# Style:

[REF] Pending reference, with the following URL

**[REF]** Pending reference, with the given topic (need to find relevant papers)

**[REF]** Pending reference, with un-specified topic (need to find relevant papers)

**<DATA>** Pending data, need to be filled with data from the cited papers

**<DATA>** Pending data, need to be find relevant paper with such data

# 2. Methodology (supplementary)

## 2.1 Data acquisition

### 2.1.1 Epidemiological data

We acquired the past COVID-19 cases, deaths, and vaccination data in the 26 Public health units (PHU) from Ontario public health [[[1]](#endnote-1)]. The data was originally stratified into **<DATA>** age bands.

### 2.1.2 Workforce data

We used the labour force age distribution from **[REF]** 上一次人口普查 (YEAR **<DATA>**) and the employment rate (Aug 2022) **[REF]** by Statistic Canada.

We constructed a dynamic model for the local and commuting labour force in Ontario.

We estimated the number of

We acquire the number of commuters in working in each county and residing in a county is.

## 2.2 Data processing

### 2.2.1 Age-specific data Calibration

Due to the different dimensionality of the contact matrix in Canada (16 age-bands) and the Ontario epidemiological data (6 age-bands), we augmentation the Ontario data using difference of Gaussians (DoG).

|  |  |  |
| --- | --- | --- |
|  |  | (1) |

Where is a positive integer which denotes to the age of distribution, denotes to the set of the raw age distribution with a 10-years age sensitivity, denotes to two positive constants, is a tuple with the median age of the age band and percentage distribution at 1st and 2nd entry, respectively.We then integrated the age of each six age bands.

### Vaccine efficacy

The most prevalence vaccine offered in Canada are offered by Moderna and Pfizer-BioNTech.

### Cases and deaths calibration

**[REF]** suggested that there are significant underascertainment of the number of cases and deaths of COVID-19 in Canada. We calculated the average of the underascertainment ratio of **<DATA>** and assumed the number to be constant throughout the pandemic.[REF]

Commuting

**(**[**https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2021.26.50.2001559?crawler=true&mimetype=application/pdf**](https://www.eurosurveillance.org/content/10.2807/1560-7917.ES.2021.26.50.2001559?crawler=true&mimetype=application/pdf)**,** [**https://www.cmajopen.ca/content/10/3/E599**](https://www.cmajopen.ca/content/10/3/E599)**).**

We analyzed the

Bolotin, S., Tran, V., Deeks, S. L., Peci, A., Brown, K. A., Buchan, S. A., Ogbulafor, K., Ramoutar, T., Nguyen, M., Thakkar, R., DelaCruz, R., Mustfa, R., Maregmen, J., Woods, O., Krasna, T., Cronin, K., Osman, S., Joh, E., &amp; Allen, V. G. (2021). Assessment of population infection with SARS-COV-2 in Ontario, Canada, March to June 2020. Eurosurveillance, 26(50). https://doi.org/10.2807/1560-7917.es.2021.26.50.2001559

1. https://data.ontario.ca/en/dataset/confirmed-positive-cases-of-covid-19-in-ontario [↑](#endnote-ref-1)