

Uncertainty in times of COVID-19: Choosing whether to ask 1 or 2 questions

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Purpose

We fielded three questions regarding uncertainty in the April 2020 COVID-19 situation in Canada. Goal is to select either a two-question survey, using different questions for employment and consumer behavior, or a composite question that encompasses both. The question is whether answers between the two-question version differ between questions. The composite question was asked as a control.

Sources

We pre-registered the decision based on **preliminary data** collected after the first day of fielding the question (on 20200421). The decision about choice of the question, as well as preliminary descriptive results, are based on **test data** collected over the entire test time period, with a target n of 250 per question. We collected data from 2020-04-12 to 2020-04-17 across Canada, achieving a total $n=753$.

The data was manually downloaded from the Google Consumer Survey site on 20200412, and saved, using the naming convention **tag-YYYYMMDD-HHMM.xlsx**. Data used for both the original design and the full test time period are available in this archive.

Preliminary data files

Test data files

Fielded questions

We fielded three questions in the test sample:

- How much longer do you expect social distancing rules (restrictions on gatherings, stay-at-home rules) to stay in place in your province?
- How much longer do you expect the closure of non-essential businesses to stay in place in your province?

- How much longer do you expect social distancing rules (restrictions on gatherings, closure of non-essential businesses, stay-at-home rules) to stay in place in your province?

For each question, we collected responses on a Likert scale with text: “less than 1 month”, “1-2 months”, “2-3 months”, “3-6 months”, “more than 6 months”, and a response equivalent to “does not apply” (“My province has not implemented such rules.”).

First results

Total observation by tag / question

tag	date	count
business	20200421	251
composite	20200421	251
people	20200421	251

Responses to Question 1

Q1	count	percent
less than 1 month	25	9.96
1-2 months	77	30.68
2-3 months	55	21.91
3-6 months	39	15.54
more than 6 months	37	14.74
My province has not implemented such rules.	18	7.17

Responses to Question 2

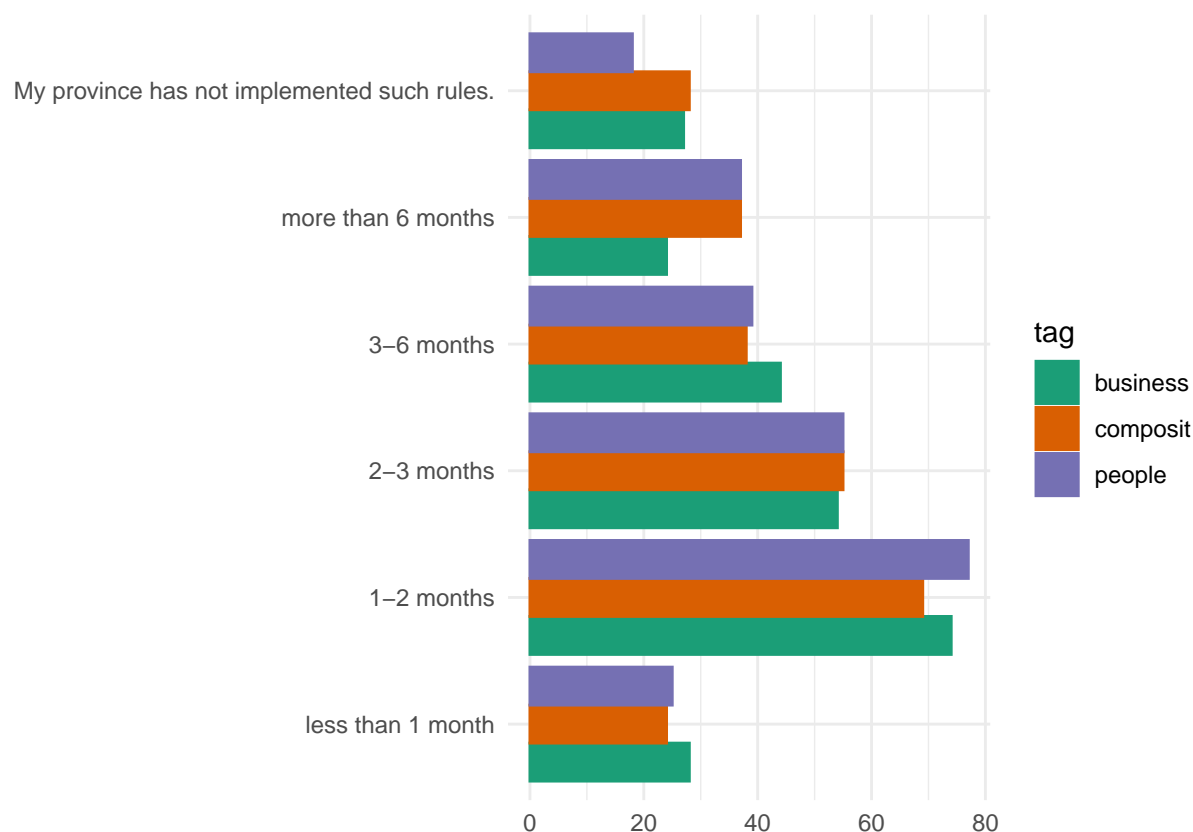
Q1	count	percent
less than 1 month	28	11.16
1-2 months	74	29.48
2-3 months	54	21.51
3-6 months	44	17.53
more than 6 months	24	9.56
My province has not implemented such rules.	27	10.76

Responses to Question 3

Q1	count	percent
less than 1 month	24	9.56
1-2 months	69	27.49
2-3 months	55	21.91
3-6 months	38	15.14
more than 6 months	37	14.74
My province has not implemented such rules.	28	11.16

Do the different questions yield different responses?

Visually



Kolmogorov-Smirnov Test

```
##  
## Two-sample Kolmogorov-Smirnov test  
##  
## data: hist.business and hist.people  
## D = 0.16667, p-value = 1  
## alternative hypothesis: two-sided
```

In the Kolmogorov-Smirnov test, the entire (cumulative) distribution is tested for equality. The hypothesis of equality of distributions is rejected when the test statistic D is larger than $c(\alpha)\sqrt{\frac{n+m}{n*m}}$ where n and m are the sample sizes.

For the full test data, $n = 251$ and $m = 251$, the square root evaluates to 0.0892644. The test statistic $D = 0.166667$, with a p-value of 1. Based on the KS test, we thus reject the hypothesis of equality of distributions.

Single-dimensional test

Alternatively, we can compute a z -test for the proportion responding to Q1 with “1-2 months”, with the remaining fractions collapsed to an “other” category. For the test sample, these numbers are 29.4820717 percent for the **business** version, and 30.6772908 percent for the **people** version. The χ^2 statistic has a value of 0.0378861 and a p-value of 0.8456721. Based on the z -test, we cannot reject the hypothesis of equality

of responses to Q1. For the (non-pre-registered) comparison of the fraction responding with “more than 6 months”, the χ^2 statistic has a value of 2.6871863 and a p-value of 0.1011583.

The test has power of 0.05 for the sample size $n=251$ and effect size 9.56 at $\alpha = 0.05$.

Fisher’s exact test

```
##
## Fisher's Exact Test for Count Data with simulated p-value (based on
## 10000 replicates)
##
## data: hist.business and hist.people
## p-value = 1
## alternative hypothesis: two.sided
```

We can also use Fisher’s exact test to assess whether the two distributions are different. The null hypothesis is that the rows *and* columns of the two histograms are independent (i.e., the two distributions are different). Fisher’s test when applied to the test sample gives a p-value of 1, so the null that the two distributions are different should be rejected.

χ^2 test

```
##
## Pearson's Chi-squared test with simulated p-value (based on 10000
## replicates)
##
## data: hist.business and hist.people
## X-squared = 30, df = NA, p-value = 1
```

Finally, a χ^2 test of independence of distributions yields a test statistic of 30 and a p-value of 1, not rejecting the null that the two histograms are different.

Decision Criterion

We will use one composite question if the two variants (**business** and **people**) are not statistically different in our test sample, according to the majority of tests.

Results

Based on the observed data from the test data collected between 2020-04-12 and 2020-04-17 across Canada, we chose the two-question version.