Fighting or Accepting Nonresponse: Considerations and Plans at Statistics Canada

Eric Rancourt[1]
Statistics Canada, 100 Tunney's Pasture Driveway, Ottawa, ON, Canada K1A 0T6

Abstract

Over the last few years, and particularly in recent post-pandemic times, survey nonresponse has been a major issue. Large efforts have been deployed across National Statistical Offices to find new ways of obtaining response rates that would seem more acceptable. While lower response rates do not necessarily imply that survey estimates will be of poor quality, everyone knows that the likelihood of bias is thus increased. Yet survey designs and estimation approaches are still mostly based on the assumption that data are missing either completely at random or at least at random. As the situation seems to keep worsening, should the reaction be to inject even more efforts to fight nonresponse, or should it be to accept it? In either case, what does it really mean? What are the underlying assumptions? This presentation attempts to revisit the basic survey design assumptions and practices and presents related considerations and developments at Statistics Canada.

Key Words: Administrative Data, Bias, Collection, Error, Sample Size, Variance

1. Introduction

Society continuously becomes more complex with technological developments as well as social and economic developments that bring the challenge of understanding society to new levels. Mobility of people, mobility of goods and mobility of information have reach never-seen-before heights. Of course, the COVID-19 pandemic momentarily slowed some of it but is also permanently altered some directions. The sociology of individuals and groups has changed. How people see themselves and how they interact with society is dramatically different today from only a decade ago. If we only think of social media, they are now a given and no serious large-scale activity or study can ignore them. Participation to social activities is viewed differently and will not go back to the high levels where National Statistical Offices (NSOs) have traditionally operated. This is quite flagrant when considering how much (or not) people are now willing to respond, how much they are willing to have their data shared and how much they can be reached.

The rest of this section looks at the nonresponse situation and the related issues. Then Section 2 focuses on the need to produce valid estimates, what it means in terms of bias and variance and what had been some of the traditional response to this. Section 3 attempts to go back to the primary assumptions that support the survey sampling theory. It is followed by Section 4 which describes some of Statistics Canada's work under what new assumptions should/could be. The conclusion completes the paper.

1.1 Nonresponse situation

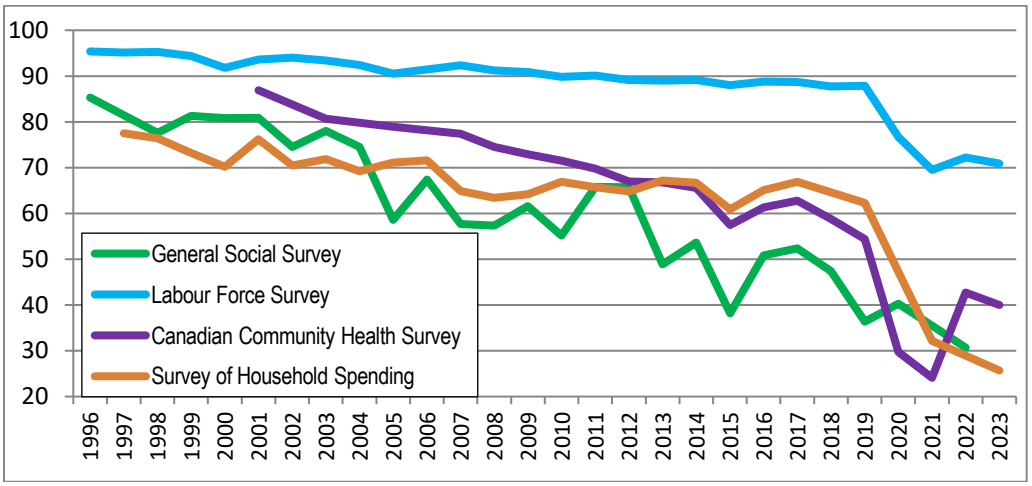
NSOs are responsible to provide with pictures of society as accurate as possible for decision-makers, organizations and people to be able to draw valid conclusions. A prime scientific approach to do this is to conduct surveys. This means that the NSO must reach and connect with people. To achieve

[1] This article contains planned approaches that have not yet been approved and/or implemented in Statistics Canada's programs.

this, solid registers and frames must be built and maintained. However, it is now very tricky to first correctly establish the link between addresses, cell phone numbers and email addresses and this makes it significantly harder to conduct surveys and achieve high response rates. We are left with declining response rates in surveys. This is taking place at the same time as the thirst and need for data keeps on increasing. It means that more surveys will be needed! Of course, one can resort to using much more administrative and alternative data, but this paper focuses on survey nonresponse.

The main issue with nonresponse with declining response rates is the potential for bias. Brick (2013) and Madans et al. (2023) provide great reviews of this field. The problem is that response rates are on a large downward trend, and this has been the case since the 1990's. Table 1. Shows the response rates for some of Statistics Canada's major household surveys. We are not presenting a table for the economic side, but the trend down is less acute but going in the same direction. As we can see, a few decades ago, response rates were generally in the 80-95% range with the flagship survey, the Labour Force Survey comfortably sitting around 95%. Nowadays, major efforts must be and are deployed to maintain it above 70% while other surveys are all (some significantly) below the 50% mark.

Table 1. Response rates (in %) for some of Statistics Canada's major household surveys



1.2 Issues and consideration

The first issue is nonresponse. Nonresponse is a complex phenomenon that has many dimensions in its causes. On the respondent side, there are refusals and avoidance. As alluded earlier, survey and social participation in general have changed. There are many psychological, sociological and economic reasons for not responding, the analysis of which is beyond this paper. On the collection side, it is more complex to find and maintain accurate contact information which makes it difficult to reach respondents and connect with them. On the survey design side, some questionnaires can be very complex because of the nature of the information needed to shed light on issues that have many facets and that are explained by or linked to many socio-economic factors. Such long or complex surveys are a real burden to respondents, combined with the fact that there are now many organizations conducting all kinds of surveys. This creates survey fatigue in the population. Further, the proliferation of misinformation and disinformation has increased scepticism in surveys in general. All of these combine to explain the nonresponse trends. So as the response rates are going down, the likelihood of producing valid estimates using traditional approaches will tend to be reduced.

A second issue is the capacity to collect. With more information being required on all fronts for decision making, NSOs are stretched to the maximum in their capacity to deliver information based

on surveys. For surveys to be successful, there needs to be interviewers available to perform data collection within the allotted time. This is carefully planned and managed for each survey and there is a need to properly sequence the timing of each survey. Given the staff turnover for interviews, the training needs and survey timing, there could be some local situations where the available capacity cannot match the collection needs. Much re-assignments and actions are put in place at the time of surveys, but they may not solve this issue in all circumstances. This will lead to nonresponse and in some cases potentially to reductions in data quality.

2. Aiming at Valid Estimates

2.1 Bias, variance and error

In surveys, when dealing with estimation and inference, a great deal of emphasis has been put on reducing and measuring the variance. This is not because people have been inconsiderate of potential bias but rather that when response rates were in the 95% vicinity, there was solid confidence that this 5% of nonresponse would be negligible. Further, all the efforts deployed by collection teams, by survey and questionnaire designers, led to safely assume that bias would be a very small component of the total error.

Nowadays, with response rates under 50%, this confidence has (rightly) eroded. The proportion of the total error that is due to bias could now dominate and put in question the efforts that are made to contain the variance. It is not that variance is no longer important to watch. Rather, it is that its relative importance to bias has changed. We are now at a point where much more attention and efforts need to be devoted to (potential) bias.

Considering the work of Meng (2018) we can look at what are the main sources of error when generally using a file (a sample in our case) to try to make valid inference about a population. The error can be summarized to be related to three elements:

1) The relation between the variable of interest and the fact of being part of the file (sample).
2) The gap in level that there is between the variables that are in and out of sample.
3) The variability of the data.

To cope with these a few approaches have been used.

2.2 Traditional response to nonresponse

Very often, to ensure that the effective sample size would be large enough, it was raised in anticipation of a certain nonresponse level. Similarly, oversampling in specific strata has often been used. These approaches help contain the variance and enable the production of disaggregated information, but they do not provide an adequate response in themselves for nonresponse.

In field operations, the practice has normally been to try to maximize efforts where most gains in terms of response rates can be made. Approaches have been developed to optimize the allocation of the work of interviewers using better case management systems, using field experience and by prioritizing cases to the extent possible given paradata. However, these could be contributing to bias in some instances when nonresponse is high.

In publications it is rarely possible to provide extensive amounts of quality indicators for every estimates. Coefficients of variation (CV) as well as response rates are the main indicators, generally provided at reduced number of aggregated estimates. Often, the CV is mapped onto a letter that indicates the quality and these are more spread in use than the actual CV. When the response rate is unusually low, this information will rather be provided to users through a general note in the publication.

Finally, nonresponse studies are sometimes conducted by linking the survey responses and nonresponses to administrative or census data whenever possible to try to gain information on the nature of nonrespondents. At the estimation stage, calibration is made using the variables that appear to have different values between respondents and nonrespondents.

3. Revisiting Survey Sampling Assumptions

3.1 Fighting or accepting nonresponse

Should nonresponse be fought or accepted?

In a sense, as was demonstrated in this paper thus far, nonresponse has been fought in many ways and this continues to be. On the other hand, nonresponse has been accepted in that the approaches considered continue to be used under the same assumptions that essentially say that there is no nonresponse. Let us look again at the issues considered so far in terms of assumptions.

Assumption 1: All units in the sample will be collected (there will be no nonresponse). This is at the heart of survey sampling. There are techniques to adjust for nonresponse, but essentially, the designs in place have been set up under this assumption. Clearly it is violated in pretty much all surveys.

Assumption 2: When/if there is nonresponse, it will have no impact. This corresponds to assuming that the data are either missing completely at random (MCAR) or at best missing at random (MAR). In the latter case, one would obviously use this knowledge to properly adjust estimates. So the assumption is that we are not in a case of data not missing at random (NMAR). One can never say with certainty that this assumption is or is not violated.

Assumption 3: The capacity to conduct surveys (with full dedication to difficult cases and to complete full collection within collection periods) is sufficient for the total number of units in all surveys. For this to be, there needs to be a planning and implementation of staff renewal, development and retention that perfectly matches the incoming demand for collection. Further, even with a complete staff complement, there are sequencing, and allocation issued across time and locations. This assumption is highly likely to be violated locally and consequently globally.

So, assumption 1 is violated, for assumption 2 we do not know and assumption 3 is highly likely to be violated. When nonresponse was 5%, the same worries existed but with much less impact. Now with much lower response rates, the question is central. In fact, the new main question is: How sustainable are designs under a trend that leads to an almost certainty that all assumptions will be not simply violated but severely violated? What if important shocks happened and made the rates drastically fall even more sharply?

3.2 Recent response

Having these shortcomings in mind, some recent activities have taken place at Statistics Canada in the last few years to try to overcome some of the issues. They were grouped under a significant corporate initiative called Modernization (Arora, 2018). With this initiative, Statistics Canada sought to get closer to user needs, to use more modern methods and to increase partnerships to reduce dependency on surveys as the main and often only data gathering vehicle. This also took the shape of an “admin-first” principle (Rancourt, 2018) whereby statistical programs, due to increasing difficulties in getting responses would attempt to maximize the use of administrative and alternative data by integrating them with surveys, if at all surveys were going to be used. This was the right approach as there was much to be gained from this wealth of data and soon the statistical programs grew in opportunities to produce more information than what surveys could produce.

The modernization initiative and the admin first principle constituted a direct answer to assumption 1 being violated. However, they created new difficulties in dealing with assumption 2 because the selection (response) mechanisms that lead to the administrative and alternative data files are not random and usually not known. So, one is left in the dark with assumption 2 and it is perhaps more likely to be violated. Then, administrative data seem to be the key to reducing the number of surveys. However, by bringing more answers, a larger output of data and information generates a larger number of more refined scientific questions and so demand for data and information increases. At Statistics Canada, while significantly more administrative files entered the statistical programs, the number of surveys also augmented, leaving assumption 3 to be a bit farther behind.

4. Working Under New Assumptions

So, impressive amounts of work have been deployed to counter nonresponse, but still there is a need to fight it even more. One possible way is to reject all the traditional assumptions and then work with adjusted ones such as:

Assumption 1*: There will be nonresponse.

Assumption 2*: Nonresponse will have an impact.

Assumption 3*: The collection capacity will be less than the sum of all sample sizes.

These are not pleasant assumptions, but they better reflect reality. They may mean important changes in theory and practice, but perhaps the first step should be to attempt to validate them (which would also equal to validating the original assumptions).

4.1 Validating assumptions

Different routes can be identified to work with the new assumptions. They could be grouped into two groups:

A) Making assumptions valid by design.
B) Validate assumptions and perhaps correct accordingly.

Under A), one could think of designing surveys in such a way to improve the use of modeling for adjustment. Rao and Ganghurde (1972) considered how to design surveys to optimize priors. Mendelson and Elliott (2024) studied how to optimally allocate the sample to account for the potential nonresponse. Another approach is to try to be reactive by changing the design during collection through responsive designs (Groves and Heeringa, 2006).

Under B), Zhang (2023) proposed to perform audit sampling whereby an external data source is used to validate the error estimates from the sample. Another option is to go back to Hanson and Hurvitz (1946) and implement a two-stage design to gather information on the nonrespondents. This is one of the directions that Statistics Canada has taken.

4.2 Current initiatives

In NSOs in general, and at Statistics Canada, there is a sense or urgency to adapt methods to the new context. Given the nonresponse issues presented in this article, it is simply not sustainable to go on under the traditional assumptions. So, to tackle nonresponse, and more broadly to further modernize its approaches and designs, Statistics Canada has embarked more aggressively into a series of projects aiming at changing aspects of survey designs as well as to make collection more sustainable. These are generally identified to be under the *methodological acceleration* and *sustainable collection* initiatives, Baribeau and Sallier (2024).

Methodological Acceleration. Under this initiative, several projects are underway and will be launched to makes survey designs evolve faster. Projects include increasing the pace at which (social) surveys move from a dwelling-based to a person-based sample design. This requires working towards a capacity to produce the required frames and samples and the statistical efficiency gains are being evaluated. Then, the aim is that modelling will be increasingly used in economic programs to produce model-based estimates. This will help reduce collection and models are being studied and validated. Another project is on the prioritization of which units should be followed-up to save collection efforts and therefore costs. Some work (Neusy et al., 2022) was already accomplish on this front, but there is still scope for more. The challenge is to ensure that resulting estimates are unbiased and fit for use. A fourth example is a project to "decouple" survey designs to better align with data needs. Such a project will look at the need for many questions vis à vis the need for large sample size and develop how to combine these in a simpler experience for respondents.

Sustainable Collection. Sustainable collection is two-fold. On the one hand it studies the differences between respondents and nonrespondents. A pilot survey of nonrespondents was carried out at the end of 2023 and showed that for a survey where the response rate was 30%, it was actually possible to design and collect data for a sub-sample of nonrespondents with a success rate of 70% response. In this case the sample was small (400 units) and significant efforts were deployed. Also, this was completed outside of the collection period which does not enable adjustment of estimates. However, it showed the potential of the approach and the fact that full capacity (assumption 3) can be secured. From a survey design planning perspective, the overall sample size could be reduced (paying the price of a slightly increased variance) to redirect the resulting funds to conduct the survey of nonrespondents. Plans are in place to study and pilot other surveys in real-time to allow for the possibility of adjusting estimates should nonrespondents significantly differ from respondents.

The second part of sustainable collection relates to the numerous research efforts that are carried out to try to find even more ways to improve and simplify collection. This can be from various viewpoints: more comprehensive research for contact information; collection scheduling; questionnaire simplification; and reducing the number of edits triggered at the time of collection.

5. Conclusion

Response rates have been on a downward trend for a long time. So, when it is time to push the gas pedal and really accelerate, how should we tackle it? The article attempted to show that the traditional survey sampling assumptions under which NSOs operate are mostly violated or will be. As a result, the current approaches are not sustainable should there be important shocks that would bring response rate to dramatically low levels. There is a need to operate immediately under the assumptions that nonresponse is high, that it can have impacts and that the capacity to collect is very limited. Getting these in motion is crucial. At Statistics Canada, two important initiatives have been launched to tackle this, the methodological acceleration and the sustainable collection. Underlying these is a view that nonresponse will not be accepted and needs to be fought aggressively and at a more fundamental level than thus far.

References

Arora, A. (2018). Modernizing the National Statistical System. Statistics Canada document, 89-20-003. Available at https://www150.statcan.gc.ca/n1/pub/89-20-003/892000032019001-eng.htm.

Baribeau, B. and Sallier, K. (2024). Sustainable collection - Optimizing Population-Based Surveying. Paper presented to the ACSM, 79. Internal document, Statistics Canada.

Brick, J. M. (2013). Unit Nonresponse and Weighting Adjustments: A Critical Review. *Journal of Official Statistics*, Vol. 29, No. 3, pp. 329-353. Available at DOI: 10.2478/jos-2013-0026.

Groves, R. M. and Heeringa, S. G. (2006). Responsive design for household surveys: tools for actively controlling survey errors and costs. *Journal of the Royal Statistical Society, Statistics in Society, Series A*, Vol. 169, Issue 3, pp. 439-457. Available at https://doi.org/10.1111/j.1467-985X.2006.00423.x.

Hansen, M.H. and Hurwitz, W.N. (1946). The Problem of Non-Response in Sample Surveys. *Journal of the American Statistical Association*, 41, 517-529. Available at http://dx.doi.org/10.1080/01621459.1946.10501894.

Madans, J. H., Earp, M. S., Blumberg, S. J., Christopher, E. M., Thompson, K. J., Sivinski, R. G., Frenk, S. M., Fakhouri, T. H. I. and Piscopo, K. D. (2023). *Best Practices for Nonresponse Reporting*, FCSM-23-01, Nonresponse Bias Subcommittee, Federal Committee on Statistical Methodology. Available at https://www.fcsm.gov/assets/files/docs/FCSM%20NRBA%20Report%20062623.pdf.

Mendelson, J. and Elliott, M. R. (2024). Optimal Allocation under Anticipated Nonresponse. *Journal of Survey Statistics and Methodology*, smae 020. Available at https://doi.org/10.1093/jssam/smae020.

Meng, X-L. (2018). Statistical Paradises and Paradoxes in Big Data (I): Law of Large Populations, Big Data Paradox, and the 2016 US Presidential Election. *The Annals of Applied Statistics*. Vol. 12, No. 2, pp. 685-726. Available at https://doi.org/10.1214/18-AOAS1161F.

Neusy, E., Beaumont, J.-F., Yung, W., Hidiroglou, M. and Haziza, D. (2022). Non-response follow-up for business surveys. *Survey Methodology*, Statistics Canada, Catalogue No. 12-001-X, Vol. 48, No. 1. Available at http://www.statcan.gc.ca/pub/12-001-x/2022001/article/00006-eng.htm.

Rancourt, E. (2018). Admin-First as a Statistical Paradigm for Canadian Official Statistics: Meaning, Challenges and Opportunities. *Proceedings of Statistics Canada Symposium 2018*. Available at https://www.statcan.gc.ca/en/media/2295.

Rao, J. N. K. and Ghangurde (1972). Bayesian Optimization in Sampling Finite Populations. *Journal of the American Statistical Association*, 67(338), pp. 439-443. Available at https://doi.org/10.1080/01621459.1972.10482406.

Zhang, L.-C. (2023). Audit Sampling as a Quality Standard for Multisource Official Statistics. *Spanish Journal of Statistics*, Vol. 5, No. 1, pp. 67-83. Available at https://doi.org/10.37830/SJS.2023.1.05.