

Sampling Weights, Estimation Weights, and Non-response Adjustments

When a sample is selected for a survey with unequal probabilities (as was the case for the NPS detailed questionnaire sample), weights are used when making estimates in order that the weighted sample is representative of the population. The original sampling weights (based on selection probabilities) are usually adjusted before estimation to reduce possible non-response biases. Censuses (a census was attempted for the 2007 NPS core questions) are subject to non-response, and as a result, weights to be used in estimation can be derived to reduce possible non-response biases. With the NPS, the non-response adjustments for both the sample survey component and the census component were performed at the province by physician type by age-group by gender level, using the method of calibration (reference: Survey Methods and Practices. Statistics Canada catalogue no.12-587-XPE, 2003.) The reference population for this calibration was the NPS Masterfile.

Eligible Population: Of the 62,441 physicians on the initial list eligibility could be determined for 20,869 physicians, of whom 1,630 were found to be ineligible. The weighting and non-response adjustment process included both the 19,239 physicians who responded to the survey and the 1,630 found to be ineligible, which allowed the estimation of the number of ineligible physicians among the 41,572 physicians whose eligibility was not confirmed. This method produces an estimate of 57,757 eligible physicians. The shaded cells in the table below are the estimated counts.

Estimated Eligible Population, 2007 NPS:

	Eligibility Determined	Eligibility not Determined	Total
Eligible	19,239	38,518	57,757
Not Eligible	1,630	3,054	4,684
Total	20,869	41,572	62,441

Responding Sample: For the core survey questions, there were 19,239 responses representing the 57,757 eligible physicians. After the non-response adjustments for different demographic groups, the final weights for these responses average almost exactly 3 (3.002), and range from 1.00 to 4.31.

For the questions on the detailed questionnaires, there were 7,347 responses representing the 57,757 eligible physicians. After the non-response adjustments were applied to the sampling weights for different demographic groups, the final weights for these responses average 7.86, and range from 1.00 to 13.72.

More detail on the distribution of the weights is provided in APPENDIX C.

Using the Weights

There are two sets of weights, one for the questions that appear on both the core and detailed questionnaires (core questions) and one for the questions that appear only on the detailed questionnaires (detail questions). For estimates that involve only core questions, such as 'Main Patient Care Setting by Province', or 'Satisfaction with Professional Life by Main Patient Care Setting', the core question weight should be used. Similarly, for estimates that only involve detail questions, such as 'Type of Internet Access by Record Keeping System', the detail question weight should be used. For tables that use both core questions and detail questions, such as 'Type of Internet Access by Main Patient Care Setting', the detail question weight should be used.

The two sets of weights make it possible to produce two estimates for any of the core questions. One is the natural estimate, using all the respondents and the core question weights, and the other is obtained by using the core question responses from the detailed questionnaire respondents (the core questions form a subset of the questions on the longer, detailed questionnaire) and the detail question weights. (The marginal totals for the core question from a table of a core question by a detail question will be estimates of the second type.) These two estimates will be slightly different because they are based on different sets of respondents. The estimates based on the larger sample (the core questionnaire sample) will be more precise because there are more respondents.

Sampling Variability of Estimates

The data from the 2007 NPS are based on a sample survey in the case of the detail questions and on a census with considerable non-response in the case of the core questions. Different results would have been obtained if a census with no non-response had been conducted for all of the items. These differences are called sampling and non-response errors, and sampling theory gives us a way to estimate how large they might be. For the NPS it has been assumed that the non-response was approximately at random and so that it can be treated essentially as part of the random selection process.

The variability of a survey estimate depends upon many factors, such as the size of the sample, its distribution among the strata, the size of the estimate, and the details of the sample design. Using the usual formulae for the sampling variance of estimates from simple random samples (ref: Cochran, W. (1977). *Sampling Techniques*. John Wiley and Sons, New York), and a conservative design effect adjustment to account for stratification and calibration, variability guidelines can be established for the 2007 NPS, and some general statements about precision of the estimates can be made:

- Estimates using core questions from the NPS for proportions of the entire population of physicians over all provinces will be within 1 percentage point of the true proportion, 19 times out of 20.
- Canada level estimates for core questions, but restricted to the Other Specialist or Family/General subpopulations will be within 1.5 percentage points, 19 times out of 20.

- Canada level estimates for detail questions for the entire population of physicians will be within 3.2 percentage points 19 times out of 20.
- Canada level estimates for detail questions for the Other Specialist or Family/General subpopulations will be within 5 percentage points 19 times out of 20.

These are conservative guidelines, based on the population and sample sizes, and on the most difficult proportion to estimate. This proportion is 50%; for smaller or larger estimates the confidence intervals are considerably narrower. For instance, an estimate of 5% (or 95%) for all physicians across Canada can be expected to be within .45 percentage points of the true value, 19 times out of 20.

The width of these confidence intervals is highly dependant on the sizes of the population and of the sample. The confidence interval widths for estimates for Newfoundland and Labrador or Prince Edward Island are about ten times the width of those for Canada, while those for Quebec or Ontario are only about three times the width of those for Canada. Please refer to APPENDIX A for additional detail about confidence limits and APPENDIX B for a list of provincial/territorial confidence limits.

The validity of the estimates of sampling variability and the resulting confidence intervals and tests of hypotheses depends on the validity of the assumptions on which they are based. The essential assumption is that the combined effect of sampling and non-response is approximately like that of a random sample within the classes that have been used for calibration. This is also the assumption under which the 2007 NPS estimates will accurately reflect the entire population of eligible physicians.

There were relatively few data elements available to test this assumption, but for the characteristics of physicians that were known for both the respondents and non-respondents the two groups looked very similar (see previous section). The next section presents the results of a supplementary survey of non-respondents to the full 2007 NPS that found some small but statistically significant differences between the respondent and non-respondent physicians.

The weighting adjusts for over- or under-representation of groups defined by province, type of physician (specialist versus FP/GP), age, and sex. Hence any response bias due to differential non-response between these groups has been removed through the calibration of the weights.