

Data Collection Using a Diary: The Experience of the Survey of Household Spending

Christiane Laperrière¹

ABSTRACT

The Survey of Household Spending collects household expenditure data using a questionnaire (administered by a computer assisted personal interview) as well as an expenditure diary. While the diary provides detailed expenditure information, it comes with a set of challenges that are unique to this collection mode. For example, different under-reporting sources have to be considered when using diaries and certain adjustments are needed to avoid under-estimation. In this paper, we discuss challenges and present the strategies we have implemented so far as well as potential strategies we seek to pursue in the future.

KEY WORDS: Expenditure diary, expenditure survey, nonresponse by day, respondent fatigue

RÉSUMÉ

L'Enquête sur les dépenses des ménages recueille des renseignements détaillés sur les dépenses des ménages en combinant l'utilisation d'un questionnaire (administré par entrevue personnelle assistée par ordinateur) et d'un journal de dépenses. Le journal fourni des données très détaillées sur les dépenses mais ce mode de collecte représente également un ensemble de défis. Par exemple, différentes sources de sous-déclaration doivent être considérées avec le journal et des ajustements aux données doivent donc être faits pour éviter la sous-estimation. Dans cet article, certains défis associés au journal seront présentés ainsi que les stratégies mises en place et considérées pour le futur.

MOTS CLÉS : Journal de dépenses, enquête sur les dépenses, non-réponse par jour, fatigue du répondant

1. INTRODUCTION

The Survey of Household Spending is an annual and voluntary survey that collects household expenditure data using a personal interview as well as an expenditure diary. The sample of selected households is spread over 12 monthly collection cycles so that data collection is continuous from January through December. The interview collects regular expenditures (such as rent and electricity) and less frequent expenditures (such as furniture and dwelling repairs) for a reference period that varies in length depending on the type of expenditure. In 2010 and 2011, all selected households also had to complete an expenditure diary for a period of two weeks starting the day after the interview. Starting in 2012, only a subsample of 50% of the sampled households was selected to complete the expenditure diary. The diary mode is used to collect frequent or less important expenditures, which are difficult for respondents to recall during a retrospective interview. Items that should be recorded on the diary include food, gas, purchases from the grocery store, personal care items, cigarettes, movie tickets, etc. All interview and diary expenditure variables are annualized i.e. they are multiplied by an appropriate factor based on the reference period so that annual expenditure estimates can be produced. Only one diary is given per household but all the members of the household are asked to record their expenditures in the diary. Households have the option of providing receipts to reduce the amount of information recorded manually in the diary. The diary is separated in two sections; the first section is for expenditures for goods and services (including food from stores) and the second section is for snacks, beverages and meals purchased from restaurants or fast-food outlets. When a household does not have expenditures to report for a given day, they should indicate that there was no spending on that date. While the diary provides detailed expenditure information, it comes with a set of challenges that are unique to this collection mode. This paper will focus on the challenges related to the under-reporting of expenditures in the diary.

2. SOURCES OF UNDER-REPORTING ON THE DIARY

¹ Christiane Laperrière, 100 Tunney's Pasture, Ottawa, Ontario, Canada, K1A 0T6, christiane.laperriere@statcan.gc.ca

There are several reasons why respondents do not indicate the totality of their spending during the two-week period covered by the diary. When this happens, we say that the household is under-reporting expenditures. In this section, the main sources of under-reporting will be presented, as well as the methods put in place to adjust the data and to minimize the under-reporting.

2.1 Forgotten Items

It is possible that some purchased items are not reported in the diary because they have been forgotten. Systematically forgotten items could lead to under-estimation, thereby causing a bias in the estimates. In order to help the respondents remember all their purchases made during the 14-day reporting period, there is a follow-up question asked by the interviewer during the pick-up of the diary after the reporting period. The follow-up question is the following: “*Some expenses such as gas and other related vehicle costs, lottery tickets, cigarettes and newspapers, meals and beverages bought outside your home, leisure activities, or hair salon and postal services are easily forgotten. Did you, or any member of your household, forget to record any of these expenses or any other expense in the diary?*”. If the respondent answers yes, then the interviewer will ask him/her to list the items that were missed. When asking the question on forgotten items, the interviewer is supposed to show a list of easily forgotten items included in the “Information Guide”. The follow-up question should be automatically asked when the diary is picked-up but some households may not respond to the question. In 2011, 3.85% of households did not answer the question.

A study of the forgotten items for the 2011 SHS (Houle and Thanabalasingam, 2014) looked at the items reported after this question was asked and the results showed that the most frequently forgotten items were gas, lottery tickets, meals and beverages bought outside the home, food, hair salon services, cigarettes and newspapers. In 2011, forgotten items were reported by 454 households, which represented 6.23% of the households for which the follow-up question was asked. This follow-up strategy helps minimize the number of expenditures that would be systematically forgotten. Note, however, that the respondents sometimes have difficulty remembering the date of the purchase and the cost of the forgotten items, resulting in missing or inaccurate information.

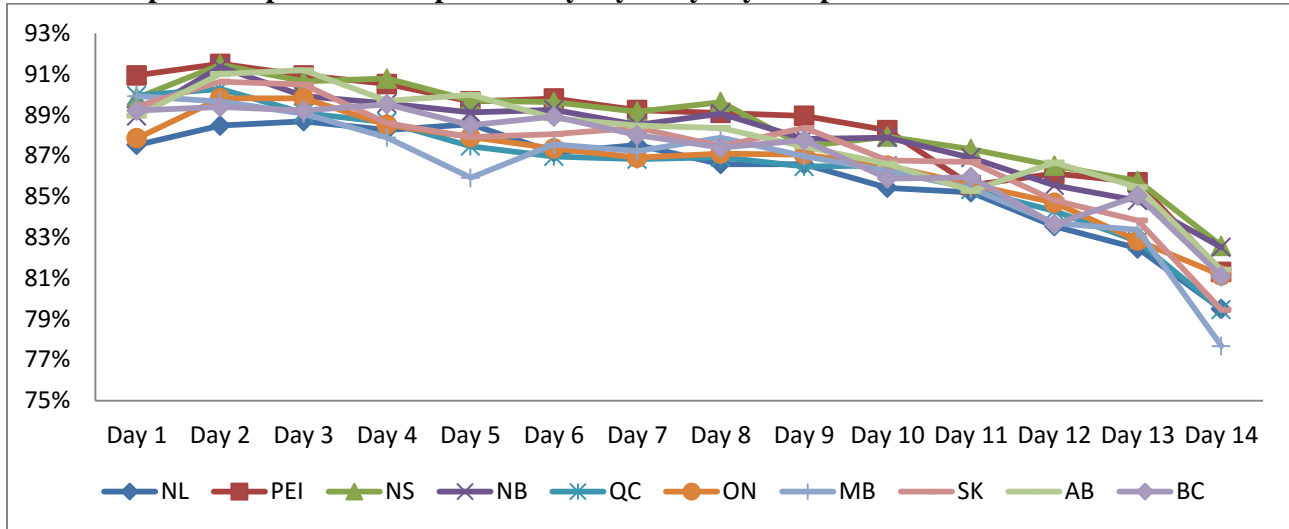
2.2 Household members who do not report their expenditures

Only one diary is given per household but all the members are asked to report their expenditures in that diary. In some cases, some members do not participate. This type of under-reporting is hard to detect and even more so to correct. A literature review was done on the use of individual diaries versus household diaries (Yurchak, 2015) in order to see if an individual diary, given to each member of the household, might encourage each individual to participate. Before considering this strategy for the SHS, evaluations would need to be done to determine the impact on household response rates as well as collection and processing costs. It is difficult to evaluate but we suspect that some household members with specific characteristics are more likely to not answer, which could lead to a bias.

2.3 Nonresponse by day

Nonresponse by day occurs when a diary is not completed for each day within the two-week period. A day is considered responded when there are expenditures reported for that day or when the respondent wrote “No spending” for that day. Otherwise, the day is considered nonresponded and it is impossible to know whether expenditures were made on that day or not. The following graphic shows the proportion of responded days by diary day and province for 2011-2013 diaries. Note that the first diary day is the next day following the interview, which can be any day of the week.

Graph 1: Proportion of responded days by diary day and province for 2011-2013 diaries



From the graph, it is clear that the proportion of responded days decreases as the days go on. In particular, the proportion of responded days is smaller in the second week of the diary. This decreasing trend is observed in all ten Canadian provinces (the territories are not included in this analysis). If the data are not adjusted for the nonresponded days, expenditures will be underestimated because of the underlying assumption that there was no spending on these days. Therefore, for each diary, an adjustment factor is computed by which the expenditures of the diary will be multiplied. In this section, the method to adjust the expenditures for nonresponded days will be described. It was developed in 2010, when the diary mode was first implemented for SHS. The results of this adjustment will be provided for 2011 to 2013 (i.e. excluding 2010) because minor coding errors occurred in the diary day variable in 2010, making some metadata information about the 2010 diaries of lesser quality. The adjustment factor to correct for nonresponded days will be a function of the number of nonresponded days in the diary and the type of diary. We define four types of diaries:

- 1) Diaries that have expenditures every day
- 2) Diaries that have expenditures and “No spending” days
- 3) Diaries that have expenditures, “No spending” days and **nonresponded days**
- 4) Diaries that have expenditures and **nonresponded days**

The diaries of type 1 and 2 are complete in terms of response by day since every day is responded. These diaries do not need to be adjusted. Diaries of type 3 and 4 are incomplete because they have at least one nonresponded day. The difference between type 3 and type 4 diaries is that type 3 diaries have at least one “No spending” day whereas type 4 diaries only have expenditures and nonresponded days. In fact, it will be assumed that the respondents to the diaries of type 4 did not follow the “No spending” day instruction properly and probably forgot to report some “No spending” days. It is therefore assumed that some of the nonresponded days of the type 4 diaries might be “No spending” days. There is information from collection which supports this assumption and confirms that some households do forget to write “No spending” on days where there were no expenditures. The following table shows the number (and proportion) of diaries by type for the combined years 2011-2013. Around 54% of the diaries are complete (i.e. of type 1 or 2).

Table 1: Proportion of diaries by type (2011-2013 combined)

Type	#	%
Type 1	1,478	9.53
Type 2	6,957	44.87
Type 3	3,077	19.85
Type 4	3,993	25.75
Total	15,505	100.00

The nonresponded day adjustment for a type 3 diary is computed by dividing 14 by the number of responded days (i.e. days with expenditures and “No Spending” days) of the diary in order to represent a 14 day period, i.e.:

$$\text{Adjustment} = 14 / \# \text{ responded days} \quad (1)$$

This means that all the expenditures and “No Spending” days of type 3 diaries will be inflated according to the number of nonresponded days that need to be corrected. The expenditures of the responded days will be inflated to represent expenditures that would have been made on nonresponded days and the number of “No spending” days will be inflated by the same factor. The underlying assumption is that nonresponded days are similar to responded days in terms of expenditures. Note that the adjustment is capped at $14/6=2.33$ to avoid getting too large adjustments.

The diaries of type 4, by definition, do not have “No spending” days identified by the household. It is possible that the respondents did not follow the instruction about writing “No spending” when appropriate, so some of the nonresponded days should actually be “No Spending” days. Consequently, before adjusting for the nonresponded days, the status of each nonresponded day needs to be revised. Some nonresponded days will remain nonresponded, but some may become “No spending” days. The goal is to convert enough nonresponded days into “No spending” days so that the final proportion of “No spending” days in type 4 diaries resembles the proportion of “No spending” days from the other diaries (of type 1 and 2, as well as type 3 after adjustment).

To do this, the proportion of “No spending” days is calculated for the diaries of type 1 to 3 combined (where the diaries of type 3 have been adjusted). This proportion is computed by day of the week (1st Monday, 1st Tuesday, ..., 2nd Sunday), household size (1, 2 and 3+) and household income quintile. In other words, the diaries of type 1, 2 and 3 of a given combination of day of week, household size and household income quintile are combined. For each group of diaries, the “No spending” proportion, PROP_NS123, is defined as follows:

$$\text{PROP_NS123} = \frac{\# \text{ No spending days}}{\text{Total number of diaries}} \quad (2)$$

Only a portion of nonresponded days of type 4 diaries will be converted to “No spending” days and so a similar adjustment factor as defined in (1) will need to be computed to correct for the remaining nonresponse. Because of this, we cannot use PROP_NS123 directly to convert nonresponded days into “No spending” days as the final proportion of “No spending” days would be greater than PROP_NS123 after the adjustment. To get the proportion of “No spending” days of type 4 diaries closer to PROP_NS123, the proportion of nonresponded days that should be changed to “No spending” was calculated as PROP_NS4:

$$\text{PROP_NS4} = \frac{(\text{PROP_NS123}) \cdot (\# \text{ of spending days in type 4})}{(1 - \text{PROP_NS123}) \cdot (\# \text{ of nonresponded days in type 4})} \quad (3)$$

This proportion is computed for each combination of day of the week, household size and household income quintile and will correspond to the proportion of the nonresponded days of type 4 diaries that will be converted to “No spending” days. Note that in some cases, for some combination of day of the week, household size and household income quintile, there are insufficient nonresponded days in type 4 diaries to allow the number of converted nonresponded days to “No spending” days to match PROP_NS123. In this case, all the nonresponded days are converted to “No spending” days but the final proportion of “No spending” days will still be smaller than PROP_NS123.

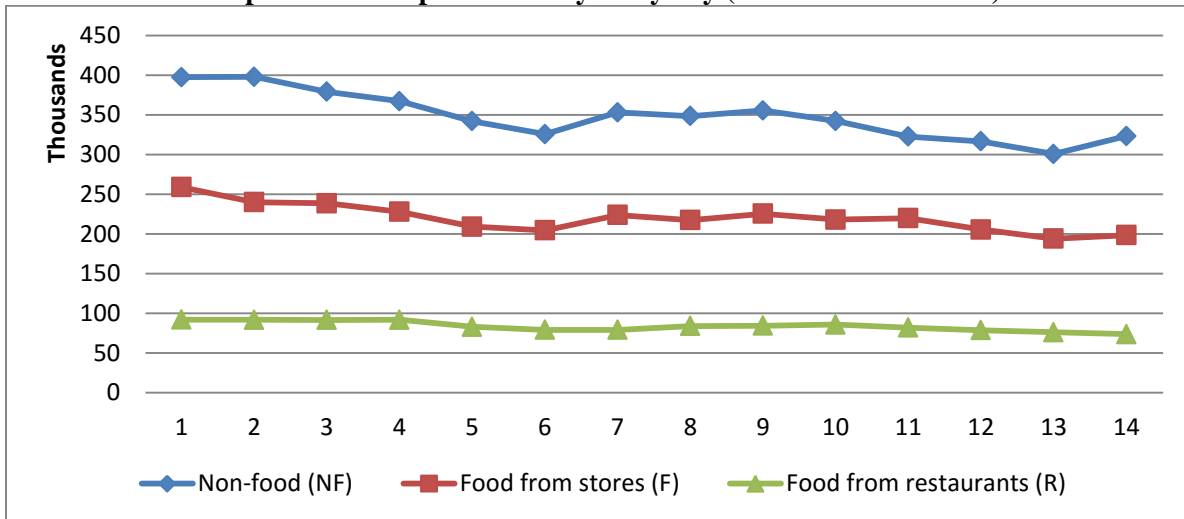
After the conversion of nonresponded days to “No spending” days (using formula (3)), a portion of nonresponded days will remain and so the expenditures (and the newly converted “No spending” days) will be adjusted to represent 14 days by using formula (1). In some cases, the final proportion of “No spending” days of type 4 diaries is still slightly different from PROP_NS123 and so we apply a final correction to bring the final number of “No spending” days from type 4 diaries closer to PROP_NS123.

Note that another way of converting some of the nonresponded days of type 4 diaries into “No spending” days would be to model the probability of a nonresponded day of being a “No spending” day. This could be done using a logistic regression and the values of the parameters could be estimated using complete diaries. It would need to be determined whether some auxiliary variables are significant in explaining the “No spending” days. Such variables might include the day of the week, the diary day (1 to 14) as well as some household level variables. This would need to be studied further and tested in order to determine if it constitutes an actual improvement over the current method.

2.4 Respondent Fatigue

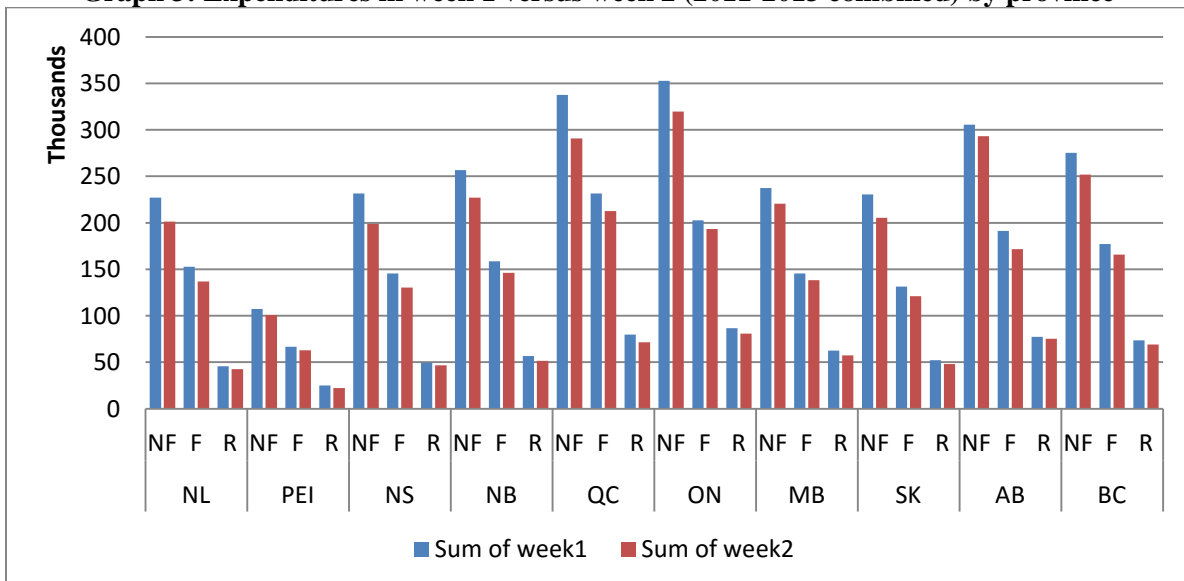
The respondent fatigue is a significant linear decrease of expenses reported in the diaries over the 14-day recording period. It is observed in SHS but also in expenditure surveys in other countries. The following graph depicts this phenomenon by showing a decreasing trend in expenditures. The dollar amount presented in the graph represents the unweighted sum of the cost of the three types of expenditures for all the diaries of 2011 to 2013 combined. Note that the expenditures in this graph are not adjusted for influential values or nonresponded days. A similar pattern is observed after adjusting for nonresponded days because the respondent fatigue is also expressed by an increasing number of No spending days and a decreasing level of expenditures (even amongst complete diaries that responded every day) as the days go on.

Graph 2: Total expenditures by diary day (2011-2013 combined)



The level of expenditures decreases over the 14-day recording period. The total expenditures for food from stores and non-food decreased by more than \$50,000 from day 1 to day 14, and total restaurant expenditures decreased by about half this amount from day 1 to day 14. In particular, the expenditures reported in the second week of the diary are less than the expenditures from the first week. The following graph shows the unweighted sum of total expenditures from week 1 and week 2 by province (for non-food items (NF), food from stores (F) and meals from restaurants (R), respectively) to measure the effect of respondent fatigue in the second week.

Graph 3: Expenditures in week 1 versus week 2 (2011-2013 combined) by province



For all categories and all provinces, the total expenditures from week 2 are lower than those from week 1. Note that similar patterns occur every year and not just when 2011 to 2013 diaries are combined. The lower total expenditures in week 2 can be attributed to more “No spending” days and nonresponded days, as well as possible under reporting of expenditures due to respondent fatigue. To evaluate the impact of this decreasing trend over the reporting period, 2013 SHS expenditure estimates were produced using only the first week data (instead of the data from the full two weeks). The same process was applied as with the usual estimates (influential value detection, adjustment for nonresponded days and annualization) but with minor changes to account for the use of only one week of data. For instance, the diary expenditures were annualized by being multiplied by 52 instead of 26 (so that expenditures represent the full year and not just the recording period). The following table shows the relative differences between the two scenarios (one-week data versus two-week data) based on the 2013 SHS diary expenditures. The differences are positive which means that the expenditures are greater when only one week of data is used. This was expected because there are more reported items in the first week. Note that these differences were not found to be statistically significant.

Table 2: Relative difference in means between one-week diary estimates and two-week diary estimates (Canada level-excluding territories) – 2013 SHS

Expenditure Categories	Relative Difference in means (%)
Food Expenditures	2.32
Food from Stores	2.20
Food from Restaurants	2.63
Transportation	5.81
Gas and other Fuels	5.74
Tobacco and Alcohol	4.96
Tobacco Products and Smokers’ Supplies	2.33
Alcoholic Beverages	6.18
Household Operations	5.39
Personal Care	3.18
Total diary	2.53

Note that the variance estimates associated with most expenditure estimates will also increase when only the first week items are considered. This is expected because there are less reporting households for each expenditure category and therefore the precision of the estimates will decrease. This is one important reason why this strategy would probably not be considered in production. Indeed, the diary is used to produce estimates for several expenditure categories, some of which are less frequent. For these less frequent expenditures, the quality of the estimates would not be sufficient if only one week of diary data was used. Furthermore, the impact on the main shares (i.e. the distribution of the total expenditures into specific major expenditure categories) was minimal. In other words, with only one week of data, the level of expenditures will go up, as well as the variance, but the distribution of the major expenditure categories remains stable.

3. CONCLUSION

Collecting expenditures with a diary can give detailed information that would be hard to collect through a retrospective interview. The diary collection mode is a good tool, especially for frequent expenditures, but it comes with a set of challenges such as under-reporting, low response rates and imputation (when level of detail is insufficient). As technology and lifestyle of the respondents evolve (e.g. increasing use of mobile and electronic devices), the methods in place to react to these challenges should be regularly evaluated and the diary collection mode might need to evolve accordingly.

REFERENCES

Houle, A.-M., Thanabalasingam, S. (2014). “Study of the forgotten items for the 2011 Survey of Household Spending”, Unpublished internal document, Statistics Canada (Household Survey Methods Division).

Yurchak, S. (2015). “Literature Review: Household vs. Individual Diaries”, Unpublished internal document, Statistics Canada (Household Survey Methods Division).