

2015 PISA Canadian Non-response Bias Analysis

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1. Introduction

In accordance with the PISA regulations, whenever a country fails to meet the required 85% school participation rate, a non-response bias analysis is required for that country. For the 2015 PISA, Canada failed to obtain this rate. Table 1 gives the weighted response rates by province.

Table 1: Weighted Response Rates by Province

Code	Province	Full Sample Size	Responding Schools	Final Weighted Response Rate
10	NL	55	49	96.97
11	PE	21	18	99.26
12	NS	59	54	98.47
13	NB	68	53	95.97
24	QC	180	93	51.67
35	ON	200	136	81.90
46	MB	112	85	92.42
47	SK	106	83	92.57
48	AB	114	80	80.37
59	BC	95	75	92.29
CAN		1,010	726	78.57

Considering these results, it is clear that Canada, as a whole, failed to meet the required 85% response rate. This is largely due to Quebec, Ontario, and Alberta missing this target by achieving values of 51.7%, 81.9%, and 80.4% respectively.

The Council of Ministers of Education Canada (CMEC) has contracted Statistics Canada to conduct the required non-response bias analysis for Quebec, Ontario, and Alberta. The purpose of this report is to document the findings of this analysis. The results for Quebec, Ontario, and Alberta are found in sections 2, 3, and 4 respectively. This report is concluded with section 5 with a summary of the findings.

2. Analysis for Quebec

In order to facilitate this analysis, the province of Quebec provided Statistics Canada with a list frame of all schools covered by the 2015 PISA. This list frame contained school demographic data detailing the type of funding of the school, the language of the school, and the size of the school. In addition to this demographic data, Quebec also provided the average student achievement scores for schools in Quebec for science and reading.

The non-response bias analysis for Quebec first considered the following distributions for the above-mentioned demographic variables.

1. The population;
2. The full weighted PISA sample (using the school base weight);
3. The weighted respondents from the PISA sample (using the school base weight);
4. The weighted non-respondents from the PISA sample (using the school base weight); and
5. The weighted respondents for the PISA sample after applying the non-response weight adjustment.

The following tables give these results.

Table 2: School Distribution by Language of School in Quebec

Language	Population Count	Population Percent	Sample Count	Full Weighted Sample (%)	Weighted Respondents (%)	Weighted Non-Respondents (%)	Weighted Sample After NR Adjustment (%)
1. English	119	19.01	64	19.21	17.48	20.88	16.41
2. French	507	80.99	116	80.79	82.52	79.12	83.59

Table 3: School Distribution by School Funding in Quebec

School Type	Population Count	Population (%)	Sample Count	Full Weighted Sample (%)	Weighted Respondents (%)	Weighted Non-Respondents (%)	Weighted Sample After NR Adjustment
1. Public	473	75.56	140	71.74	67.51	75.79	67.42
2. Private	153	24.44	40	28.26	32.49	24.21	32.58

Table 4: School Distribution by School Size in Quebec

School Size	Population Count	Population (%)	Sample Count	Full Weighted Sample (%)	Weighted Respondents (%)	Weighted Non-Respondents (%)	Weighted Sample After NR Adjustment
1. 27 or less	162	25.88	15	30.96	23.72	37.90	24.38
2. 28 to 93	155	24.76	35	24.35	28.51	20.36	28.73
3. 94 to 189	154	24.60	51	22.26	24.34	20.26	23.92
4. 190+	155	24.76	79	22.43	23.43	21.48	22.97

Considering these distributions, after adjusting for non-response, we do see some differences in the percentage of English schools, the percentage of public schools, and the percentages of schools in each school size in Quebec. These absolute differences are 2.6% and 8.14% for language and school funding type respectively and range as high as 3.97% for school sizes. While these differences may seem large at first, when one considers the average non-response adjusted weight, we find that some of these differences may be a bit misleading. That is, in the case of language, the average non-response adjusted weight for English schools is three. This implies that the observed differences are of the magnitude of about one weighted school. For school funding type, we find that these differences are of the magnitude of about six weighted schools. All of the differences observed for school sizes are of the magnitude of about one and a half weighted schools.

After considering the demographic data, we then considered the average student achievement scores for schools in Quebec for science and reading. During this analysis, for both science and reading, we produced the mean, first quartile, median, and third quartile for the average student achievement scores for schools in Quebec for the following.

1. The population;
2. The full weighted PISA sample (using the school base weight);
3. The weighted respondents from the PISA sample (using the school base weight);
4. The weighted non-respondents from the PISA sample (using the school base weight);
5. The weighted respondents for the PISA sample after applying the non-response weight adjustment;
6. The 95% confidence intervals were also produced for the weighted respondents for the PISA sample after applying the non-response weight adjustment.

The following tables give these results.

Table 5: Statistics for Average Student Achievement Scores for Schools in Quebec for Science

Statistic	Population	Full Weighted Sample	Weighted Respondents	Weighted Non-Respondents	Weighted Sample After NR Adjustment	95% Confidence Interval
1. Mean	70.35	70.97	72.45	69.29	72.50	(71.58,73.43)
2. Q1	66.22	66.22	68.13	64.18	68.21	(65.71,70.60)
3. Median	70.77	71.37	73.48	70.04	73.58	(71.62,75.40)
4. Q3	74.45	76.39	76.61	73.61	76.61	(75.44,77.36)

Table 6: Statistics for Average Student Achievement Scores for Schools in Quebec for Reading

Statistic	Population	Full Weighted Sample	Weighted Respondents	Weighted Non-Respondents	Weighted Sample After NR Adjustment	95% Confidence Interval
1. Mean	72.68	73.04	72.97	73.14	72.88	(71.69,74.07)
2. Q1	69.82	70.07	69.24	70.37	69.21	(65.34,72.73)
3. Median	72.53	73.20	73.39	73.04	73.20	(71.84,74.55)
4. Q3	76.00	76.33	76.69	74.81	76.33	(75.13,77.50)

Considering these results, we see statistically significant differences between non-response adjusted estimates of the mean and the median and the corresponding population parameters for science. The absolute differences between the estimates and the population parameters are 2.15% and 2.81% respectively. No statistically significant differences are observed between non-response adjusted estimates and the population parameters when considering the student achievement scores for reading.

3. Analysis for Ontario

The province of Ontario provided Statistics Canada with a list frame of all schools covered by the 2015 PISA. This list frame contained school demographic data detailing the type of funding of the school, the language of the school, and the size of the school. In addition to this demographic data, Ontario also provided the school success rate for a 2015 provincial assessment for schools selected for the PISA sample.

The non-response bias analysis for Ontario first considered the following distributions for the above-mentioned demographic variables.

1. The population;
2. The full weighted PISA sample (using the school base weight);
3. The weighted respondents from the PISA sample (using the school base weight);
4. The weighted non-respondents from the PISA sample (using the school base weight); and
5. The weighted respondents for the PISA sample after applying the non-response weight adjustment.

The following tables give these results.

Table 7: School Distribution by Language of School in Ontario

Language	Population Count	Population (%)	Sample Count	Full Weighted Sample (%)	Weighted Respondents (%)	Weighted Non-Respondents (%)	Weighted Sample After NR Adjustment
1. English	1,219	91.86	112	90.20	88.73	94.08	87.98
2. French	108	8.14	51	9.80	11.27	5.92	12.02

Table 8: School Distribution by School Funding in Ontario

School Type	Population Count	Population (%)	Sample Count	Full Weighted Sample (%)	Weighted Respondents (%)	Weighted Non-Respondents (%)	Weighted Sample After NR Adjustment
1. Public	760	57.27	93	57.64	69.09	27.35	69.66
2. Private	278	20.95	8	19.70	1.42	68.03	1.38
3. Catholic	289	21.78	62	22.66	29.48	4.62	28.96

Table 9: School Distribution by School Size in Ontario

School Size	Population Count	Population (%)	Sample Count	Full Weighted Sample (%)	Weighted Respondents (%)	Weighted Non-Respondents (%)	Weighted Sample After NR Adjustment
1) 5 or less	347	26.15	3	6.29	1.82	18.12	2.16
2) 6 to 78	319	24.04	26	25.01	19.07	40.71	20.00
3) 79 to 207	331	24.94	61	36.26	41.01	23.68	40.53
4) 207+	330	24.87	73	32.44	38.1	17.49	37.31

Considering the results for language, we find an absolute difference of about 3.88% between the non-response adjusted estimate for English schools and the corresponding population parameter. This difference is of the magnitude of about six weighted English schools or two weighted French schools.

Considering the results for school funding type, we do find large differences between the distribution of the population and the non-response adjusted sample. These differences are explained by the fact that the sample design did not explicitly take this data into account. As a result, only one responding private school was obtained.

Considering the results for school size, once again we do observe some large differences. Once again, these differences are attributed to the sample design and weighting strategy and not non-response bias.

After considering the demographic data, we then considered the school success rate for a 2015 provincial assessment for Ontario schools sampled for PISA. During this analysis we produced the mean, first quartile, median, and third quartile for the following.

1. The full weighted PISA sample (using the school base weight);
2. The weighted respondents from the PISA sample (using the school base weight);
3. The weighted non-respondents from the PISA sample (using the school base weight);
4. The weighted respondents for the PISA sample after applying the non-response weight adjustment;
5. The 95% confidence intervals were also produced for the weighted respondents for the PISA sample after applying the non-response weight adjustment.

The following table gives these results.

Table 10: Statistics on School Success Rate for a 2015 Provincial Assessment of Ontario Schools

Statistic	Full Weighted Sample	Weighted Respondents	Weighted Non-Respondents	Weighted Sample After NR Adjustment	95% Confidence Interval
1. Mean	78.12	75.95	87.36	75.76	(70.77,80.75)
2. Q1	73.20	71.35	82.88	71.35	(64.71,76.76)
3. Median	84.34	84.00	91.89	84.00	(82.03,85.93)
4. Q3	91.67	89.43	100.00	89.43	(88.41,90.44)

Considering these results, we cannot conclude that there is a statistically significant difference between the non-response adjusted estimates and what we would have obtained if we achieved a 100% response rate.

4. Analysis for Alberta

The province of Alberta provided Statistics Canada with a list frame of all schools covered by the 2015 PISA. This list frame contained school success rates for a provincial assessment covering the topics of math, reading, and science. In addition to this data, demographic data was obtained for the full PISA sample.

The non-response bias analysis for Alberta first considered the following distributions for the obtained demographic data.

1. The full weighted PISA sample (using the school base weight);
2. The weighted respondents from the PISA sample (using the school base weight);
3. The weighted non-respondents from the PISA sample (using the school base weight); and
4. The weighted respondents for the PISA sample after applying the non-response weight adjustment.

The following tables give these results.

Table 11: School Distribution by Language of School in Alberta

Language	Sample Count	Full Weighted Sample (%)	Weighted Respondents (%)	Weighted Non-Respondents (%)	Weighted Sample After NR Adjustment
1. English	101	98.01	95.21	99.43	96.24
2. French	13	1.99	4.79	0.57	3.76

Table 12: School Distribution by School Funding in Alberta

School Type	Sample Count	Full Weighted Sample (%)	Weighted Respondents (%)	Weighted Non-Respondents (%)	Weighted Sample After NR Adjustment
1. Public	110	91.37	94.91	89.57	95.67
2. Private	4	8.63	5.09	10.43	4.33

Table 13: School Distribution by School Size in Alberta

School Size	Sample Count	Full Weighted Sample (%)	Weighted Respondents (%)	Weighted Non-Respondents (%)	Weighted Sample After NR Adjustment
1) 3 or less	15	48.61	2.10	72.16	1.65
2) 4 to 19	18	27.46	45.09	18.54	57.23
3) 20 to 68	17	13.19	25.61	6.89	20.36
4) 69+	64	10.74	27.20	2.41	20.75

Considering these results, there is little we can say about the effect of non-response on these demographic data. For language and school funding type, it is clear that any observed differences would be caused by small sample sizes for French and private schools. Once again, differences observed for school sizes are attributed to the sample design and weighting strategy and not non-response bias.

After considering the demographic data, we then considered the school success rates for a provincial assessment of Alberta schools in math, reading, and science. During this analysis we produced the mean, first quartile, median, and third quartile for the following.

1. The population
2. The full weighted PISA sample (using the school base weight);
3. The weighted respondents from the PISA sample (using the school base weight);
4. The weighted non-respondents from the PISA sample (using the school base weight);
5. The weighted respondents for the PISA sample after applying the non-response weight adjustment;
6. The 95% confidence intervals were also produced for the weighted respondents for the PISA sample after applying the non-response weight adjustment.

The following tables give these results.

Table 14: Statistics on School Success Rate for Math for a Provincial Assessment of Alberta Schools

Statistic	Population	Full Weighted Sample	Weighted Respondents	Weighted Non-Respondents	Weighted Sample After NR Adjustment	95% Confidence Interval
1. Mean	67.11	61.66	65.79	53.57	64.00	(61.21,66.79)
2. Q1	55.81	50.00	60.00	33.33	60.00	(47.67,68.00)
3. Median	69.08	64.84	67.86	63.79	64.84	(60.75,68.82)
4. Q3	81.01	70.73	72.94	66.67	70.73	(68.28,71.92)

Table 15: Statistics on School Success Rate for Reading for a Provincial Assessment of Alberta Schools

Statistic	Population	Full Weighted Sample	Weighted Respondents	Weighted Non-Respondents	Weighted Sample After NR Adjustment	95% Confidence Interval
1. Mean	79.75	80.18	80.85	79.28	79.09	(75.84,82.34)
2. Q1	73.08	76.47	78.33	60.00	76.47	(69.24,83.38)
3. Median	83.33	83.30	82.14	88.89	81.05	(80.06,81.87)
4. Q3	91.49	90.10	88.89	91.67	87.12	(85.28,88.63)

Table 16: Statistics on School Success Rate for Science for a Provincial Assessment of Alberta Schools

Statistic	Population	Full Weighted Sample	Weighted Respondents	Weighted Non-Respondents	Weighted Sample After NR Adjustment	95% Confidence Interval
1. Mean	75.79	73.80	77.06	68.84	75.45	(73.30,77.60)
2. Q1	69.41	66.67	73.02	60.00	73.02	(62.76,82.34)
3. Median	79.41	75.00	75.00	74.14	75.00	(74.20,75.03)
4. Q3	87.60	85.29	85.71	77.78	84.42	(80.41,88.30)

Considering the results for math, we do find statistically significant differences between the non-response adjusted estimates and the population parameters for the mean, median, and third quartile. These absolute differences are 3.1%, 4.2%, and 10.3% respectively.

The non-response adjusted estimates seem more comparable to the corresponding population parameters for reading and science observing statistically significant differences for the medians and third quartiles for these topics. These absolute differences are 2.3% and 4.4% for reading and 4.4% and 3.2% for science respectively.

While we did observe some differences between the non-response adjusted estimates and the corresponding population parameters, very few statistically significant differences are observed between the non-response adjusted estimates and the estimates we would have obtained with a 100% response rate. Only the median and third quartile for reading are identified in this case with absolute differences of 2.25% and 2.98% respectively. This suggests that the differences between the population and the non-response adjusted sample are not associated with non-response.

5. Conclusion

In this report, we conducted a non-response bias analysis for Quebec, Ontario, and Alberta. For each of these provinces, we considered the impact that non-response has on estimates of demographic data and on estimates of student achievement.

For all three provinces, the analysis of the demographic data yielded nothing definitive in terms of non-response bias.

With respect to the estimates of student achievement, the results for Quebec seem to suggest that the non-response adjusted estimates for science differ slightly from the population parameters. There were no differences observed for the Quebec reading results.

In Ontario, no differences were observed between the non-response adjusted estimates and the estimates we would have obtained under a 100% response rate for student success rate.

In Alberta, the non-response adjusted estimates differed significantly from the population parameters for student success rate in math, reading, and science. However, only two statistically significant differences are observed between the non-response adjusted estimates and the estimates we would have observed if we obtained a 100% response rate. These two differences being the median and third quartile for reading. This suggests that the differences between the population and the non-response adjusted sample are not associated with non-response.

Based on this analysis, it does not seem likely that the sub-85% response rates in Quebec, Ontario, and Alberta would adversely impact the quality of the Canadian estimates.