy intake from day one to day two for both orders of mode of interview and a marginal difference in this effect between the two mode orders. Many age sex groups show a difference in reported energy intake from day one to day two but no difference between the two mode orders. Some, such as females 14 to 18, exhibit no significant effect of day for the person-person interviews, exhibit an effect for the person-telephone order and exhibit no effect on these differences of the mode order. This is counterintuitive and most likely results because of the difference in the numbers available in each group and the differences in the power of the tests.

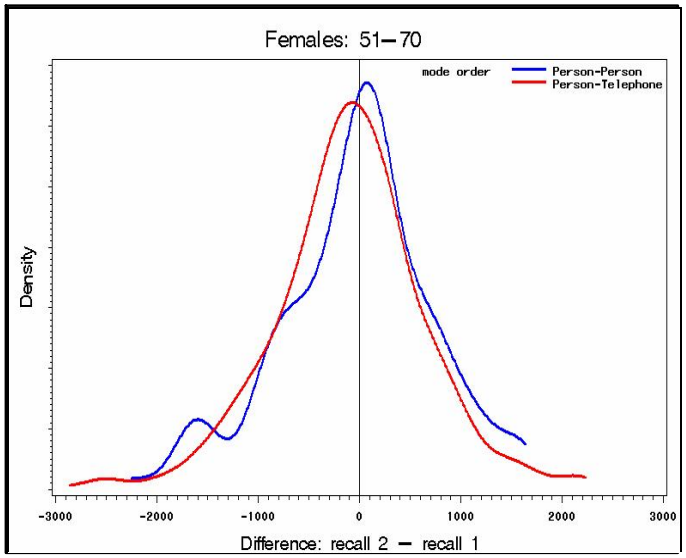
Table 6. Effect of Mode of Interview on Reported Change in Energy Intake from Day 1 to Day 2

Age Group	Male			Female		
	PP=0[1]	PT=0[2]	PP=PT[3]	PP=0	PT=0	PP=PT
9-13	0.0005	0.0006	0.040	0.0006	0.0002	0.088
14-18	0.0044	<0.0001	0.54	0.19	<0.0001	0.31
19-30	0.83	0.0008	0.025	0.88	<0.0001	0.015
31-50	0.094	0.0001	0.67	0.0019	0.0001	0.24
51-70	0.015	0.031	0.21	0.40	0.0051	0.0055
71+	0.18	0.037	0.0019	0.10	0.22	0.38

Significant p-value indicates significant difference in reported intakes from day 1 to day 2 for: [1] two in person interviews; [2] one in person followed by a telephone interview.
[3] Significant p-value indicates an effect of the order of interview on the day 1 day 2 differences.

The most interesting results are for those age groups that exhibit no effect on reported energy intake from day one to day two for the person-person interviews but exhibit both a significant difference for the person-telephone interviews and a significant effect of interview mode order. In these cases the difference from day one to day two can be attributed solely to the effect of the telephone interview and not the effect of day. The most notable example is for females age 51 to 70. Plots of the distributions of these differences, figure 5, show that there is a shift towards negative differences in the distribution for in person interviews followed by telephone interviews. This is consistent with the day one results that give evidence of a shift towards reporting less energy intake when reporting by telephone.

Figure 5. Distribution of the Difference in Energy Intake



The effects of mode of interview, however are less regular when considered across two days of interview than when considered only on the first day of interview. In figure 6, the distributions of the difference in energy intakes for males aged 71 plus, exhibit a bimodal pattern for the person-person order of interview mode whereas the in person-telephone mode order exhibits a very normal looking, unimodal distribution. In figure 7, for the distribution of differences in saturated fat intake for males 9 to 13, there is a shift towards negative differences, but this time it is for the subjects interviewed both days in person.

Figure 6. Distribution of the Difference in Energy Intake Day One to Day Two

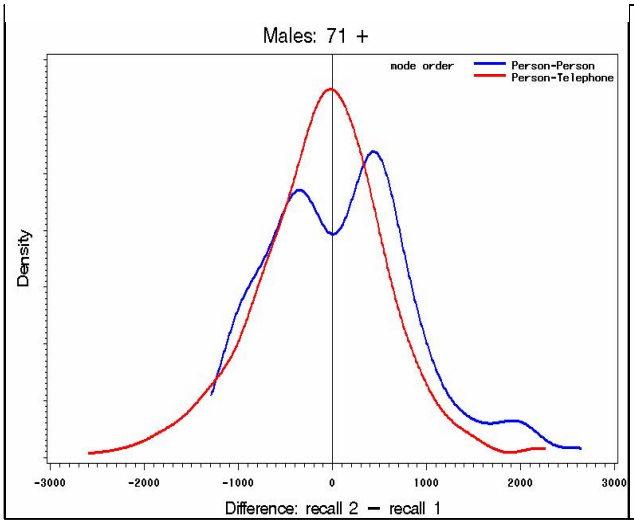
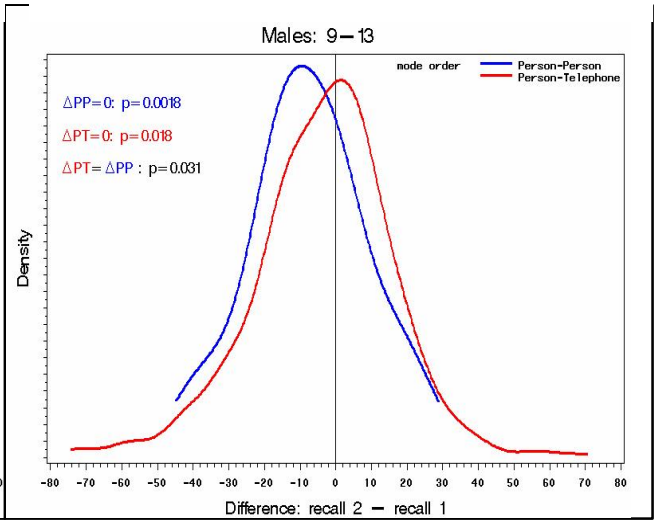


Figure 7. Distribution of the Difference in Saturated Fat Intake Day One to Day Two



It could be reasonably surmised that the effects of interview mode that have been observed would have an impact on the estimation of usual intake, particularly since the larger absolute differences between day one and day two for some age-sex groups and some intakes for one or the other of the interview orders would lead to larger estimates of the within-person variability. However, consider the energy intakes for females aged 19 to 30. Table 7 lists the estimated variance component before and after the removal of the effect of the telephone mode of interview. The

adjustment factor used to adjust the data towards the means of the populations is derived from the variance components as follows;

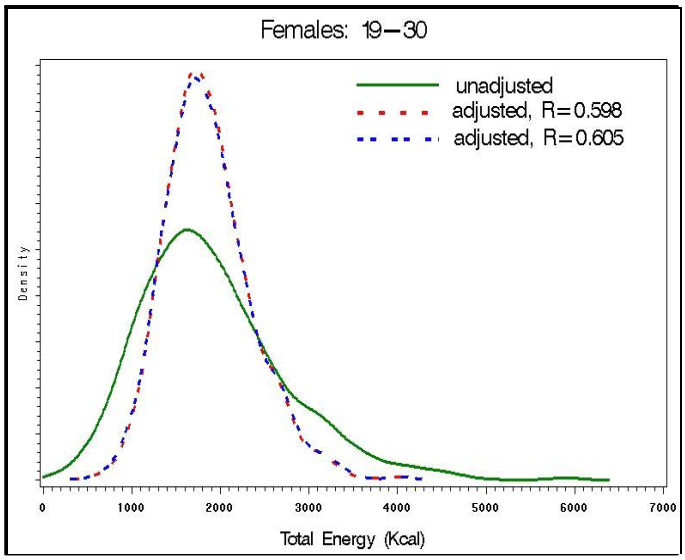
$$R = \sqrt{\frac{s^2_{within}}{s^2_{between} + s^2_{within}}}$$

Table 7. Variance Component Estimates for Energy Intake, Females 19 to 30

Removal of Telephone Effect	Variance Component		Adjustment Factor
	between subject	within subject	
Before	30.33	57.50	0.587
After	31.86	55.22	0.605

Although there is the expected reduction in the within subject component of variance after the removal of the mode of interview effect, and the between subject component is slightly inflated, the changes in the estimates of the variance components are not large enough to make much difference to the adjustment factor. This small change is barely discernable in the plots of the distribution of one day and usual intakes seen in figure 8. As mightily as a tried, I could not find an example were the effect of the mode of interview made a notable impact on the estimation of usual intake.

Figure 8. Distribution of Unadjusted and Adjusted Intakes of Energy



4.3 General Results Two Day Results

Beyond saying that there are observed effects of the order of interview mode on the differences in reported intakes between day one and day two, there is not much that can be said about consistent results, because they weren't consistent. It would take a much more in depth investigation of the data to tease out all the effects of the interview modes and their order on reported intakes for each nutrient. It should also be noted that there is also a difference between day one and day two telephone interviews. When a subject is interviewed by telephone for the first recall they are not visited by an interviewer, and most likely do not have access to the booklet of reference models. If they are interviewed first in person, then these models are available to them for the subsequent telephone interview. Thus, the telephone interviews are fundamentally different on day one than on day two. There are more ways to

look at these data and more, I am sure, that these data have to tell us with respect to the effect of mode of interview.

5. Conclusions

This has been a cursory look at the effect of interview mode on reported intakes of nutrients. There are things that I have ignored, among them the possible interaction between interview mode and province, other possible influences such as socioeconomic factors, and the effect of interview mode on variance. It should also be noted that subjects do not report nutrient intakes, which is the data that were available to me: they report foods. The mechanisms that underlie the effects of mode of interview are to do with changes in the reporting of food items. It is possible that vitamin C resists the effect of telephone interview because many of the items that supply vitamin C in our diet are countable such as the number of fruit or glasses of juice, which can be accurately reported whether you are interviewed by telephone or in person. The other reason that the effect of mode of interview needs to be understood in the context of foods is because nutrients are not the only food related intakes that are of interest. Our food supply is also a medium of exposure to toxins, some specific to a food such as solanine in potatoes and other exogenous toxins such as dioxins that are found in a variety of foods, particularly those containing animal fats. For the purpose of understanding the effect of mode of interview on the reported intakes of these toxins in the context of an exposure assessment, it is necessary to understand the mechanisms at the food level.

There is still much to explore in the area of the effect of mode of interview on reporting food and nutrient intakes for the CCHS 2.2 survey data and, I am sure, some interesting results yet to be found.

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