# 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

Canada offers

### 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] We estimated the number of cases from the reported deaths and CFR, using the following method:

Where denotes to the case fatality ratio of COVID-19 for a specific age band , denotes to the number of deaths within the age band.

**(**[**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

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