

Effectiveness_of_travel_restrictions

October 14, 2020

```
[1]: from IPython.display import Image  
Image("../Images/Logo.jpg")
```

[1]:



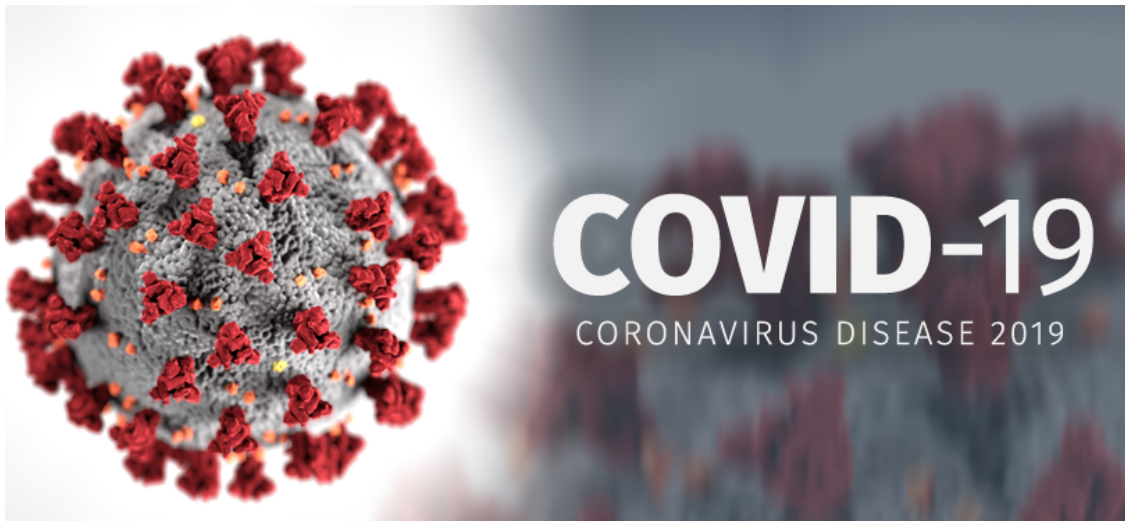
#

Graduate Project ENEL 698

Github Link

```
[2]: Image("../Images/Covid-19.png")
```

[2]:



0.1 This Notebook constitutes of analysis of Effectiveness of inter/inner travel restrictions for reducing Coronavirus Disease 2019 (COVID-19) transmission.

0.2 Objective and Scope

0.2.1 Quarantine measures have been implemented around the world in response to the global spread of severe acute respiratory syndrome-coronavirus 2 (SARS-CoV-2). This analysis helps in understanding how travel and quarantine affect the dynamics of the propagation of this new human virus.

- This analysis will address the following question:

1. This analysis will tell us what is the effectiveness of inter/inner travel restrictions on reducing transmission of COVID-19?

Lets load the intervention scan data (Canada Specific)

- Data Source - For more info please click [here](#).

```
[3]: #importing the necessary files required for visualization and statistical
      ↪analysis

import requests

import pandas as pd
import numpy as np

import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline

import plotly.express as px
import chart_studio.plotly as py
import plotly.graph_objects as go
from plotly.offline import download_plotlyjs, init_notebook_mode, plot, iplot
```

```
[4]: intervention_scan = pd.ExcelFile('../covid_data/Data/InterventionScanCanada/
      ↪covid-19-intervention-scan-data-tables-en.xlsx')

# Its a big datasheet lets see how many sheets it constitutes

print("This dataset contains {} sheets {}".format(len(intervention_scan.
      ↪sheet_names), intervention_scan.sheet_names))
```

This dataset contains 6 sheets ['COVID-19 Intervention Scan', 'Notes to readers', 'Intervention scan', 'Data dictionary', 'Version history', 'Filters'].

Loading Individual Sheets

```
[5]: # Parsing Individual sheets to gather data specific information

intervention_scan_data_info = intervention_scan.parse('COVID-19 Intervention_
↳Scan')
intervention_scan_data_info.head()
```

[5]: Screen reader users: This workbook has 5 worksheets, including this title page, notes to readers on tab 2, an intervention scan on tab 3, a data dictionary on tab 4 and version history on tab 5.

```
0      COVID-19 Intervention Scan - Data Tables
1  This data table provides information on select...
2  Unless otherwise indicated, this product uses ...
3      Additional resources
4  To learn more about data and information on CO...
```

```
[6]: pd.set_option('display.max_colwidth', -1)
```

C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:1:
FutureWarning:

Passing a negative integer is deprecated in version 1.0 and will not be supported in future version. Instead, use None to not limit the column width.

```
[7]: intervention_scan_notes_to_reader = intervention_scan.parse('Notes to readers')
intervention_scan_notes_to_reader.head(5)
```

```
[7]:      Notes to readers
0  This data table provides information on select interventions (policies and
other measures) to stop the spread and improve health outcomes from COVID-19 by
jurisdiction (Canada, province and territory).
1  Data sources
2  Primary sources of data include announcements of interventions on the
following websites: ministry press releases, ministry websites,
federal/provincial/territorial public health agency websites, Indigenous
organizations as well as provincial and territorial regulatory bodies for health
professions. Secondary sources of data include additional links (e.g., media
articles, updated releases, and supporting documentation) that provide more
information not covered in the primary source.
3  Scope and search strategy
4  • The scan provides comprehensive information on key health interventions for
case finding and management, physical distancing, health workforce capacity,
health services and travel restrictions. Contextual information, such as the
timing of spring breaks, is also included.\n• The search strategy for this scan
is limited to interventions announced or implemented by the federal, provincial
and territorial governments, along with regulatory bodies of select health
professions. Interventions announced by national Indigenous organizations (e.g.,
```

Assembly of First Nations, National Association of Friendship Centres) are also included. \n• Interventions related to Indigenous groups are noted in the Indigenous population group column. \n• Interventions announced below the provincial and territorial level were considered out of scope for the data collection search strategy. In some instances, however, health region or municipal level interventions are included in provincial and territorial announcements and may be tracked in this document. Regional and municipal entries can be identified by filtering by the "Level" column.\n• See Data dictionary tab for more information on the scope and categorization of interventions for this project.

```
[8]: intervention_scan_DataDictionary = intervention_scan.parse('Data dictionary')
intervention_scan_DataDictionary.head(5)
```

[8]: Screen reader users: This tab contains 2 tables. The first table is called Table 2: Column attributes. It begins at cell A8 and ends at cell B20. The second table is called Table 3: Intervention attributes. It begins at cell A22 and ends at cell D61. \

0 Data dictionary

1 This tab provides a list of variables, intervention types and their descriptions for CIHI's COVID-19 Intervention Scan.

2 Data set description:

3 Data current to:

4 Update frequency:

	Unnamed: 1	Unnamed: 2	Unnamed: 3
0	NaN	NaN	NaN
1	NaN	NaN	NaN
2	COVID-19 Intervention Scan	NaN	NaN
3	2020-06-22 00:00:00	NaN	NaN
4	Ad hoc	NaN	NaN

```
[9]: intervention_scan_versionhistory = intervention_scan.parse('Version history')
intervention_scan_versionhistory
```

[9]: Screen reader users: There is 1 table on this tab called Table 4: Version history. It begins at cell A3 and ends at cell B6. \

0 Table 4 Version history

1 Publication date

2 2020-06-18 00:00:00

3 2020-07-14 00:00:00

4 2020-08-18 00:00:00

	Unnamed: 1
0	NaN
1	Changes made
2	Initial release. Includes announcements up to May 5.

- 3 Updated to include announcements up to May 27.
- 4 Updated to include announcements up to June 22.

[10]: *#### Now Lets see the Dataframe*

```
intervention_scan_data = intervention_scan.parse('Intervention scan',header=2)
intervention_scan_data.head(5)
```

```
[10]:  Entry ID Jurisdiction      Date announced      Date implemented \
0  BC007      B.C.          2020-03-15 00:00:00  2020-03-16 00:00:00
1  ON021      Ont.          2020-03-17 00:00:00  2020-03-17 00:00:00
2  ON022      Ont.          2020-03-17 00:00:00  2020-03-17 00:00:00
3  ON023      Ont.          2020-03-17 00:00:00  2020-03-17 00:00:00
4  ON111      Ont.          2020-03-17 00:00:00  2020-03-17 00:00:00
```

```
 Intervention category      Intervention type \
0 Case management          Case management - test criteria
1 Closures                  Closures - recreation
2 Closures                  Closures - recreation
3 Closures                  Closures - non-essential services
4 Closures                  Closures - daycares
```

```
 Intervention summary \
0 Who: BC Centre for Disease Control, Provincial Health Services
  Authority\nWhat: Testing criteria first published. Testing is prioritized for
  patients with respiratory symptoms who are hospitalized or likely to be
  hospitalized; health care workers; residents of long term care facilities; part
  of an investigation of a cluster or outbreak.\nEffective until:
1 Who: Office of the Premier\nWhat: Closed all facilities providing indoor
  recreational programs and public libraries, with subsequent extensions (see
  secondary source column)\nEffective until: 2020-06-12
2 Who: Office of the Premier\nWhat: Closed all theatres including those
  offering live performances of music, dance and other art forms, as well as
  cinemas that show movies and concert venues, with subsequent extensions (see
  secondary source column)\nEffective until: 2020-06-12
3 Who: Office of the Premier\nWhat: Closures of all bars and restaurants,
  except to the extent that such facilities provide takeout food and delivery,
  with subsequent extensions (see secondary source column)\nEffective until:
  2020-06-12
4 Who: Office of the Premier\nWhat: Closures of all licensed child care
  facilities and EarlyON programs, with subsequent extensions (see secondary
  source column)\nEffective until: 2020-06-12
```

```
 Primary source\n(news
release or specific resource) \
0 http://www.bccdc.ca/health-info/diseases-conditions/covid-19/testing/phases-
of-covid-19-testing-in-bc
```

```

1 https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-
emergency-to-protect-the-public.html
2 https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-
emergency-to-protect-the-public.html
3 https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-
emergency-to-protect-the-public.html
4 https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-
emergency-to-protect-the-public.html

```

Secondary source \

```

0 http://www.bccdc.ca/Health-Professionals-Site/Documents/PHSA-labtesting-
archived-summary.pdf
1 https://www.ontario.ca/laws/regulation/200051?_ga=2.184837289.1860153609.1592
920176-470745044.1584640249
2 https://www.ontario.ca/laws/regulation/200051?_ga=2.184837289.1860153609.1592
920176-470745044.1584640249
3 https://www.ontario.ca/laws/regulation/200051?_ga=2.184837289.1860153609.1592
920176-470745044.1584640249
4 https://www.ontario.ca/laws/regulation/200051?_ga=2.184837289.1860153609.1592
920176-470745044.1584640249

```

	Level	...	Column16364	Column16365	Column16366	\
0	Provincial/territorial	...	NaN	NaN	NaN	
1	Provincial/territorial	...	NaN	NaN	NaN	
2	Provincial/territorial	...	NaN	NaN	NaN	
3	Provincial/territorial	...	NaN	NaN	NaN	
4	Provincial/territorial	...	NaN	NaN	NaN	

	Column16367	Column16368	Column16369	Column16370	Column16371	Column16372	\
0	NaN	NaN	NaN	NaN	NaN	NaN	
1	NaN	NaN	NaN	NaN	NaN	NaN	
2	NaN	NaN	NaN	NaN	NaN	NaN	
3	NaN	NaN	NaN	NaN	NaN	NaN	
4	NaN	NaN	NaN	NaN	NaN	NaN	

Column16373

```

0 NaN
1 NaN
2 NaN
3 NaN
4 NaN

```

[5 rows x 16384 columns]

```

[11]: intervention_scan_data = intervention_scan_data.loc[:, 'Indigenous \npopulation_
↳group']
print(intervention_scan_data.columns)

```

```
intervention_scan_data.head()
```

```
Index(['Entry ID', 'Jurisdiction ', 'Date announced', 'Date implemented',
      'Intervention category', 'Intervention type', 'Intervention summary',
      'Primary source\n(news release or specific resource)',
      'Secondary source', 'Level', 'Indigenous \npopulation group'],
      dtype='object')
```

```
[11]:  Entry ID Jurisdiction      Date announced      Date implemented \
0  BC007      B.C.      2020-03-15 00:00:00  2020-03-16 00:00:00
1  ON021      Ont.      2020-03-17 00:00:00  2020-03-17 00:00:00
2  ON022      Ont.      2020-03-17 00:00:00  2020-03-17 00:00:00
3  ON023      Ont.      2020-03-17 00:00:00  2020-03-17 00:00:00
4  ON111      Ont.      2020-03-17 00:00:00  2020-03-17 00:00:00
```

```
      Intervention category      Intervention type \
0  Case management      Case management - test criteria
1  Closures      Closures - recreation
2  Closures      Closures - recreation
3  Closures      Closures - non-essential services
4  Closures      Closures - daycares
```

```
      Intervention summary \
0  Who: BC Centre for Disease Control, Provincial Health Services
   Authority\nWhat: Testing criteria first published. Testing is prioritized for
   patients with respiratory symptoms who are hospitalized or likely to be
   hospitalized; health care workers; residents of long term care facilities; part
   of an investigation of a cluster or outbreak.\nEffective until:
1  Who: Office of the Premier\nWhat: Closed all facilities providing indoor
   recreational programs and public libraries, with subsequent extensions (see
   secondary source column)\nEffective until: 2020-06-12
2  Who: Office of the Premier\nWhat: Closed all theatres including those
   offering live performances of music, dance and other art forms, as well as
   cinemas that show movies and concert venues, with subsequent extensions (see
   secondary source column)\nEffective until: 2020-06-12
3  Who: Office of the Premier\nWhat: Closures of all bars and restaurants,
   except to the extent that such facilities provide takeout food and delivery,
   with subsequent extensions (see secondary source column)\nEffective until:
   2020-06-12
4  Who: Office of the Premier\nWhat: Closures of all licensed child care
   facilities and EarlyON programs, with subsequent extensions (see secondary
   source column)\nEffective until: 2020-06-12
```

```
      Primary source\n(news
   release or specific resource) \
0  http://www.bccdc.ca/health-info/diseases-conditions/covid-19/testing/phases-
   of-covid-19-testing-in-bc
```

```

1 https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-
emergency-to-protect-the-public.html
2 https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-
emergency-to-protect-the-public.html
3 https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-
emergency-to-protect-the-public.html
4 https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-
emergency-to-protect-the-public.html

```

Secondary source \

```

0 http://www.bccdc.ca/Health-Professionals-Site/Documents/PHSA-labtesting-
archived-summary.pdf
1 https://www.ontario.ca/laws/regulation/200051?_ga=2.184837289.1860153609.1592
920176-470745044.1584640249
2 https://www.ontario.ca/laws/regulation/200051?_ga=2.184837289.1860153609.1592
920176-470745044.1584640249
3 https://www.ontario.ca/laws/regulation/200051?_ga=2.184837289.1860153609.1592
920176-470745044.1584640249
4 https://www.ontario.ca/laws/regulation/200051?_ga=2.184837289.1860153609.1592
920176-470745044.1584640249

```

Level Indigenous \npopulation group

```

0 Provincial/territorial No
1 Provincial/territorial No
2 Provincial/territorial No
3 Provincial/territorial No
4 Provincial/territorial No

```

```
[12]: # Intervention scan jurisdiction
```

```
intervention_scan_data['Jurisdiction'].unique()
```

```
[12]: array(['B.C.', 'Ont.', 'N.S.', 'Que.', 'Sask.', 'Nun.', 'P.E.I.',
        'N.W.T.', 'Man.', 'N.B.', 'N.L.', 'Alta.', 'Y.T.', 'Can.'],
        dtype=object)
```

```
[13]: # Slicing Intervention Summary to get Who implemented the policy what was the
        ↳ policy and how long it will be effective.
```

```

Intervention_summary = intervention_scan_data['Intervention summary'].str.
        ↳ split("Who: |\nWhat: |\nEffective until:",
        ↳ expand=True)

```

```
[14]: # Sliced Columns are expanded into individual columns.
```



```
Intervention_summary.rename(columns={1: "Who Implemented", 2: "What_
↳Implemented", 3: "Effective Until"},
                             inplace = True)
Intervention_summary.head()
```

```
[14]: 0                                     Who Implemented \
0    BC Centre for Disease Control, Provincial Health Services Authority
1    Office of the Premier
2    Office of the Premier
3    Office of the Premier
4    Office of the Premier

      What Implemented \
0  Testing criteria first published. Testing is prioritized for patients with
respiratory symptoms who are hospitalized or likely to be hospitalized; health
care workers; residents of long term care facilities; part of an investigation
of a cluster or outbreak.
1  Closed all facilities providing indoor recreational programs and public
libraries, with subsequent extensions (see secondary source column)
2  Closed all theatres including those offering live performances of music,
dance and other art forms, as well as cinemas that show movies and concert
venues, with subsequent extensions (see secondary source column)
3  Closures of all bars and restaurants, except to the extent that such
facilities provide takeout food and delivery, with subsequent extensions (see
secondary source column)
4  Closures of all licensed child care facilities and EarlyON programs, with
subsequent extensions (see secondary source column)

      Effective Until
0
1    2020-06-12
2    2020-06-12
3    2020-06-12
4    2020-06-12
```

```
[15]: # concatenating intervention_scan data and intervention summary data.

intervention_scan_data = pd.
↳concat([intervention_scan_data, Intervention_summary], axis=1)
intervention_scan_data.head()
```

```
[15]: Entry ID Jurisdiction      Date announced      Date implemented \
0  BC007      B.C.          2020-03-15 00:00:00  2020-03-16 00:00:00
1  ON021      Ont.          2020-03-17 00:00:00  2020-03-17 00:00:00
2  ON022      Ont.          2020-03-17 00:00:00  2020-03-17 00:00:00
3  ON023      Ont.          2020-03-17 00:00:00  2020-03-17 00:00:00
4  ON111      Ont.          2020-03-17 00:00:00  2020-03-17 00:00:00
```

	Intervention category	Intervention type \
0	Case management	Case management - test criteria
1	Closures	Closures - recreation
2	Closures	Closures - recreation
3	Closures	Closures - non-essential services
4	Closures	Closures - daycares

Intervention summary \

0 Who: BC Centre for Disease Control, Provincial Health Services
 Authority\nWhat: Testing criteria first published. Testing is prioritized for patients with respiratory symptoms who are hospitalized or likely to be hospitalized; health care workers; residents of long term care facilities; part of an investigation of a cluster or outbreak.\nEffective until:

1 Who: Office of the Premier\nWhat: Closed all facilities providing indoor recreational programs and public libraries, with subsequent extensions (see secondary source column)\nEffective until: 2020-06-12

2 Who: Office of the Premier\nWhat: Closed all theatres including those offering live performances of music, dance and other art forms, as well as cinemas that show movies and concert venues, with subsequent extensions (see secondary source column)\nEffective until: 2020-06-12

3 Who: Office of the Premier\nWhat: Closures of all bars and restaurants, except to the extent that such facilities provide takeout food and delivery, with subsequent extensions (see secondary source column)\nEffective until: 2020-06-12

4 Who: Office of the Premier\nWhat: Closures of all licensed child care facilities and EarlyON programs, with subsequent extensions (see secondary source column)\nEffective until: 2020-06-12

Primary source\n(news release or specific resource) \

0 <http://www.bccdc.ca/health-info/diseases-conditions/covid-19/testing/phases-of-covid-19-testing-in-bc>

1 <https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-emergency-to-protect-the-public.html>

2 <https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-emergency-to-protect-the-public.html>

3 <https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-emergency-to-protect-the-public.html>

4 <https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-emergency-to-protect-the-public.html>

Secondary source \

0 <http://www.bccdc.ca/Health-Professionals-Site/Documents/PHSA-labtesting-archived-summary.pdf>

1 https://www.ontario.ca/laws/regulation/200051?_ga=2.184837289.1860153609.1592920176-470745044.1584640249

```

2 https://www.ontario.ca/laws/regulation/200051?_ga=2.184837289.1860153609.1592
920176-470745044.1584640249
3 https://www.ontario.ca/laws/regulation/200051?_ga=2.184837289.1860153609.1592
920176-470745044.1584640249
4 https://www.ontario.ca/laws/regulation/200051?_ga=2.184837289.1860153609.1592
920176-470745044.1584640249

```

```

Level Indigenous \npopulation group 0 \
0 Provincial/territorial No
1 Provincial/territorial No
2 Provincial/territorial No
3 Provincial/territorial No
4 Provincial/territorial No

```

```

Who Implemented \
0 BC Centre for Disease Control, Provincial Health Services Authority
1 Office of the Premier
2 Office of the Premier
3 Office of the Premier
4 Office of the Premier

```

```

What Implemented \
0 Testing criteria first published. Testing is prioritized for patients with
respiratory symptoms who are hospitalized or likely to be hospitalized; health
care workers; residents of long term care facilities; part of an investigation
of a cluster or outbreak.
1 Closed all facilities providing indoor recreational programs and public
libraries, with subsequent extensions (see secondary source column)
2 Closed all theatres including those offering live performances of music,
dance and other art forms, as well as cinemas that show movies and concert
venues, with subsequent extensions (see secondary source column)
3 Closures of all bars and restaurants, except to the extent that such
facilities provide takeout food and delivery, with subsequent extensions (see
secondary source column)
4 Closures of all licensed child care facilities and EarlyON programs, with
subsequent extensions (see secondary source column)

```

```

Effective Until
0
1 2020-06-12
2 2020-06-12
3 2020-06-12
4 2020-06-12

```

[16]: *# Dropping Secondary source*

```
intervention_scan_data.drop(['Secondary source',0],axis=1,inplace=True)
```

```
# Renaming the columns
```

```
intervention_scan_data.rename(columns = {"Indigenous \npopulation group":  
↳ "Indigenous population group", 'Primary source\n(news release or specific  
↳ resource)': 'Primary source'}, inplace=True)  
intervention_scan_data.head()
```

```
[16]: Entry ID Jurisdiction      Date announced      Date implemented \
0 BC007      B.C.          2020-03-15 00:00:00  2020-03-16 00:00:00
1 ON021      Ont.          2020-03-17 00:00:00  2020-03-17 00:00:00
2 ON022      Ont.          2020-03-17 00:00:00  2020-03-17 00:00:00
3 ON023      Ont.          2020-03-17 00:00:00  2020-03-17 00:00:00
4 ON111      Ont.          2020-03-17 00:00:00  2020-03-17 00:00:00
```

```
Intervention category      Intervention type \
0 Case management          Case management - test criteria
1 Closures                 Closures - recreation
2 Closures                 Closures - recreation
3 Closures                 Closures - non-essential services
4 Closures                 Closures - daycares
```

```
Intervention summary \
0 Who: BC Centre for Disease Control, Provincial Health Services  
Authority\nWhat: Testing criteria first published. Testing is prioritized for  
patients with respiratory symptoms who are hospitalized or likely to be  
hospitalized; health care workers; residents of long term care facilities; part  
of an investigation of a cluster or outbreak.\nEffective until:  
1 Who: Office of the Premier\nWhat: Closed all facilities providing indoor  
recreational programs and public libraries, with subsequent extensions (see  
secondary source column)\nEffective until: 2020-06-12  
2 Who: Office of the Premier\nWhat: Closed all theatres including those  
offering live performances of music, dance and other art forms, as well as  
cinemas that show movies and concert venues, with subsequent extensions (see  
secondary source column)\nEffective until: 2020-06-12  
3 Who: Office of the Premier\nWhat: Closures of all bars and restaurants,  
except to the extent that such facilities provide takeout food and delivery,  
with subsequent extensions (see secondary source column)\nEffective until:  
2020-06-12  
4 Who: Office of the Premier\nWhat: Closures of all licensed child care  
facilities and EarlyON programs, with subsequent extensions (see secondary  
source column)\nEffective until: 2020-06-12
```

```
Primary source \
0 http://www.bccdc.ca/health-info/diseases-conditions/covid-19/testing/phases-  
of-covid-19-testing-in-bc  
1 https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-
```

```

emergency-to-protect-the-public.html
2 https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-
emergency-to-protect-the-public.html
3 https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-
emergency-to-protect-the-public.html
4 https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-
emergency-to-protect-the-public.html

```

```

Level Indigenous population group \
0 Provincial/territorial No
1 Provincial/territorial No
2 Provincial/territorial No
3 Provincial/territorial No
4 Provincial/territorial No

```

```

Who Implemented \
0 BC Centre for Disease Control, Provincial Health Services Authority
1 Office of the Premier
2 Office of the Premier
3 Office of the Premier
4 Office of the Premier

```

```

What Implemented \
0 Testing criteria first published. Testing is prioritized for patients with
respiratory symptoms who are hospitalized or likely to be hospitalized; health
care workers; residents of long term care facilities; part of an investigation
of a cluster or outbreak.
1 Closed all facilities providing indoor recreational programs and public
libraries, with subsequent extensions (see secondary source column)
2 Closed all theatres including those offering live performances of music,
dance and other art forms, as well as cinemas that show movies and concert
venues, with subsequent extensions (see secondary source column)
3 Closures of all bars and restaurants, except to the extent that such
facilities provide takeout food and delivery, with subsequent extensions (see
secondary source column)
4 Closures of all licensed child care facilities and EarlyON programs, with
subsequent extensions (see secondary source column)

```

```

Effective Until
0
1 2020-06-12
2 2020-06-12
3 2020-06-12
4 2020-06-12

```

[17]: *#converting the date column to datetime format and extracting month from it.*

```
intervention_scan_data[intervention_scan_data['Date announced']=='No data']

DateColumns = ['Date announced', 'Date implemented', 'Effective Until']

for column in DateColumns:

    intervention_scan_data[column] = pd.
    ↳to_datetime(intervention_scan_data[column],
    ↳infer_datetime_format=True, errors='coerce')
```

[18]: *# Rearranging the columns*

```
intervention_scan_data = intervention_scan_data[['Entry ID', 'Jurisdiction',
    ↳', 'Level', 'Date announced', 'Date implemented',
    ↳'Intervention category', 'Intervention type', 'Who Implemented',
    ↳'What Implemented', 'Effective Until', 'Indigenous population group',
    ↳'Primary source']]
```

[19]: *# Time difference between date announced and date implemented.*

```
intervention_scan_data['timediff'] = ((intervention_scan_data['Date_
    ↳implemented'] - intervention_scan_data['Date announced']).dt.total_seconds().
    ↳fillna(0))//3600
intervention_scan_data['duration'] = ((intervention_scan_data['Effective_
    ↳Until'] - intervention_scan_data['Date implemented']).dt.total_seconds().
    ↳fillna(0))//(3600*24)
intervention_scan_data.head()
```

```
[19]:  Entry ID Jurisdiction Level Date announced \
0  BC007 B.C. Provincial/territorial 2020-03-15
1  ON021 Ont. Provincial/territorial 2020-03-17
2  ON022 Ont. Provincial/territorial 2020-03-17
3  ON023 Ont. Provincial/territorial 2020-03-17
4  ON111 Ont. Provincial/territorial 2020-03-17

Date implemented Intervention category Intervention type \
0 2020-03-16 Case management Case management - test criteria
1 2020-03-17 Closures Closures - recreation
2 2020-03-17 Closures Closures - recreation
3 2020-03-17 Closures Closures - non-essential services
4 2020-03-17 Closures Closures - daycares

Who Implemented \
0 BC Centre for Disease Control, Provincial Health Services Authority
1 Office of the Premier
```

2 Office of the Premier
 3 Office of the Premier
 4 Office of the Premier

What Implemented \

0 Testing criteria first published. Testing is prioritized for patients with respiratory symptoms who are hospitalized or likely to be hospitalized; health care workers; residents of long term care facilities; part of an investigation of a cluster or outbreak.
 1 Closed all facilities providing indoor recreational programs and public libraries, with subsequent extensions (see secondary source column)
 2 Closed all theatres including those offering live performances of music, dance and other art forms, as well as cinemas that show movies and concert venues, with subsequent extensions (see secondary source column)
 3 Closures of all bars and restaurants, except to the extent that such facilities provide takeout food and delivery, with subsequent extensions (see secondary source column)
 4 Closures of all licensed child care facilities and EarlyON programs, with subsequent extensions (see secondary source column)

Effective Until Indigenous population group \

0 NaT	No
1 2020-06-12	No
2 2020-06-12	No
3 2020-06-12	No
4 2020-06-12	No

Primary source \

0 <http://www.bccdc.ca/health-info/diseases-conditions/covid-19/testing/phases-of-covid-19-testing-in-bc>
 1 <https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-emergency-to-protect-the-public.html>
 2 <https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-emergency-to-protect-the-public.html>
 3 <https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-emergency-to-protect-the-public.html>
 4 <https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-emergency-to-protect-the-public.html>

	timediff	duration
0	24.0	0.0
1	0.0	87.0
2	0.0	87.0
3	0.0	87.0
4	0.0	87.0

```
[20]: # Lets load public Covid-19 cases dataset
```

```
canada_covid_df = pd.read_csv("../covid_data/Data/Covid-19/
↳public-covid-19-cases-canada.csv")
canada_covid_df
```

```
[20]:
```

	case_id	provincial_case_id	age	sex	\
0	NaN	1	50-59	Male	
1	NaN	2	50-59	Female	
2	NaN	1	40-49	Male	
3	NaN	3	20-29	Female	
4	NaN	2	50-59	Female	
...	
133342	NaN	44851	Not Reported	Not Reported	
133343	NaN	44852	Not Reported	Not Reported	
133344	NaN	44853	Not Reported	Not Reported	
133345	NaN	44854	Not Reported	Not Reported	
133346	NaN	44855	Not Reported	Not Reported	

	health_region	province	country	date_report	\
0	Toronto	Ontario	Canada	2020-01-25 00:00:00+00	
1	Toronto	Ontario	Canada	2020-01-27 00:00:00+00	
2	Not Reported	BC	Canada	2020-01-28 00:00:00+00	
3	Middlesex-London	Ontario	Canada	2020-01-31 00:00:00+00	
4	Vancouver Coastal	BC	Canada	2020-02-04 00:00:00+00	
...	
133342	York	Ontario	Canada	2020-09-05 00:00:00+00	
133343	York	Ontario	Canada	2020-09-05 00:00:00+00	
133344	York	Ontario	Canada	2020-09-05 00:00:00+00	
133345	York	Ontario	Canada	2020-09-05 00:00:00+00	
133346	York	Ontario	Canada	2020-09-05 00:00:00+00	

	report_week	has_travel_history	locally_acquired	\
0	2020-01-19 00:00:00+00	t	NaN	
1	2020-01-26 00:00:00+00	t	NaN	
2	2020-01-26 00:00:00+00	t	NaN	
3	2020-01-26 00:00:00+00	t	NaN	
4	2020-02-02 00:00:00+00	f	Close Contact	
...	
133342	2020-08-30 00:00:00+00	NaN	NaN	
133343	2020-08-30 00:00:00+00	NaN	NaN	
133344	2020-08-30 00:00:00+00	NaN	NaN	
133345	2020-08-30 00:00:00+00	NaN	NaN	
133346	2020-08-30 00:00:00+00	NaN	NaN	


```
case_source
0      (1) https://news.ontario.ca/mohltc/en/2020/01/ontario-confirms-first-
```


case-of-wuhan-novel-coronavirus.html ;(2)
<https://globalnews.ca/news/6497313/coronavirus-timeine-cases-canada/>; (3)
<https://globalnews.ca/news/6462626/coronavirus-toronto-hospital/>
1 (1) <https://news.ontario.ca/mohltc/en/2020/01/ontario-confirms-second-presumptive-case-of-wuhan-novel-coronavirus.html> ;(2)
<https://globalnews.ca/news/6497313/coronavirus-timeine-cases-canada/>
2 <https://news.gov.bc.ca/releases/2020HLTH0015-000151>
3 (1) <https://news.ontario.ca/mohltc/en/2020/01/ontario-confirms-third-case-of-2019-novel-coronavirus.html> ;(2)
<https://globalnews.ca/news/6497313/coronavirus-timeine-cases-canada/>
4 <https://news.gov.bc.ca/releases/2020HLTH0023-000222>
...
133342 https://www.york.ca/wps/portal/yorkhome/health/yr/covid-19/covid19inyorkregion/01covid19inyorkregion/!ut/p/z1/tZVNU8IwEIZ_iveOnWzSQpJjrEhbpSDKVy9MLaWN0hZrBPn3Bged8RMdTQ9pktl9s3lm5w2K0ARFZbyWWaxkVcZLvZ5GrZkvOr7nnUHQc5gLAnoiIJRBM2M0fg6ALz4BKPPJ_mtA55I54I8CKka4B45vH8ofOqhfQ0T00ZTYKWUJZxaFZmI5cdKyOL6e64EvmpwvYq7jdXRSqpXK0XRbz5KqVGmpGrCt6lu9uFdSPTxv5FWR6jGNlypvQFKt5dzCfD_DXJa7jDrNNKYGAP5k-_3VPtYefU9uvCtWhxDitDzsQgBej4F_SvvNE-Zh0CP7g0_ov-X3Ee9UF0m_LHJA0Hgt0wOallVd6H64_CVuD_YnU0YKT3SgD1dDChdt6rDWebd_PsB_POHABQzL20b1KZiVJ2b1_wd04IOLxa557bYNgvgu07YDFoZm2Ydm2Ydm2Ydm-370VzjBIV_XDw-pu24307Kxyi1ZLio0efHh_eyd4U4-92EtJW_u7iKhrX_n948KTUx7_6oYDgtmb63bAdtcLfKsmHXbdvPQ795bZkdPbkKTMQ!!/dz/d5/L2dBISEvZ0FBIS9nQSEh/#.X1QBBY8ZMxe
133343 https://www.york.ca/wps/portal/yorkhome/health/yr/covid-19/covid19inyorkregion/01covid19inyorkregion/!ut/p/z1/tZVNU8IwEIZ_iveOnWzSQpJjrEhbpSDKVy9MLaWN0hZrBPn3Bged8RMdTQ9pktl9s3lm5w2K0ARFZbyWWaxkVcZLvZ5GrZkvOr7nnUHQc5gLAnoiIJRBM2M0fg6ALz4BKPPJ_mtA55I54I8CKka4B45vH8ofOqhfQ0T00ZTYKWUJZxaFZmI5cdKyOL6e64EvmpwvYq7jdXRSqpXK0XRbz5KqVGmpGrCt6lu9uFdSPTxv5FWR6jGNlypvQFKt5dzCfD_DXJa7jDrNNKYGAP5k-_3VPtYefU9uvCtWhxDitDzsQgBej4F_SvvNE-Zh0CP7g0_ov-X3Ee9UF0m_LHJA0Hgt0wOallVd6H64_CVuD_YnU0YKT3SgD1dDChdt6rDWebd_PsB_POHABQzL20b1KZiVJ2b1_wd04IOLxa557bYNgvgu07YDFoZm2Ydm2Ydm2Ydm-370VzjBIV_XDw-pu24307Kxyi1ZLio0efHh_eyd4U4-92EtJW_u7iKhrX_n948KTUx7_6oYDgtmb63bAdtcLfKsmHXbdvPQ795bZkdPbkKTMQ!!/dz/d5/L2dBISEvZ0FBIS9nQSEh/#.X1QBBY8ZMxe
133344 https://www.york.ca/wps/portal/yorkhome/health/yr/covid-19/covid19inyorkregion/01covid19inyorkregion/!ut/p/z1/tZVNU8IwEIZ_iveOnWzSQpJjrEhbpSDKVy9MLaWN0hZrBPn3Bged8RMdTQ9pktl9s3lm5w2K0ARFZbyWWaxkVcZLvZ5GrZkvOr7nnUHQc5gLAnoiIJRBM2M0fg6ALz4BKPPJ_mtA55I54I8CKka4B45vH8ofOqhfQ0T00ZTYKWUJZxaFZmI5cdKyOL6e64EvmpwvYq7jdXRSqpXK0XRbz5KqVGmpGrCt6lu9uFdSPTxv5FWR6jGNlypvQFKt5dzCfD_DXJa7jDrNNKYGAP5k-_3VPtYefU9uvCtWhxDitDzsQgBej4F_SvvNE-Zh0CP7g0_ov-X3Ee9UF0m_LHJA0Hgt0wOallVd6H64_CVuD_YnU0YKT3SgD1dDChdt6rDWebd_PsB_POHABQzL20b1KZiVJ2b1_wd04IOLxa557bYNgvgu07YDFoZm2Ydm2Ydm2Ydm-370VzjBIV_XDw-pu24307Kxyi1ZLio0efHh_eyd4U4-92EtJW_u7iKhrX_n948KTUx7_6oYDgtmb63bAdtcLfKsmHXbdvPQ795bZkdPbkKTMQ!!/dz/d5/L2dBISEvZ0FBIS9nQSEh/#.X1QBBY8ZMxe
133345 https://www.york.ca/wps/portal/yorkhome/health/yr/covid-19/covid19inyorkregion/01covid19inyorkregion/!ut/p/z1/tZVNU8IwEIZ_iveOnWzSQpJjrEhbpSDKVy9MLaWN0hZrBPn3Bged8RMdTQ9pktl9s3lm5w2K0ARFZbyWWaxkVcZLvZ5GrZkvOr7nnUHQc5gLAnoiIJRBM2M0fg6ALz4BKPPJ_mtA55I54I8CKka4B45vH8ofOqhfQ0T00ZTYKWUJZxaFZmI5cdKyOL6e64EvmpwvYq7jdXRSqpXK0XRbz5KqVGmpGrCt6lu9uFdSPTxv5FWR6jGNlypvQFKt5dzCfD_DXJa7jDrNNKYGAP5k-_3VPtYefU9uvCtWhxDitDzsQgBej4F_SvvNE-Zh0CP7g0_ov-X3Ee9UF0m_LHJA0Hgt0wOallVd6H64_CVuD_YnU0YKT3SgD1dDChdt6rDWebd_PsB_POHABQzL20b1KZiVJ2b1_wd04IOLxa557bYNgvgu07YDFoZm2Ydm2Ydm2Ydm-370VzjBIV_XDw-pu24307Kxyi1ZLio0efHh_eyd4U4-92EtJW_u7iKhrX_n948KTUx7_6oYDgtmb63bAdtcLfKsmHXbdvPQ795bZkdPbkKTMQ!!/dz/d5/L2dBISEvZ0FBIS9nQSEh/#.X1QBBY8ZMxe

YefU9uvCtWhxDitDzsQgBej4F_SvvNE-Zh0CP7g0_ov-X3Ee9UF0m_LHJA0Hgt0w0allVd6H64_CVuD_YnU0YKT3SgD1dDChdt6rDWebd_PsB_POHABQzL20b1KZiVJ2b1_wd04IOLxa557bYNgvgu07YDFoZm2Ydm2Ydm2Ydm-370VzjBIV_XDw-pu24307Kxyi1ZLio0efHh_eyd4U4-92EtJW_u7iKhrX_n948KTUx7_6oYDgtmb63bAdtcLfKsmHXbdvPQ795bZkdPbkKTMQ!!/dz/d5/L2dBISEvZ0FBIS9nQSEh/#.X1QBBY8ZMxe

133346 https://www.york.ca/wps/portal/yorkhome/health/yr/covid-19/covid19inyorkregion/01covid19inyorkregion/!ut/p/z1/tZVNU8IwEIZ_iweOnWzSQpJjrEhbpSDKVy9MLaWN0hZrBPn3Bged8RMdTQ9pktl9s3lm5w2K0ARFZbyWWaxkVcZLvZ5GrZkv0r7nnUHqc5gLAnoiIJRbm2M0fg6ALz4BKppJ_mtA55I54I8CKka4B45vH8of0QhFq0T00ZTYKWUJZxaFZmI5cdKyOL6e64EvmppwvYq7jdXRSqpXK0XRbz5KqVGmpGrCt6lu9uFdSPTxv5FWR6jGNlypvQFKt5dzCfD_DXJa7jDrNNKYGAP5k-_3VptYefU9uvCtWhxDitDzsQgBej4F_SvvNE-Zh0CP7g0_ov-X3Ee9UF0m_LHJA0Hgt0w0allVd6H64_CVuD_YnU0YKT3SgD1dDChdt6rDWebd_PsB_POHABQzL20b1KZiVJ2b1_wd04IOLxa557bYNgvgu07YDFoZm2Ydm2Ydm2Ydm-370VzjBIV_XDw-pu24307Kxyi1ZLio0efHh_eyd4U4-92EtJW_u7iKhrX_n948KTUx7_6oYDgtmb63bAdtcLfKsmHXbdvPQ795bZkdPbkKTMQ!!/dz/d5/L2dBISEvZ0FBIS9nQSEh/#.X1QBBY8ZMxe

[133347 rows x 12 columns]

```
[21]: # Dropping case_id

canada_covid_df.drop('case_id',axis=1,inplace=True)

# Making it numerical column as it will be easier to work with numerical data.

canada_covid_df['has_travel_history'] = (canada_covid_df['has_travel_history'].
    ↳apply(lambda x : 1 if (x == 't')
                                                else 0))
```

```
[22]: canada_covid_df
```

```
[22]:
```

	provincial_case_id	age	sex	health_region \
0	1	50-59	Male	Toronto
1	2	50-59	Female	Toronto
2	1	40-49	Male	Not Reported
3	3	20-29	Female	Middlesex-London
4	2	50-59	Female	Vancouver Coastal
...
133342	44851	Not Reported	Not Reported	York
133343	44852	Not Reported	Not Reported	York
133344	44853	Not Reported	Not Reported	York
133345	44854	Not Reported	Not Reported	York
133346	44855	Not Reported	Not Reported	York

	province	country	date_report	report_week \
0	Ontario	Canada	2020-01-25 00:00:00+00	2020-01-19 00:00:00+00
1	Ontario	Canada	2020-01-27 00:00:00+00	2020-01-26 00:00:00+00
2	BC	Canada	2020-01-28 00:00:00+00	2020-01-26 00:00:00+00

3	Ontario	Canada	2020-01-31 00:00:00+00	2020-01-26 00:00:00+00
4	BC	Canada	2020-02-04 00:00:00+00	2020-02-02 00:00:00+00
...
133342	Ontario	Canada	2020-09-05 00:00:00+00	2020-08-30 00:00:00+00
133343	Ontario	Canada	2020-09-05 00:00:00+00	2020-08-30 00:00:00+00
133344	Ontario	Canada	2020-09-05 00:00:00+00	2020-08-30 00:00:00+00
133345	Ontario	Canada	2020-09-05 00:00:00+00	2020-08-30 00:00:00+00
133346	Ontario	Canada	2020-09-05 00:00:00+00	2020-08-30 00:00:00+00

	has_travel_history	locally_acquired	\
0	1		NaN
1	1		NaN
2	1		NaN
3	1		NaN
4	0		Close Contact
...
133342	0		NaN
133343	0		NaN
133344	0		NaN
133345	0		NaN
133346	0		NaN

case_source

0	(1) https://news.ontario.ca/mohltc/en/2020/01/ontario-confirms-first-case-of-wuhan-novel-coronavirus.html ;(2) https://globalnews.ca/news/6497313/coronavirus-timeine-cases-canada/ ; (3) https://globalnews.ca/news/6462626/coronavirus-toronto-hospital/
1	(1) https://news.ontario.ca/mohltc/en/2020/01/ontario-confirms-second-presumptive-case-of-wuhan-novel-coronavirus.html ;(2) https://globalnews.ca/news/6497313/coronavirus-timeine-cases-canada/
2	https://news.gov.bc.ca/releases/2020HLTH0015-000151
3	(1) https://news.ontario.ca/mohltc/en/2020/01/ontario-confirms-third-case-of-2019-novel-coronavirus.html ;(2) https://globalnews.ca/news/6497313/coronavirus-timeine-cases-canada/
4	https://news.gov.bc.ca/releases/2020HLTH0023-000222
...	...
133342	https://www.york.ca/wps/portal/yorkhome/health/yr/covid-19/covid19inyorkregion/01covid19inyorkregion/!ut/p/z1/tZVNU8IwEIZ_iweOnWzSQpJjrEhbpSDKVy9MLaWN0hZrBPn3Bged8RMdTQ9pktl9s3lm5w2K0ARFZbyWWaxkVcZLvZ5GrZkvOr7nnUHQc5gLANoiIJRBm2M0fg6ALz4BKPPj_mtA55I54I8CKka4B45vH8ofOqhfQ0T00ZTYKWUJZxaFZmI5cdKyOL6e64EvmpwvYq7jdXRSqpXK0XRbz5KqVGmpGrCt6lu9uFdSPTxv5FWR6jGNlypvQFKt5dzCfD_DXJa7jDrNNKYGAP5k-_3VPTYefU9uvCtWhxDitDzsQgBej4F_SvvNE-Zh0CP7g0_ov-X3Ee9UF0m_LHJA0Hgt0wOallVd6H64_CVuD_YnU0YKT3SgD1dDChdt6rDWebd_PsB_POHABQzL20blKZiVJ2bl_wd04IOLxa557bYNgvgu07YDFoZm2Ydm2Ydm2Ydm-370VzjBIV_XDw-pu24307Kxyi1ZLio0efHh_eyd4U4-92EtJW_u7iKhRX_n948KTUx7_6oYDgtmb63bAdtcLfKsmHXbdvPQ795bZkdPbkKTMQ!!/dz/d5/L2dBISEvZ0FBIS9nQSEh/#.X1QBBY8ZMxe
133343	https://www.york.ca/wps/portal/yorkhome/health/yr/covid-19/covid19inyorkregion/01covid19inyorkregion/!ut/p/z1/tZVNU8IwEIZ_iweOnWzSQpJjrEhbpSDKVy9MLaWN0hZrBPn3Bged8RMdTQ9pktl9s3lm5w2K0ARFZbyWWaxkVcZLvZ5GrZkvOr7nnUHQc5gLANoiIJRBm2M0fg6ALz4BKPPj_mtA55I54I8CKka4B45vH8ofOqhfQ0T00ZTYKWUJZxaFZmI5cdKyOL6e64EvmpwvYq7jdXRSqpXK0XRbz5KqVGmpGrCt6lu9uFdSPTxv5FWR6jGNlypvQFKt5dzCfD_DXJa7jDrNNKYGAP5k-_3VPTYefU9uvCtWhxDitDzsQgBej4F_SvvNE-Zh0CP7g0_ov-X3Ee9UF0m_LHJA0Hgt0wOallVd6H64_CVuD_YnU0YKT3SgD1dDChdt6rDWebd_PsB_POHABQzL20blKZiVJ2bl_wd04IOLxa557bYNgvgu07YDFoZm2Ydm2Ydm2Ydm-370VzjBIV_XDw-pu24307Kxyi1ZLio0efHh_eyd4U4-92EtJW_u7iKhRX_n948KTUx7_6oYDgtmb63bAdtcLfKsmHXbdvPQ795bZkdPbkKTMQ!!/dz/d5/L2dBISEvZ0FBIS9nQSEh/#.X1QBBY8ZMxe

region/01covid19inyorkregion/!ut/p/z1/tZVNU8IwEIZ_iveOnWzSQpJjrEhbpSDKVy9MLaWN0hZrBPn3Bged8RMdTQ9pktl9s3lm5w2K0ARFZbyWWaxkVcZLvZ5GrZkvOr7nnUHQc5gLAnoiIJRBM2M0fg6ALz4BKPPJ_mtA55I54I8CKka4B45vH8ofOqhfQ0T00ZTYKWUJZxaFZmI5cdKyOL6e64EvmpwvYq7jdXRSqpXK0XRbz5KqVGmpGrCt6lu9uFdSPTxv5FWR6jGNlypvQFKt5dzCfD_DXJa7jDrNNKYGAP5k-_3VPtYefU9uvCtWhxDitDzsQgBej4F_SvvNE-Zh0CP7g0_ov-X3Ee9UF0m_LHJA0Hgt0w0allVd6H64_CVuD_YnU0YKT3SgD1dDChdt6rDWebd_PsB_POHABQzL20b1KZiVJ2b1_wd04IOLxa557bYNgvgu07YDFoZm2Ydm2Ydm2Ydm-370VzjBIV_XDw-pu24307Kxyi1ZLio0efHh_eyd4U4-92EtJW_u7iKhrX_n948KTUx7_6oYDgtmb63bAdtcLfKsmHXbdvPQ795bZkdPbkKTMQ!!/dz/d5/L2dBISEvZ0FBIS9nQSEh/#.X1QBBY8ZMxe

133344 https://www.york.ca/wps/portal/yorkhome/health/yr/covid-19/covid19inyorkregion/01covid19inyorkregion/!ut/p/z1/tZVNU8IwEIZ_iveOnWzSQpJjrEhbpSDKVy9MLaWN0hZrBPn3Bged8RMdTQ9pktl9s3lm5w2K0ARFZbyWWaxkVcZLvZ5GrZkvOr7nnUHQc5gLAnoiIJRBM2M0fg6ALz4BKPPJ_mtA55I54I8CKka4B45vH8ofOqhfQ0T00ZTYKWUJZxaFZmI5cdKyOL6e64EvmpwvYq7jdXRSqpXK0XRbz5KqVGmpGrCt6lu9uFdSPTxv5FWR6jGNlypvQFKt5dzCfD_DXJa7jDrNNKYGAP5k-_3VPtYefU9uvCtWhxDitDzsQgBej4F_SvvNE-Zh0CP7g0_ov-X3Ee9UF0m_LHJA0Hgt0w0allVd6H64_CVuD_YnU0YKT3SgD1dDChdt6rDWebd_PsB_POHABQzL20b1KZiVJ2b1_wd04IOLxa557bYNgvgu07YDFoZm2Ydm2Ydm2Ydm-370VzjBIV_XDw-pu24307Kxyi1ZLio0efHh_eyd4U4-92EtJW_u7iKhrX_n948KTUx7_6oYDgtmb63bAdtcLfKsmHXbdvPQ795bZkdPbkKTMQ!!/dz/d5/L2dBISEvZ0FBIS9nQSEh/#.X1QBBY8ZMxe

133345 https://www.york.ca/wps/portal/yorkhome/health/yr/covid-19/covid19inyorkregion/01covid19inyorkregion/!ut/p/z1/tZVNU8IwEIZ_iveOnWzSQpJjrEhbpSDKVy9MLaWN0hZrBPn3Bged8RMdTQ9pktl9s3lm5w2K0ARFZbyWWaxkVcZLvZ5GrZkvOr7nnUHQc5gLAnoiIJRBM2M0fg6ALz4BKPPJ_mtA55I54I8CKka4B45vH8ofOqhfQ0T00ZTYKWUJZxaFZmI5cdKyOL6e64EvmpwvYq7jdXRSqpXK0XRbz5KqVGmpGrCt6lu9uFdSPTxv5FWR6jGNlypvQFKt5dzCfD_DXJa7jDrNNKYGAP5k-_3VPtYefU9uvCtWhxDitDzsQgBej4F_SvvNE-Zh0CP7g0_ov-X3Ee9UF0m_LHJA0Hgt0w0allVd6H64_CVuD_YnU0YKT3SgD1dDChdt6rDWebd_PsB_POHABQzL20b1KZiVJ2b1_wd04IOLxa557bYNgvgu07YDFoZm2Ydm2Ydm2Ydm-370VzjBIV_XDw-pu24307Kxyi1ZLio0efHh_eyd4U4-92EtJW_u7iKhrX_n948KTUx7_6oYDgtmb63bAdtcLfKsmHXbdvPQ795bZkdPbkKTMQ!!/dz/d5/L2dBISEvZ0FBIS9nQSEh/#.X1QBBY8ZMxe

133346 https://www.york.ca/wps/portal/yorkhome/health/yr/covid-19/covid19inyorkregion/01covid19inyorkregion/!ut/p/z1/tZVNU8IwEIZ_iveOnWzSQpJjrEhbpSDKVy9MLaWN0hZrBPn3Bged8RMdTQ9pktl9s3lm5w2K0ARFZbyWWaxkVcZLvZ5GrZkvOr7nnUHQc5gLAnoiIJRBM2M0fg6ALz4BKPPJ_mtA55I54I8CKka4B45vH8ofOqhfQ0T00ZTYKWUJZxaFZmI5cdKyOL6e64EvmpwvYq7jdXRSqpXK0XRbz5KqVGmpGrCt6lu9uFdSPTxv5FWR6jGNlypvQFKt5dzCfD_DXJa7jDrNNKYGAP5k-_3VPtYefU9uvCtWhxDitDzsQgBej4F_SvvNE-Zh0CP7g0_ov-X3Ee9UF0m_LHJA0Hgt0w0allVd6H64_CVuD_YnU0YKT3SgD1dDChdt6rDWebd_PsB_POHABQzL20b1KZiVJ2b1_wd04IOLxa557bYNgvgu07YDFoZm2Ydm2Ydm2Ydm-370VzjBIV_XDw-pu24307Kxyi1ZLio0efHh_eyd4U4-92EtJW_u7iKhrX_n948KTUx7_6oYDgtmb63bAdtcLfKsmHXbdvPQ795bZkdPbkKTMQ!!/dz/d5/L2dBISEvZ0FBIS9nQSEh/#.X1QBBY8ZMxe

[133347 rows x 11 columns]

[23]: `canada_covid_df.info()`

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 133347 entries, 0 to 133346
Data columns (total 11 columns):
```

#	Column	Non-Null Count	Dtype
0	provincial_case_id	133347 non-null	int64
1	age	133347 non-null	object
2	sex	133347 non-null	object
3	health_region	133347 non-null	object
4	province	133347 non-null	object
5	country	133347 non-null	object
6	date_report	133347 non-null	object
7	report_week	133347 non-null	object
8	has_travel_history	133347 non-null	int64
9	locally_acquired	1099 non-null	object
10	case_source	133347 non-null	object

dtypes: int64(2), object(9)
memory usage: 11.2+ MB

```
[24]: # converting columns to datetime

DateColumns = ['date_report', 'report_week']

for column in DateColumns:

    canada_covid_df[column] = pd.to_datetime(canada_covid_df[column],
    ↪infer_datetime_format=True, errors='coerce')
```

```
[25]: canada_covid_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 133347 entries, 0 to 133346
Data columns (total 11 columns):
#   Column                Non-Null Count  Dtype
---  ---
0   provincial_case_id     133347 non-null  int64
1   age                   133347 non-null  object
2   sex                   133347 non-null  object
3   health_region         133347 non-null  object
4   province              133347 non-null  object
5   country               133347 non-null  object
6   date_report           133347 non-null  datetime64[ns]
7   report_week           133347 non-null  datetime64[ns]
8   has_travel_history     133347 non-null  int64
9   locally_acquired       1099 non-null    object
10  case_source            133347 non-null  object
dtypes: datetime64[ns](2), int64(2), object(7)
memory usage: 11.2+ MB
```

```
[26]: # Getting all the cases having travel history
```

```
travel_cases_df = canada_covid_df[canada_covid_df['has_travel_history']==1]
travel_cases_df
```

```
[26]:
```

	provincial_case_id	age	sex	health_region	province	\
0	1	50-59	Male	Toronto	Ontario	
1	2	50-59	Female	Toronto	Ontario	
2	1	40-49	Male	Not Reported	BC	
3	3	20-29	Female	Middlesex-London	Ontario	
5	3	30-39	Male	Not Reported	BC	
...	
132041	45	20-29	Male	Prince Edward Island	PEI	
132042	46	30-39	Male	Prince Edward Island	PEI	
132683	47	10-19	Male	Prince Edward Island	PEI	
132872	44583	20-29	Male	Porcupine	Ontario	
133009	270	20-39	Female	Eastern	NL	

	country	date_report	report_week	has_travel_history	locally_acquired	\
0	Canada	2020-01-25	2020-01-19	1	NaN	
1	Canada	2020-01-27	2020-01-26	1	NaN	
2	Canada	2020-01-28	2020-01-26	1	NaN	
3	Canada	2020-01-31	2020-01-26	1	NaN	
5	Canada	2020-02-06	2020-02-02	1	NaN	
...	
132041	Canada	2020-09-03	2020-08-30	1	NaN	
132042	Canada	2020-09-03	2020-08-30	1	NaN	
132683	Canada	2020-09-04	2020-08-30	1	NaN	
132872	Canada	2020-09-04	2020-08-30	1	NaN	
133009	Canada	2020-09-05	2020-08-30	1	NaN	

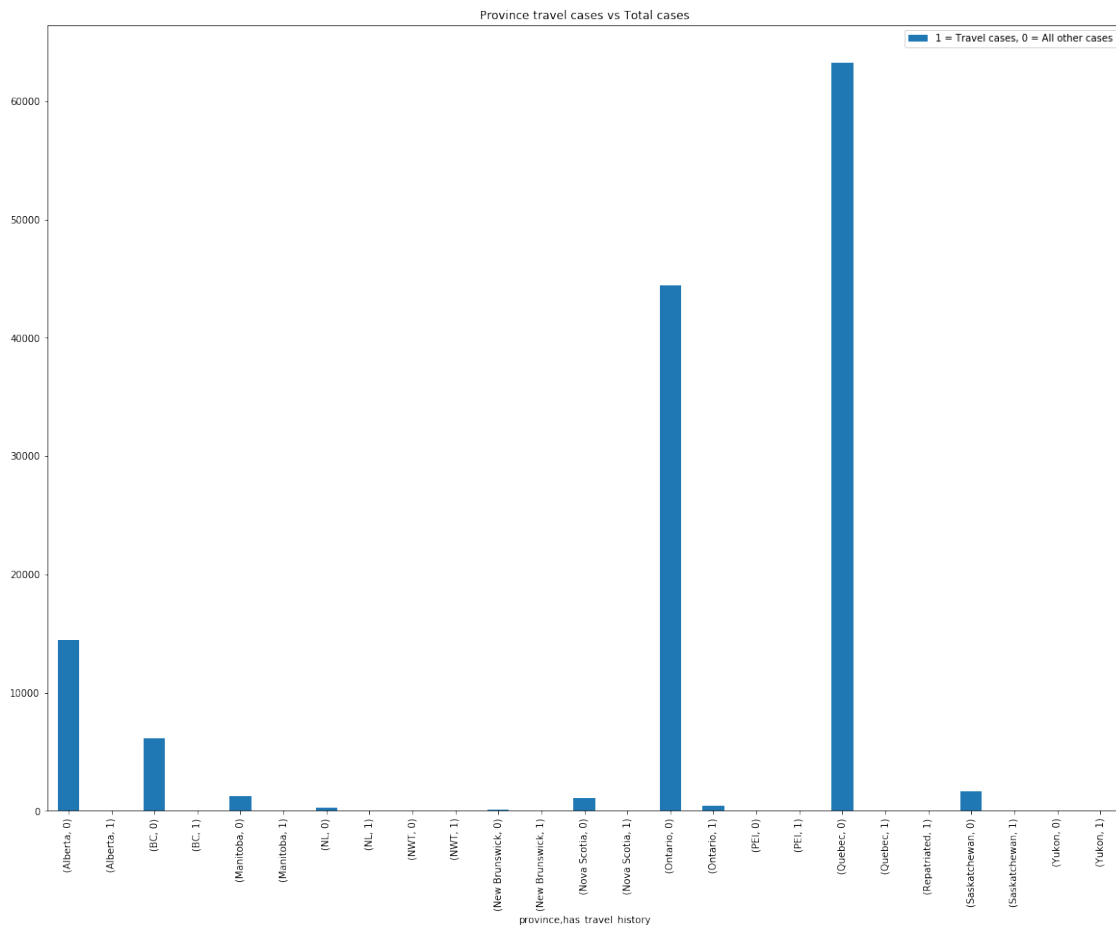
	case_source
0	(1) https://news.ontario.ca/mohltc/en/2020/01/ontario-confirms-first-case-of-wuhan-novel-coronavirus.html ;(2) https://globalnews.ca/news/6497313/coronavirus-timeine-cases-canada/ ; (3) https://globalnews.ca/news/6462626/coronavirus-toronto-hospital/
1	(1) https://news.ontario.ca/mohltc/en/2020/01/ontario-confirms-second-presumptive-case-of-wuhan-novel-coronavirus.html ;(2) https://globalnews.ca/news/6497313/coronavirus-timeine-cases-canada/
2	https://news.gov.bc.ca/releases/2020HLTH0015-000151
3	(1) https://news.ontario.ca/mohltc/en/2020/01/ontario-confirms-third-case-of-2019-novel-coronavirus.html ;(2) https://globalnews.ca/news/6497313/coronavirus-timeine-cases-canada/
5	https://news.gov.bc.ca/releases/2020HLTH0025-000236
...	...
132041	https://atlantic.ctvnews.ca/p-e-i-reports-two-new-travel-related-cases-of-covid-19-1.5091533

132042 <https://atlantic.ctvnews.ca/p-e-i-reports-two-new-travel-related-cases-of-covid-19-1.5091533>
 132683 <https://globalnews.ca/news/7316875/pei-covid-19-update-sept-4-coronavirus/>
 132872 <https://www.porcupinehu.on.ca/en/your-health/infectious-diseases/novel-coronavirus/covid-cases/>
 133009 <https://www.cbc.ca/news/canada/newfoundland-labrador/nl-covid-sept-5-1.5713769>

[682 rows x 11 columns]

```
[27]: canada_covid_df.groupby(['province', 'has_travel_history']).size().plot.  
      ↪ bar(figsize=(20,15))  
plt.legend(['1 = Travel cases, 0 = All other cases'])  
plt.title("Province travel cases vs Total cases")
```

```
[27]: Text(0.5, 1.0, 'Province travel cases vs Total cases')
```



- Number of travel related cases are very low as compared to overall cases.

But these cases were primary factor in spreading this virus across the world.

- Ontario has maximum travel related covid cases.
- This shift demonstrates that an increasing number cases are being spread within the community.
- Cases coming from travellers abroad were, ``at the beginning'' the cause of 90% of the cases.

```
[28]: fig = px.bar(x = travel_cases_df['date_report'], y=travel_cases_df['has_travel_history'],
    → color=travel_cases_df['province'], title="Monthly Provincial travel related
    → cases")
fig.show()
print(travel_cases_df.groupby(['province', 'date_report']).size().
    → reset_index(name='Travel case count'))
```

	province	date_report	Travel case count
0	Alberta	2020-03-05	1
1	Alberta	2020-03-06	1
2	Alberta	2020-03-08	1
3	Alberta	2020-03-09	10
4	Alberta	2020-03-11	5
..
201	Yukon	2020-03-25	1
202	Yukon	2020-04-01	1
203	Yukon	2020-04-08	1
204	Yukon	2020-07-17	2
205	Yukon	2020-07-24	1

[206 rows x 3 columns]

- Here we can see a significant spike in the number of the cases related to travel in the Month of Mar, and Apr.
- March and April can be viewed as hotspot months for spreading this virus globally because most countries implemented travel restrictions in or after march.
- After the month of April we can see a drop of more than ~90% in the cases related to travel.

```
[29]: fig = px.bar(x = travel_cases_df['province'], y =
    → travel_cases_df['has_travel_history'], color=travel_cases_df['sex'],
    → title='Total Provincial travel related cases')
fig.show()
print(travel_cases_df.groupby('province').size().reset_index(name='Travel
    → related cases'))
```

	province	Travel related cases
0	Alberta	24
1	BC	34

2	Manitoba	20
3	NL	16
4	NWT	3
5	New Brunswick	47
6	Nova Scotia	32
7	Ontario	407
8	PEI	40
9	Quebec	17
10	Repatriated	13
11	Saskatchewan	21
12	Yukon	8

- Here we can see Ontario has maximum number of COVID-19 cases, and recently 32 new travel related cases were reported, and public health officials are bracing for more as international college and university students pour into brampton from abroad.
- Equal number of male and female were tested positive for travel related cases.

0.3 Policies implemented by provinces

```
[30]: intervention_scan_data.head()
```

```
[30]:
```

	Entry ID	Jurisdiction	Level	Date announced	\
0	BC007	B.C.	Provincial/territorial	2020-03-15	
1	ON021	Ont.	Provincial/territorial	2020-03-17	
2	ON022	Ont.	Provincial/territorial	2020-03-17	
3	ON023	Ont.	Provincial/territorial	2020-03-17	
4	ON111	Ont.	Provincial/territorial	2020-03-17	

	Date implemented	Intervention category	Intervention type	\
0	2020-03-16	Case management	Case management - test criteria	
1	2020-03-17	Closures	Closures - recreation	
2	2020-03-17	Closures	Closures - recreation	
3	2020-03-17	Closures	Closures - non-essential services	
4	2020-03-17	Closures	Closures - daycares	

	Who Implemented	\
0	BC Centre for Disease Control, Provincial Health Services Authority	
1	Office of the Premier	
2	Office of the Premier	
3	Office of the Premier	
4	Office of the Premier	

	What Implemented	\
0	Testing criteria first published. Testing is prioritized for patients with respiratory symptoms who are hospitalized or likely to be hospitalized; health care workers; residents of long term care facilities; part of an investigation	

of a cluster or outbreak.

- 1 Closed all facilities providing indoor recreational programs and public libraries, with subsequent extensions (see secondary source column)
- 2 Closed all theatres including those offering live performances of music, dance and other art forms, as well as cinemas that show movies and concert venues, with subsequent extensions (see secondary source column)
- 3 Closures of all bars and restaurants, except to the extent that such facilities provide takeout food and delivery, with subsequent extensions (see secondary source column)
- 4 Closures of all licensed child care facilities and EarlyON programs, with subsequent extensions (see secondary source column)

	Effective Until	Indigenous population group	\
0	NaT	No	
1	2020-06-12	No	
2	2020-06-12	No	
3	2020-06-12	No	
4	2020-06-12	No	

	Primary source	\
0	http://www.bccdc.ca/health-info/diseases-conditions/covid-19/testing/phases-of-covid-19-testing-in-bc	
1	https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-emergency-to-protect-the-public.html	
2	https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-emergency-to-protect-the-public.html	
3	https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-emergency-to-protect-the-public.html	
4	https://news.ontario.ca/opo/en/2020/03/ontario-enacts-declaration-of-emergency-to-protect-the-public.html	

	timediff	duration
0	24.0	0.0
1	0.0	87.0
2	0.0	87.0
3	0.0	87.0
4	0.0	87.0

```
[31]: travel_intervention_df =
↳ intervention_scan_data[intervention_scan_data['Intervention_
↳ category']=='Travel']
travel_intervention_df.head(5)
```

[31]:	Entry ID	Jurisdiction	Level	Date announced	\
89	CAN128	Can.	Federal	2020-05-29	
90	CAN129	Can.	Federal	2020-05-29	
91	CAN130	Can.	Federal	2020-05-29	

115	NU065	Nun.	Provincial/territorial	2020-06-01
123	AB142	Alta.	Provincial/territorial	2020-06-02

	Date implemented	Intervention category	Intervention type \
89	2020-05-29	Travel	Travel - restrictions
90	2020-07-01	Travel	Travel - restrictions
91	2020-07-01	Travel	Travel - restrictions
115	2020-06-01	Travel	Travel - restrictions
123	2020-06-02	Travel	Travel - restrictions

	Who Implemented \
89	Transport Canada
90	Transport Canada
91	Transport Canada
115	Government of Nunavut, Chief Public Health Officer
123	Government of Alberta

	What Implemented \
89	Prohibited cruise ships with overnight accommodations carrying more than 100 persons from operating in Canadian waters and passenger vessels with the capacity to carry more than 12 persons from entering Arctic coastal waters (including Nunatsiavut, Nunavik and the Labrador coast)
90	Announced that all passenger vessels (with the exception of cruise ships with overnight accommodations) must follow provincial, territorial, local and regional health authority requirements for timelines and processes to resume operations
91	Lifted restriction allowing all passenger vessels (with the exception of cruise ships with overnight accommodations) to operate in inland rivers and lakes in the N.W.T., Nun. and Y.T.
115	Lifted restrictions on in-territory travel; travel outside Nun. still not recommended
123	Implemented enhanced border screening measures at the Alta./U.S. border crossing at Coutts (busiest in the province and open 24 hours)

	Effective Until	Indigenous population group \
89	2020-10-31	No
90	NaT	No
91	NaT	No
115	NaT	No
123	NaT	No

	Primary source \
89	https://www.canada.ca/en/transport-canada/news/2020/05/minister-garneau-announces-updated-measures-for-cruise-ships-and-passenger-vessels-in-canadian-waters-up-to-october-31-2020.html
90	https://www.canada.ca/en/transport-canada/news/2020/05/minister-garneau-announces-updated-measures-for-cruise-ships-and-passenger-vessels-in-canadian-waters-up-to-october-31-2020.html

waters-up-to-october-31-2020.html

91 <https://www.canada.ca/en/transport-canada/news/2020/05/minister-garneau-announces-updated-measures-for-cruise-ships-and-passenger-vessels-in-canadian-waters-up-to-october-31-2020.html>

115 <https://gov.nu.ca/executive-and-intergovernmental-affairs/news/covid-19-gn-update-june-1-2020>

123

<https://www.alberta.ca/release.cfm?xID=72509A85B0A03-E887-D5E7-6DBB576BFE8509D6>

	timediff	duration
89	0.0	155.0
90	792.0	0.0
91	792.0	0.0
115	0.0	0.0
123	0.0	0.0

```
[32]: travel_intervention_df.columns
```

```
[32]: Index(['Entry ID', 'Jurisdiction ', 'Level', 'Date announced',  
        'Date implemented', 'Intervention category', 'Intervention type',  
        'Who Implemented', 'What Implemented', 'Effective Until',  
        'Indigenous population group', 'Primary source', 'timediff',  
        'duration'],  
        dtype='object')
```

```
[33]: travel_intervention_df.groupby('Jurisdiction ').size()
```

```
[33]: Jurisdiction  
Alta.      3  
B.C.       6  
Can.      23  
Man.       5  
N.B.       8  
N.L.       6  
N.S.       3  
N.W.T.     8  
Nun.      12  
Ont.       1  
P.E.I.     4  
Que.      11  
Sask.      8  
Y.T.      10  
dtype: int64
```

Provincial Travel Restrictions

```
[34]: column_name = ['Intervention type', 'Who Implemented']

for column in column_name:

    fig = px.bar(x = travel_intervention_df['Date implemented'], y =
↳travel_intervention_df[column], color=travel_intervention_df['Jurisdiction_
↳'], title='Provincial travel restriction')
    fig.show()
```

- Here we can see most provinces implemented travel restriction in the month of March.
 - Some of the policies that were in effect from march are as follows:
1. Prohibited cruise ships with overnight accommodations carrying more than 100 persons from operating in Canadian waters and passenger vessels with the capacity to carry more than 12 persons from entering Arctic coastal waters
 2. Announced that all passenger vessels (with the exception of cruise ships with overnight accommodations) must follow provincial, territorial, local and regional health authority requirements for timelines and processes to resume operations
 3. Implemented enhanced border screening measures at the Alta./U.S. border crossing at Coutts (busiest in the province and open 24 hours)
 4. Announced that foreign nationals who are immediate family members of Canadian citizens and permanent residents, and who do not have COVID-19 or exhibit any signs or symptoms of COVID-19, or who do not have reason to believe they have COVID-19, will be exempt from the prohibition on entry to Canada if entering to be with an immediate family member for a period of at least 15 days and they quarantine for 14 days
 5. Reminding Manitobans that the Public Health Agency of Canada is recommending that travellers who have been in the province of Hubei, including the city of Wuhan, self-isolate for 14 days after departing the area
 6. Travellers returning to N.B. from outside Canada are required to self-monitor for symptoms for 14 days

Number of policies implemented

```
[35]: travel_intervention_df['What Implemented'] = travel_intervention_df['What_
↳Implemented'].astype('str')
text = " ".join(who for who in travel_intervention_df['What Implemented'])
print("There are {} number of policies, which were implemented by above_
↳mentioned officials.".format(travel_intervention_df['What Implemented'].
↳nunique()))
```

There are 108 number of policies, which were implemented by above mentioned officials.

C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:1:
SettingWithCopyWarning:

A value is trying to be set on a copy of a slice from a DataFrame.
Try using `.loc[row_indexer,col_indexer] = value` instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy

```
[36]: # Here we are downloading Wordcloud to create wordcloud based on the column  
      ↪ values using textmining
```

```
from PIL import Image  
from wordcloud import WordCloud, STOPWORDS, ImageColorGenerator
```

```
[38]: # generating Wordcloud based on the frequency of word.
```

```
# Create stopword list:  
stopwords = set(STOPWORDS)  
stopwords.update(["of", ",", ";",  
    ↪ "a", "an", "or", "is", "for", "are", "with", "to", "be", "all", "(see secondary",  
    ↪ source column)",  
    ↪  
    ↪ "apply", "including", "COVID", "people", "include", "Launched", "region", "will", "Updated", "may",  
    ↪ "new", "Permitted", "must", "Issued", "source",  
    ↪ column", "Announced", "provided", "released"]])  
  
wc = WordCloud(background_color="white", max_words=2000, stopwords=stopwords,  
    ↪ max_font_size=50,  
    ↪ contour_width=3, contour_color='firebrick')  
wc.generate(text)  
plt.figure(figsize=(20,15))  
plt.imshow(wc, interpolation='bilinear')  
plt.axis("off")  
plt.show()
```



- Here we can see some of the keywords from the policies implemented:

1. Non Essential related travels were called off.
2. Travellers returning to Canada needed to self isolate themselves for 14 days
3. Temporary restrictions on travels related to cruise ship
4. Closing of the border
5. Essential services and workers were told to take all required preventive measures

From Apple's Mobility data we can understand the pattern of inner travel restriction in the Canada

```
[40]: mobility_data = pd.read_csv('https://covid19-static.cdn-apple.com/
↳covid19-mobility-data/2018HotfixDev22/v3/en-us/
↳applemobilitytrends-2020-10-09.csv')
mobility_data.head()
```

C:\ProgramData\Anaconda3\lib\site-packages\IPython\core\interactiveshell.py:3063: DtypeWarning:

Columns (3) have mixed types.Specify dtype option on import or set low_memory=False.

```
[40]:
```

	geo_type	region	transportation_type	alternative_name	sub-region	\
0	country/region	Albania	driving	NaN	NaN	
1	country/region	Albania	walking	NaN	NaN	
2	country/region	Argentina	driving	NaN	NaN	
3	country/region	Argentina	walking	NaN	NaN	
4	country/region	Australia	driving	AU	NaN	

	country	2020-01-13	2020-01-14	2020-01-15	2020-01-16	...	2020-09-30	\
0	NaN	100.0	95.30	101.43	97.20	...	119.24	
1	NaN	100.0	100.68	98.93	98.46	...	159.83	
2	NaN	100.0	97.07	102.45	111.21	...	60.03	
3	NaN	100.0	95.11	101.37	112.67	...	50.20	
4	NaN	100.0	102.98	104.21	108.63	...	104.14	

		2020-10-01	2020-10-02	2020-10-03	2020-10-04	2020-10-05	2020-10-06	\
0	118.79	130.25	148.03	136.67	123.11		117.50	
1	154.84	159.32	166.40	130.23	168.27		140.04	
2	61.63	74.42	71.69	38.69	55.99		59.95	
3	50.76	57.44	51.42	29.54	46.80		49.56	
4	115.34	109.16	92.42	93.21	96.03		97.06	

		2020-10-07	2020-10-08	2020-10-09
0	119.25	113.17	126.39	
1	154.46	153.60	157.14	
2	62.76	65.86	79.00	
3	53.87	56.02	63.35	
4	97.95	106.72	102.34	

[5 rows x 277 columns]

```
[110]: def get_mobility_by_province(transportation_type, province, day):
        return
        ↳mobility_data[mobility_data['region']==province][mobility_data['transportation_type']==tran
        ↳sum()[day]
```

```
[109]: get_mobility_by_province('walking', 'Manitoba', '2020-09-30')
```

C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

```
[109]: 1466      129.52
        Name: 2020-09-30, dtype: float64
```

```
[116]: provincelist = ['Newfoundland and Labrador', 'Ontario', 'Quebec', 'Nova_
        ↳Scotia', 'New Brunswick', 'Manitoba', 'British Columbia', 'Prince Edward_
        ↳Island', 'Saskatchewan', 'Alberta']

        for province in provincelist:
            print(get_mobility_by_province('driving', province, '2020-10-09'))
```

169.99

140.83
124.59
186.24
183.92
153.5
141.35
184.84
177.09
154.81

C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

```
[113]: mobility_data[mobility_data['region']=='Prince Edward Island']
```

```
[113]:      geo_type      region transportation_type \
1705 sub-region Prince Edward Island driving

      alternative_name sub-region country 2020-01-13 2020-01-14 \
1705 PE|Île-du-Prince-Édouard NaN Canada 100.0 107.65

      2020-01-15 2020-01-16 ... 2020-09-30 2020-10-01 2020-10-02 \
1705 104.29 95.3 ... 163.14 168.47 205.01

      2020-10-03 2020-10-04 2020-10-05 2020-10-06 2020-10-07 2020-10-08 \
1705 206.13 169.85 145.64 163.36 153.33 145.93

      2020-10-09
1705 184.84
```

[1 rows x 277 columns]

- some province only have driving mobility report

```
[197]: cols = mobility_data.keys()
mobility = mobility_data.loc[:, cols[6]:cols[-1]]
```

```
[198]: dates = mobility.keys()
dates
```

```
[198]: Index(['2020-01-13', '2020-01-14', '2020-01-15', '2020-01-16', '2020-01-17',
        '2020-01-18', '2020-01-19', '2020-01-20', '2020-01-21', '2020-01-22',
        ...,
        '2020-09-30', '2020-10-01', '2020-10-02', '2020-10-03', '2020-10-04',
        '2020-10-05', '2020-10-06', '2020-10-07', '2020-10-08', '2020-10-09'],
        dtype='object', length=271)
```

```
[209]: import datetime
```

```
[211]: date_obj = []

for i in range(len(dates)):
    date_obj.append(datetime.datetime.strptime(dates[i], '%Y-%m-%d').
↳strptime('%Y-%m-%d'))
```

```
[213]: def weekday_or_weekend(date):
    day = datetime.datetime.strptime(date, '%Y-%m-%d').weekday()

    if (((day+1)%6==0) or ((day+1)%7==0)):
        return True
```

```
[214]: days_since_1_13 = [i for i in range(len(date_obj))]
```

- Travel Restrictions were implemented in the month of march.
- The mobility reports will show us the trend how implementing these policies helped in spreading the virus.
- Low mobility means less spread of the virus.
- High mobility means more spread of the virus.

```
[231]: column_name = ['Intervention type', 'Who Implemented']

for column in column_name:

    fig = px.bar(x = travel_intervention_df['Date implemented'], y =_
↳travel_intervention_df[column], color=travel_intervention_df['Jurisdiction_
↳'], title='Provincial travel restriction')
    fig.show()

import matplotlib.dates as mdates

provincelist = ['Newfoundland and Labrador', 'Ontario', 'Quebec', 'Nova_
↳Scotia', 'New Brunswick', 'Manitoba', 'British Columbia', 'Prince Edward_
↳Island', 'Saskatchewan', 'Alberta']

mobility_latest_date = mobility_data.columns[-1]
mobility_latest_index = date_obj.index(mobility_latest_date)

for province in provincelist:

    weekday_mobility = []
    weekend_mobility = []
```

```

weekday_dates = []
weekend_dates = []

for i in range(len(date_obj)):

    if i <= mobility_latest_index:

        if weekday_or_weekend(date_obj[i]):
            weekend_mobility.append(get_mobility_by_province('driving',
↪province, date_obj[i]))
            weekend_dates.append(i)

        else:
            weekday_mobility.
↪append(get_mobility_by_province('driving', province, date_obj[i]))
            weekday_dates.append(i)

for i in range(len(weekend_mobility)):
    if weekend_mobility[i]==0 and i!=0:
        weekend_mobility[i] = weekend_mobility[i-1]
    elif weekend_mobility[i] == 0 and i ==0:
        weekend_mobility[i] = weekend_mobility[i+1]
    else:
        pass

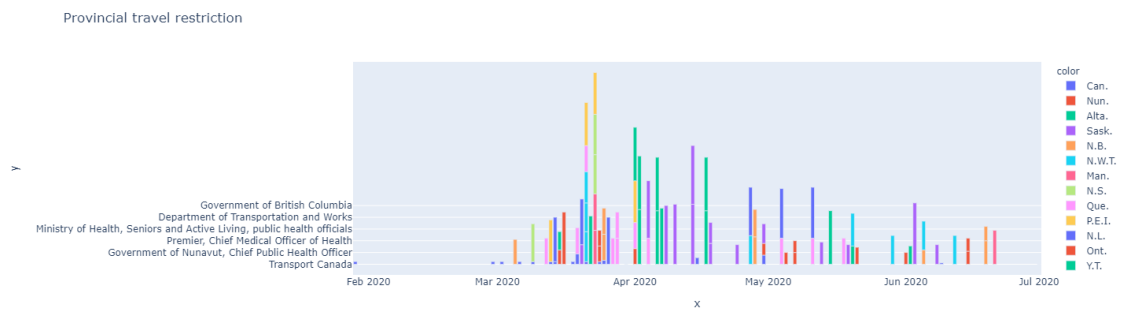
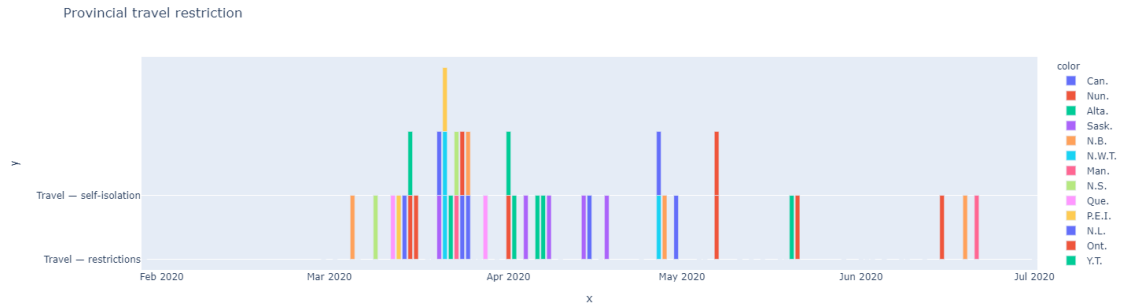
for i in range(len(weekday_mobility)):
    if weekday_mobility[i]==0 and i!=0:
        weekday_mobility[i] = weekday_mobility[i-1]
    elif weekday_mobility[i] == 0 and i ==0:
        weekday_mobility[i] = weekday_mobility[i+1]
    else:
        pass

plt.figure(figsize=(20,15))
# plt.bar(weekday_dates,weekday_mobility, color='cornflowerblue')
plt.plot(weekday_dates,weekday_mobility, color='green')

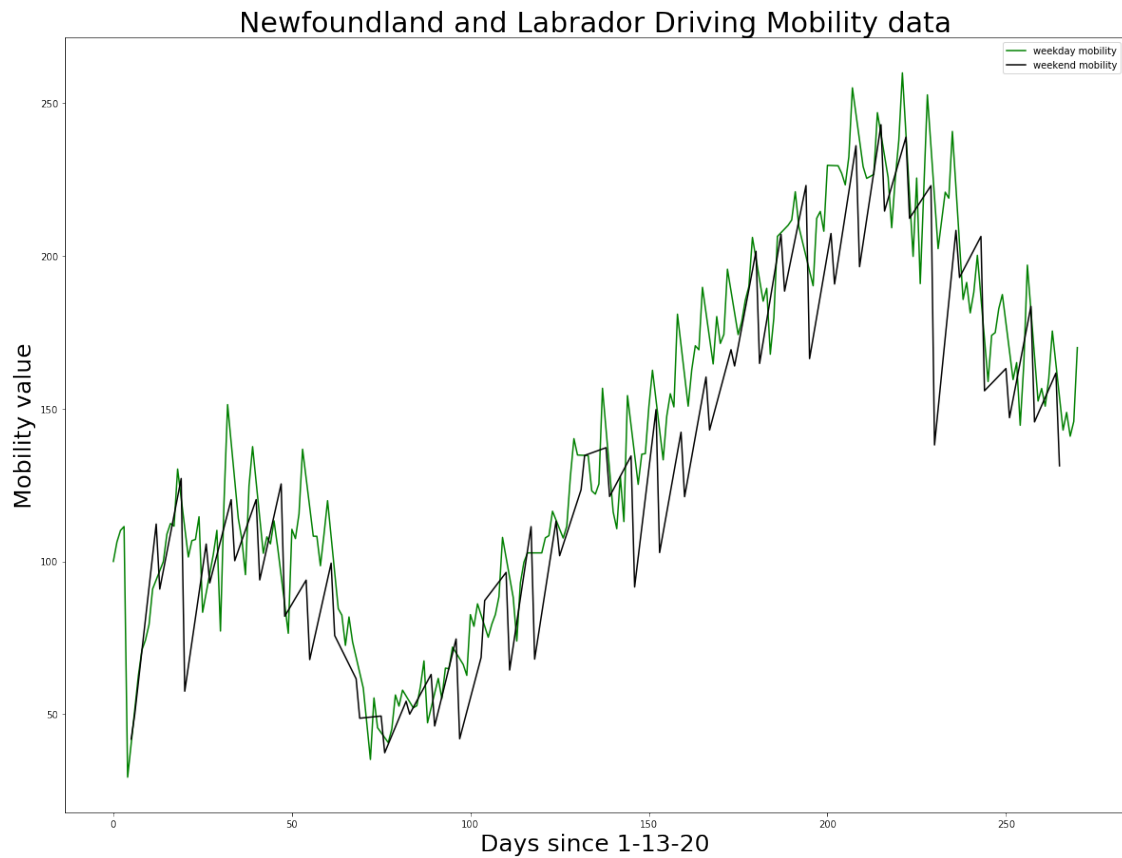
# plt.bar(weekend_dates,weekend_mobility, color='salmon')
plt.plot(weekend_dates,weekend_mobility, color='black')

plt.legend(['weekday mobility','weekend mobility'])
plt.title('{} Driving Mobility data'.format(province),size=30)
plt.xlabel('Days since 1-13-20', size=25)
plt.ylabel('Mobility value', size = 25)
plt.show()

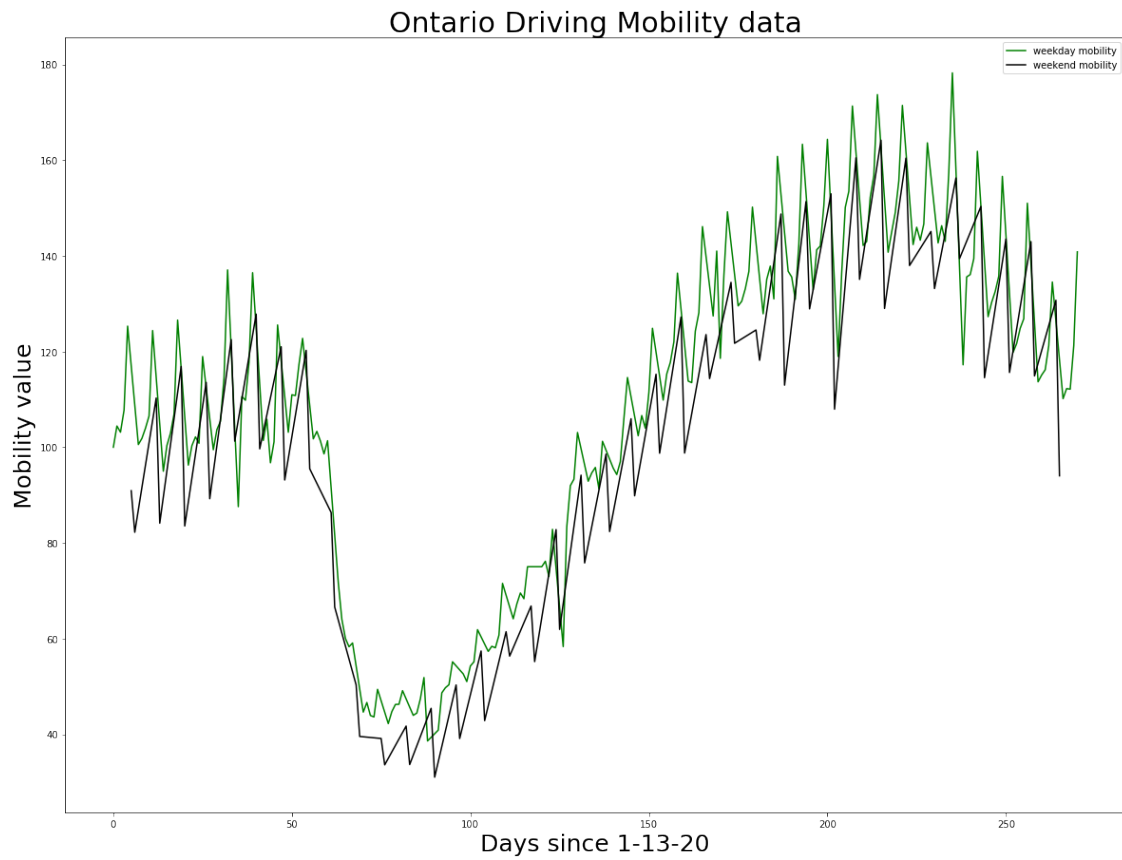
```



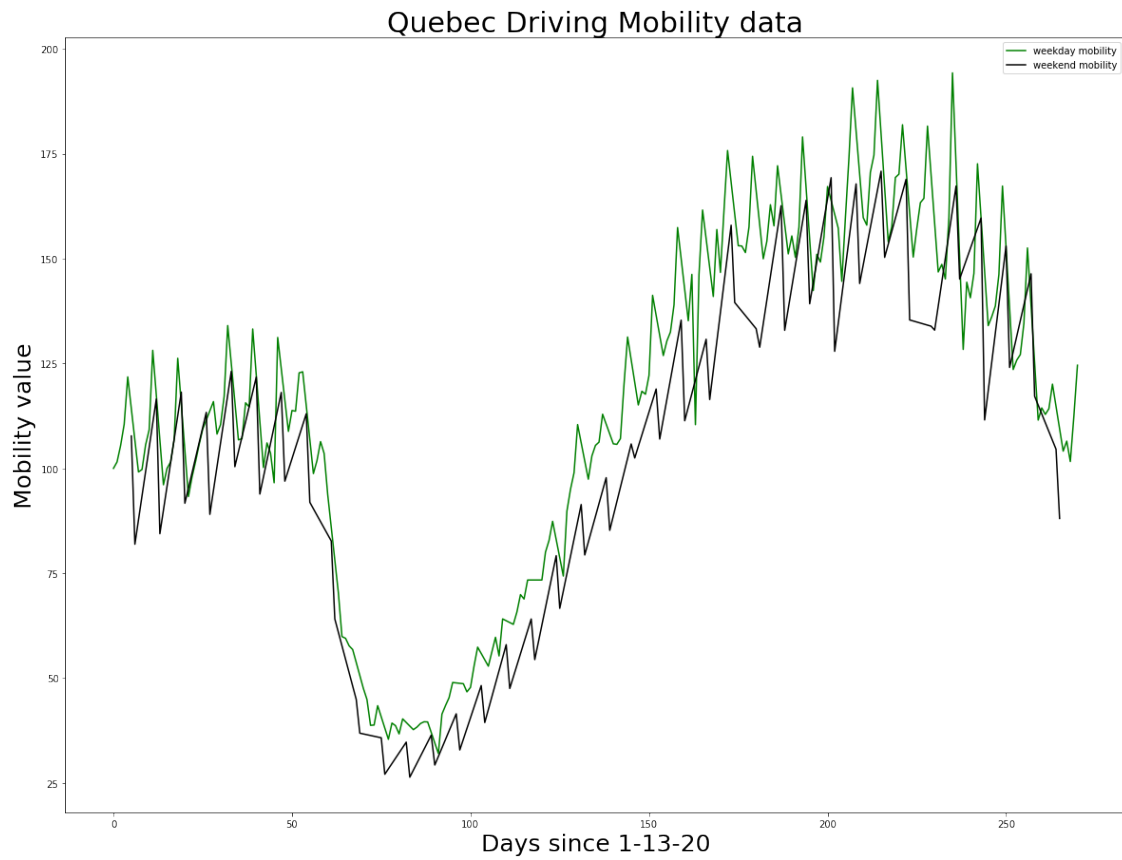
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:
Boolean Series key will be reindexed to match DataFrame index.



```
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:  
Boolean Series key will be reindexed to match DataFrame index.
```

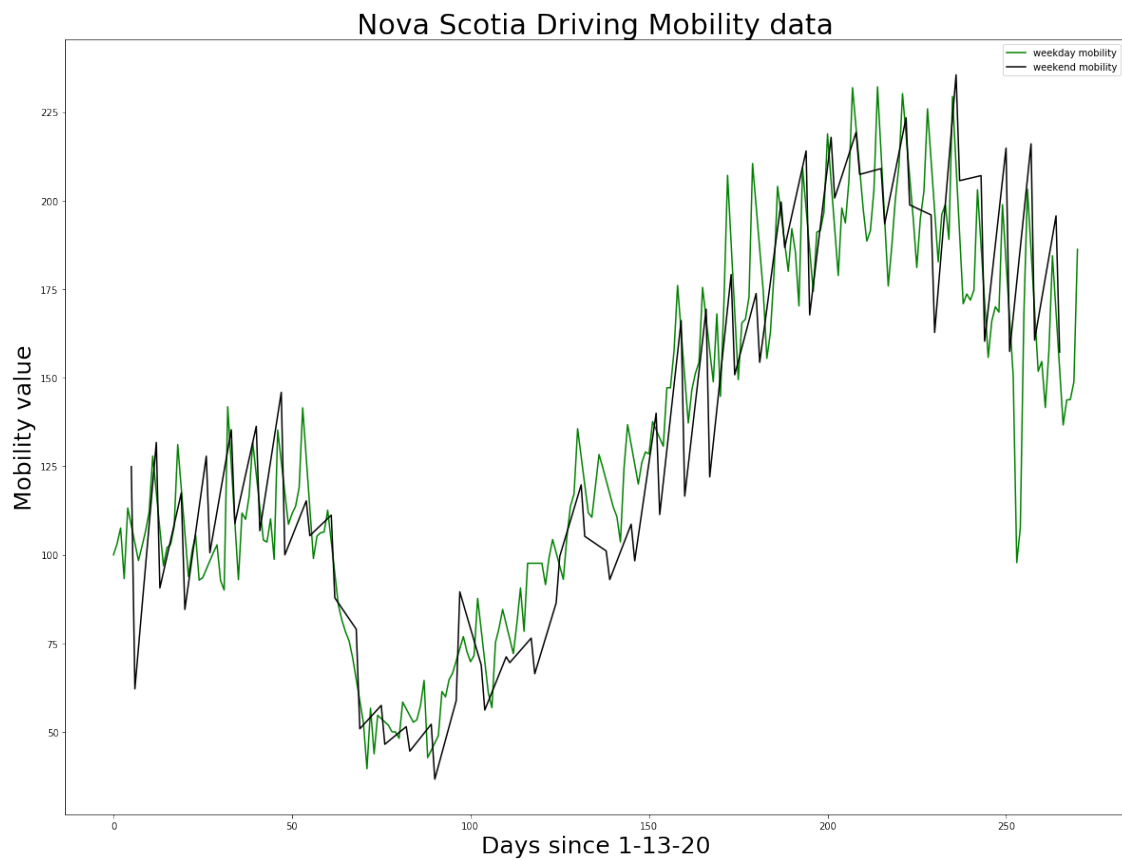


```
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:  
Boolean Series key will be reindexed to match DataFrame index.
```

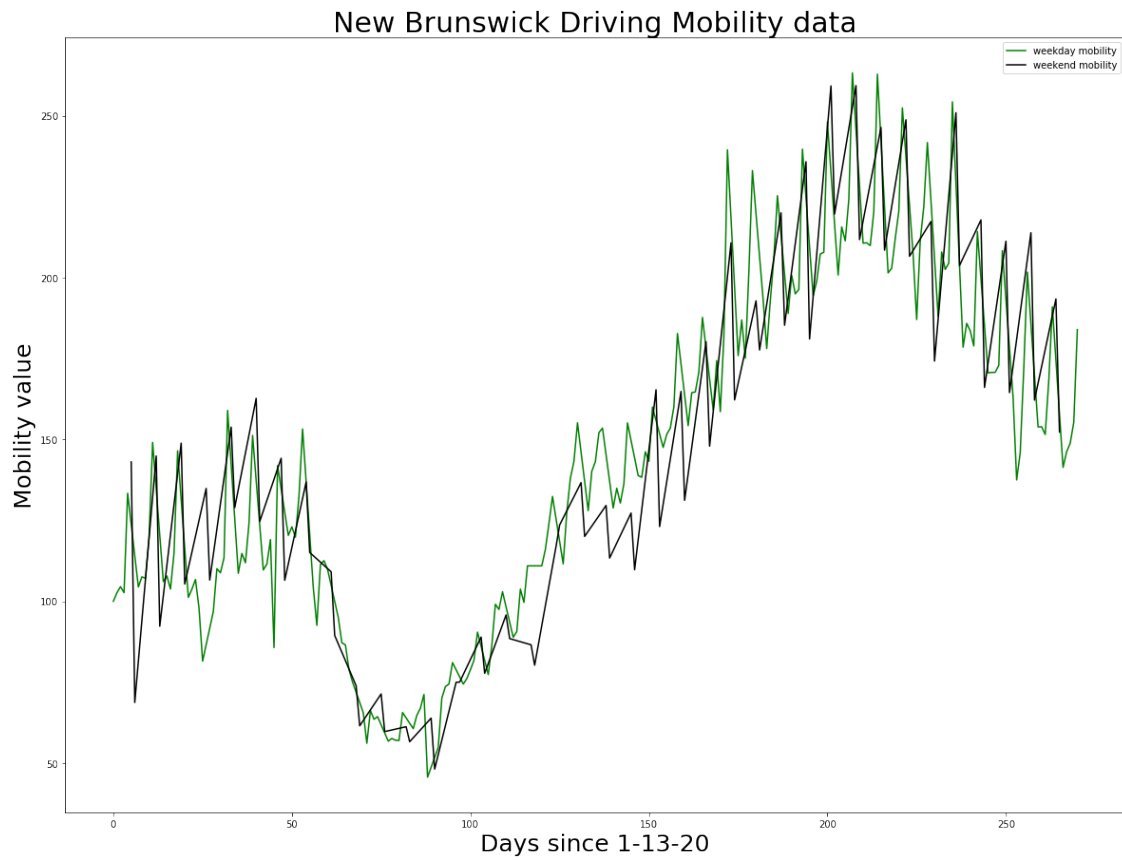


C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:

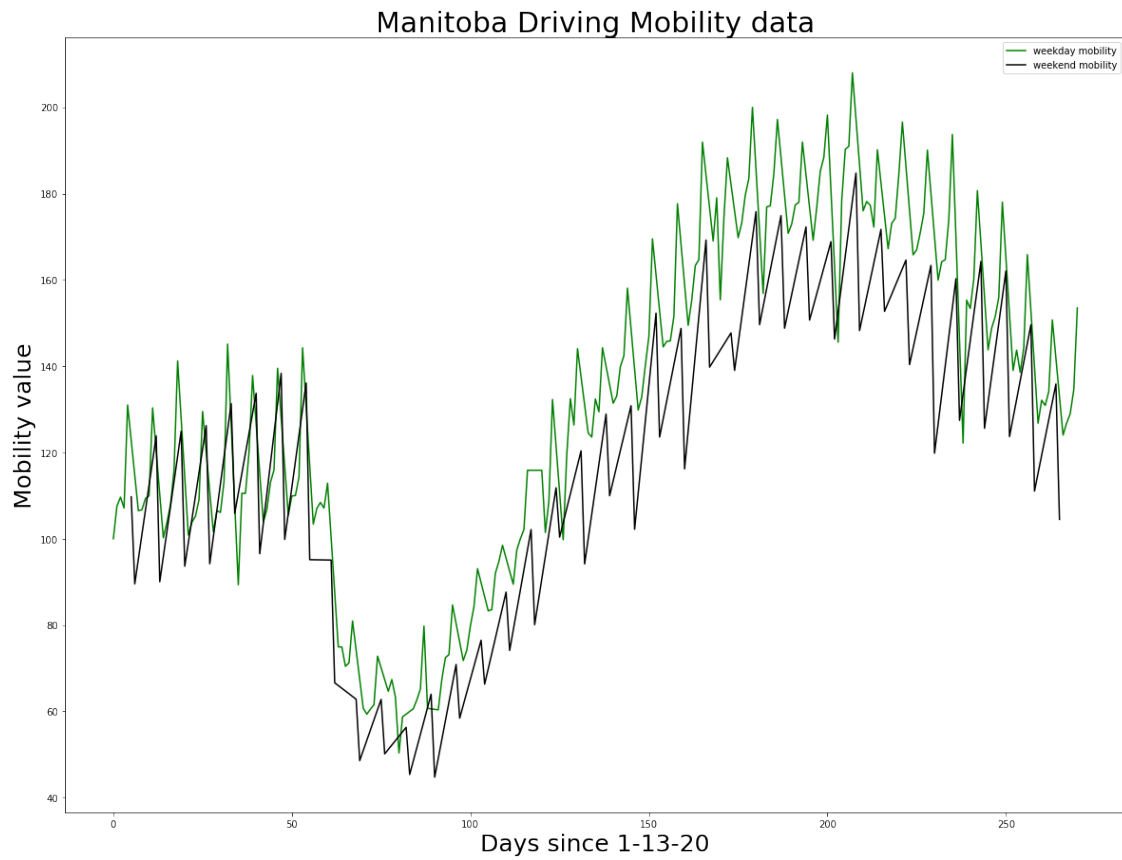
Boolean Series key will be reindexed to match DataFrame index.



```
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:  
Boolean Series key will be reindexed to match DataFrame index.
```

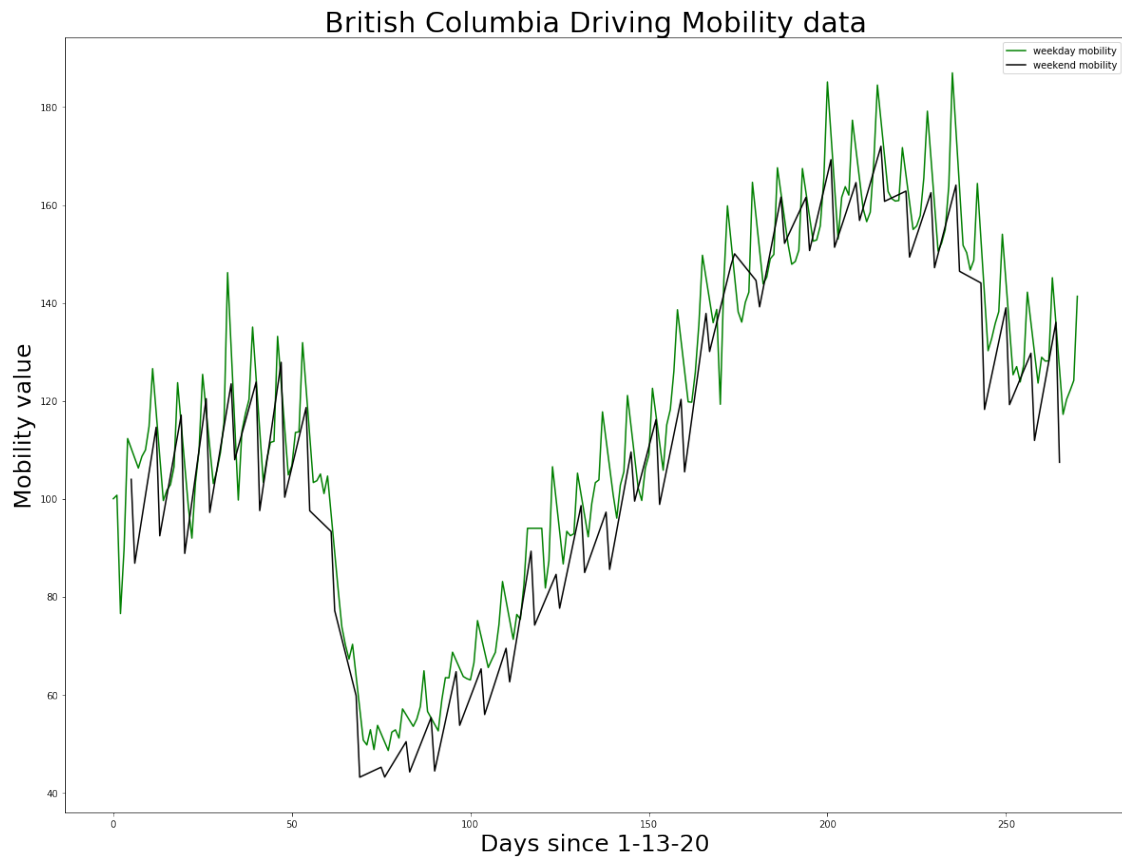



```
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:  
Boolean Series key will be reindexed to match DataFrame index.
```



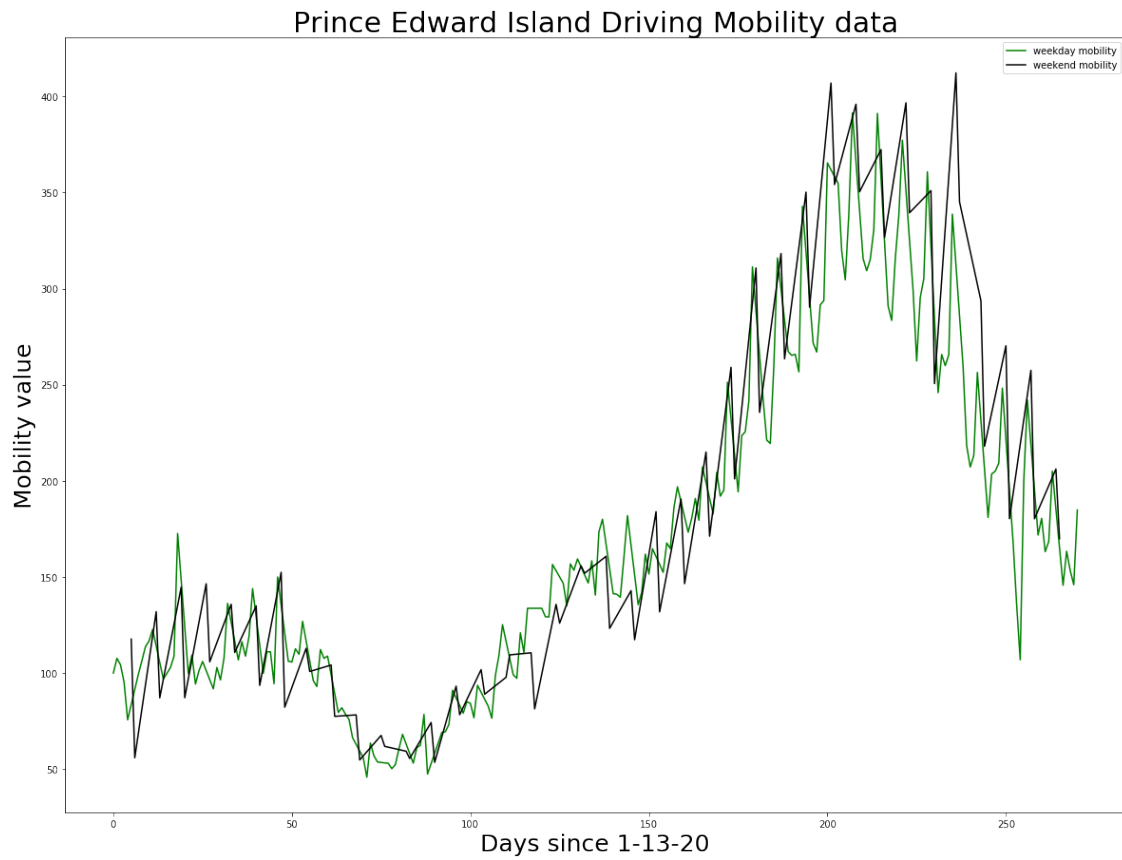
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

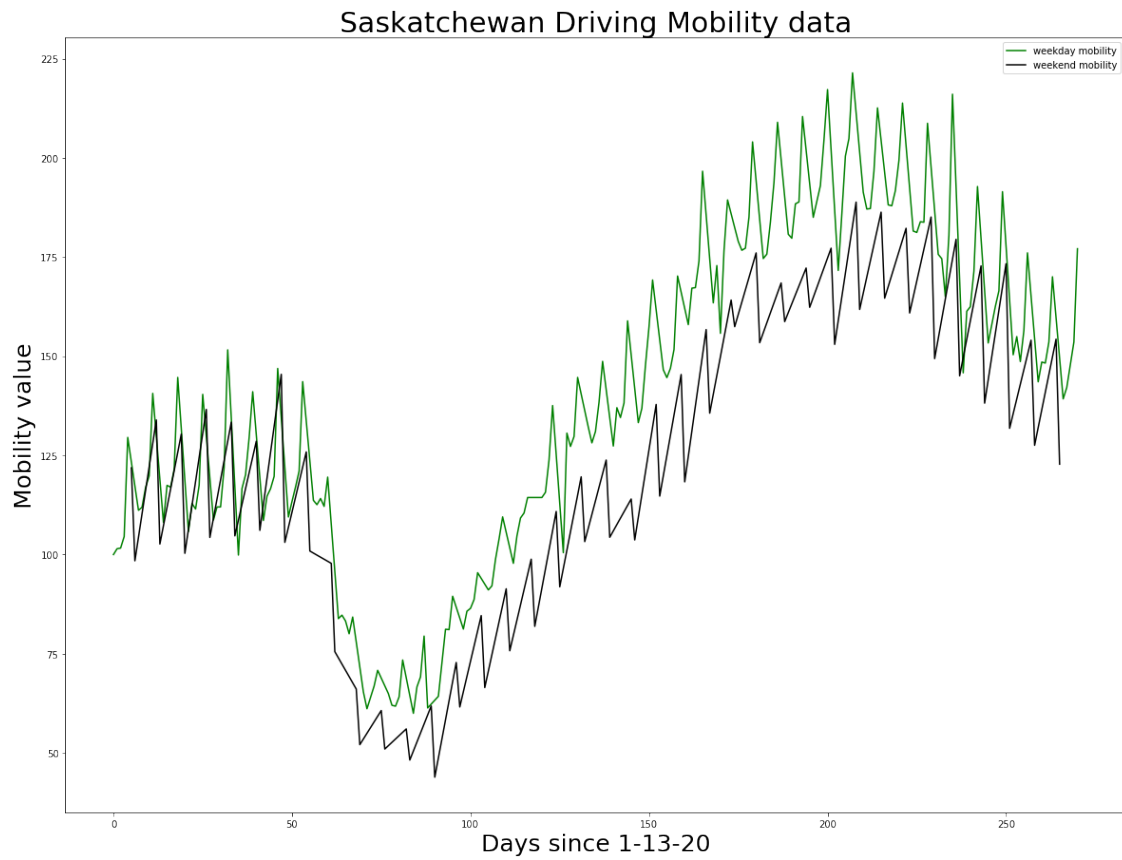


C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

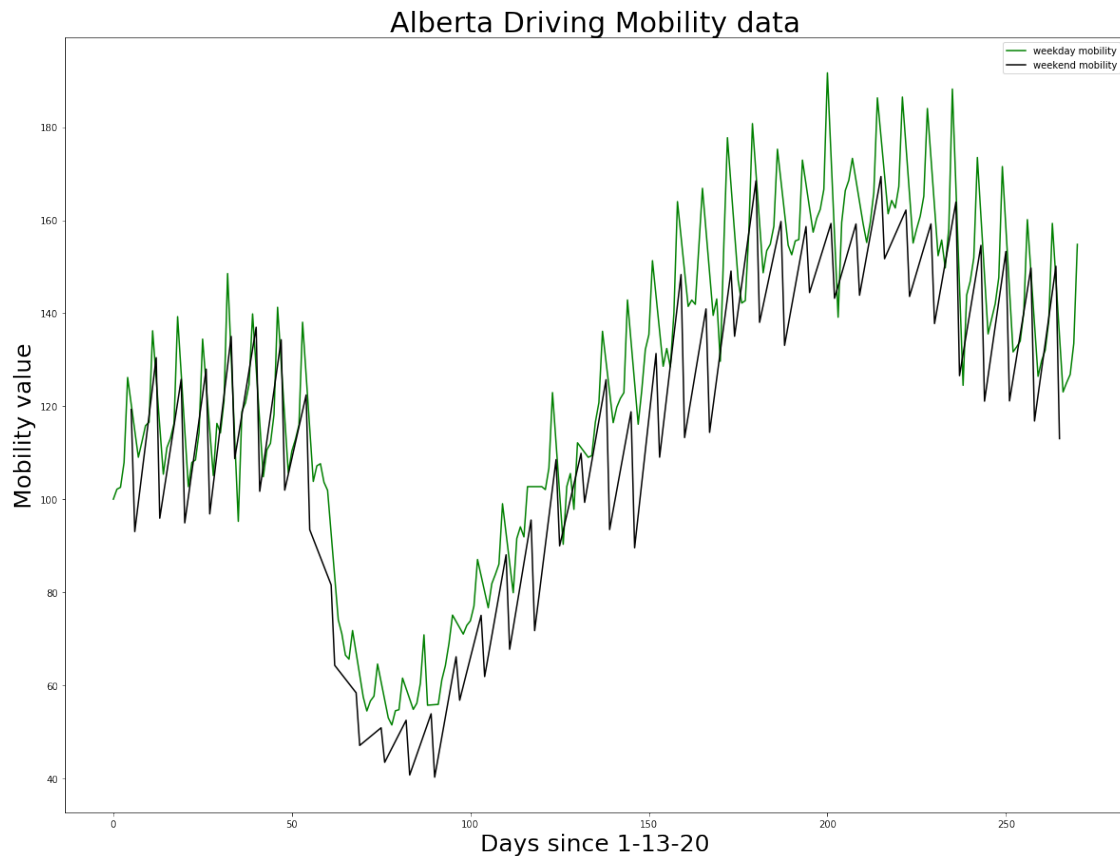


```
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:  
Boolean Series key will be reindexed to match DataFrame index.
```



C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.



Some provinces doesn't have walking and transit data available

```
[224]: # sample testing for driving data
provincelist = ['Newfoundland and Labrador', 'Ontario', 'Quebec', 'Nova_
↳Scotia', 'New Brunswick', 'Manitoba', 'British Columbia', 'Prince Edward_
↳Island', 'Saskatchewan', 'Alberta']

for province in provincelist:
    print(get_mobility_by_province('walking', province, '2020-10-09'))
```

```
201.15
114.08
110.22
196.81
200.0
151.98
138.12
0.0
187.7
186.11
```

C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

- we can see prince edward island doesn't have walking mobility data available, so we will update our province list by removing it and plotting the data for the rest of others.

```
[225]: import matplotlib.dates as mdates

# updated list

provincelist = ['Newfoundland and Labrador', 'Ontario', 'Quebec', 'Nova_
↳Scotia', 'New Brunswick', 'Manitoba', 'British_
↳Columbia', 'Saskatchewan', 'Alberta']

mobility_latest_date = mobility_data.columns[-1]
mobility_latest_index = date_obj.index(mobility_latest_date)

for province in provincelist:

    weekday_mobility = []
    weekend_mobility = []
    weekday_dates = []
    weekend_dates = []

    for i in range(len(date_obj)):

        if i <= mobility_latest_index:

            if weekday_or_weekend(date_obj[i]):
                weekend_mobility.append(get_mobility_by_province('walking',
↳province, date_obj[i]))
                weekend_dates.append(i)

            else:
                weekday_mobility.
↳append(get_mobility_by_province('walking', province, date_obj[i]))
                weekday_dates.append(i)

    for i in range(len(weekend_mobility)):
        if weekend_mobility[i]==0 and i!=0:
            weekend_mobility[i] = weekend_mobility[i-1]
        elif weekend_mobility[i] == 0 and i ==0:
            weekend_mobility[i] = weekend_mobility[i+1]
```

```

        else:
            pass

    for i in range(len(weekday_mobility)):
        if weekday_mobility[i]==0 and i!=0:
            weekday_mobility[i] = weekday_mobility[i-1]
        elif weekday_mobility[i] == 0 and i ==0:
            weekday_mobility[i] = weekday_mobility[i+1]
        else:
            pass

    plt.figure(figsize=(20,15))
    # plt.bar(weekday_dates,weekday_mobility, color='cornflowerblue')
    plt.plot(weekday_dates,weekday_mobility, color='green')

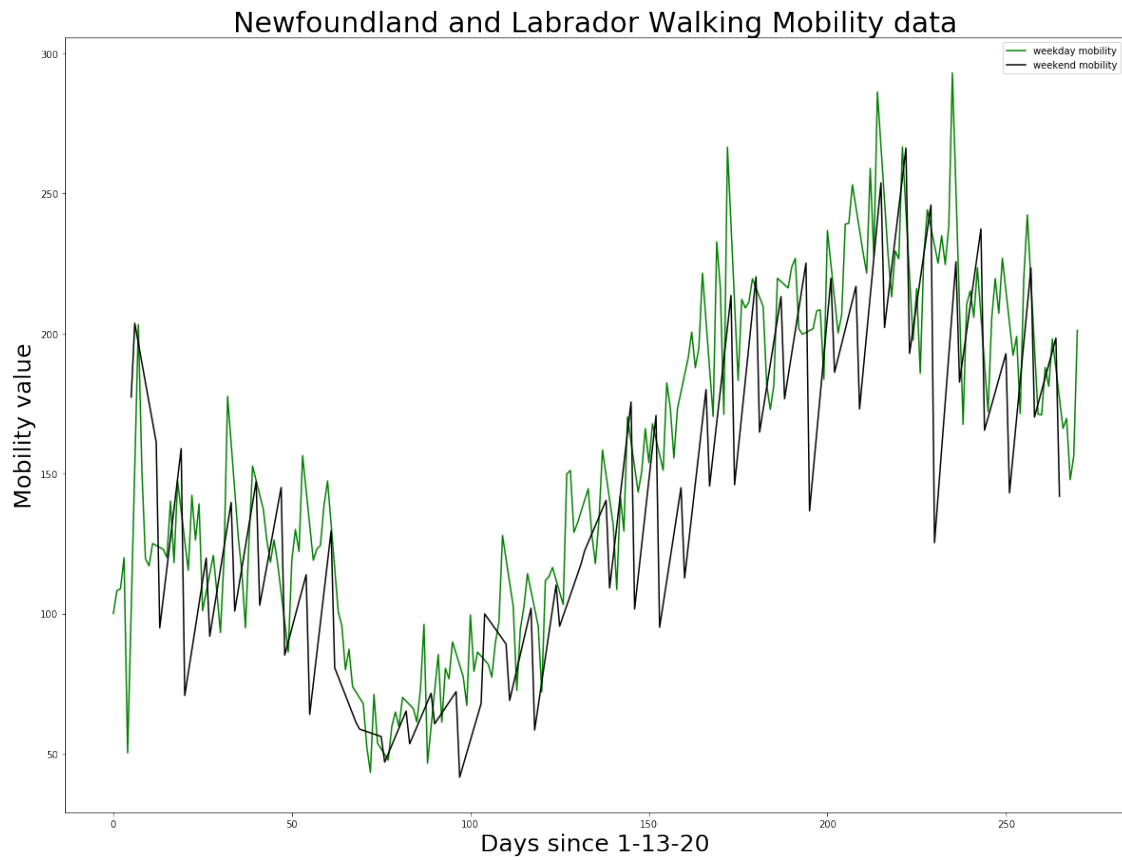
    # plt.bar(weekend_dates,weekend_mobility, color='salmon')
    plt.plot(weekend_dates,weekend_mobility, color='black')

    plt.legend(['weekday mobility','weekend mobility'])
    plt.title('{} Walking Mobility data'.format(province),size=30)
    plt.xlabel('Days since 1-13-20', size=25)
    plt.ylabel('Mobility value', size = 25)
    plt.show()

```

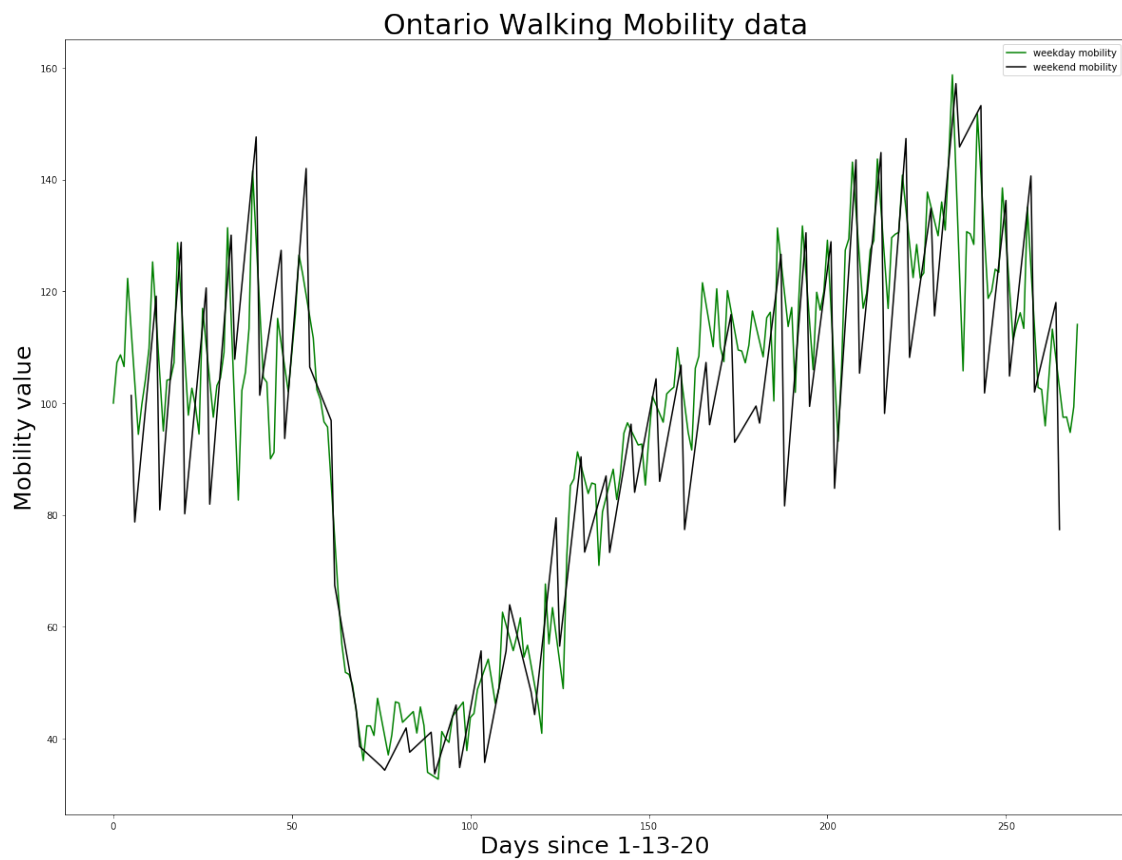
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

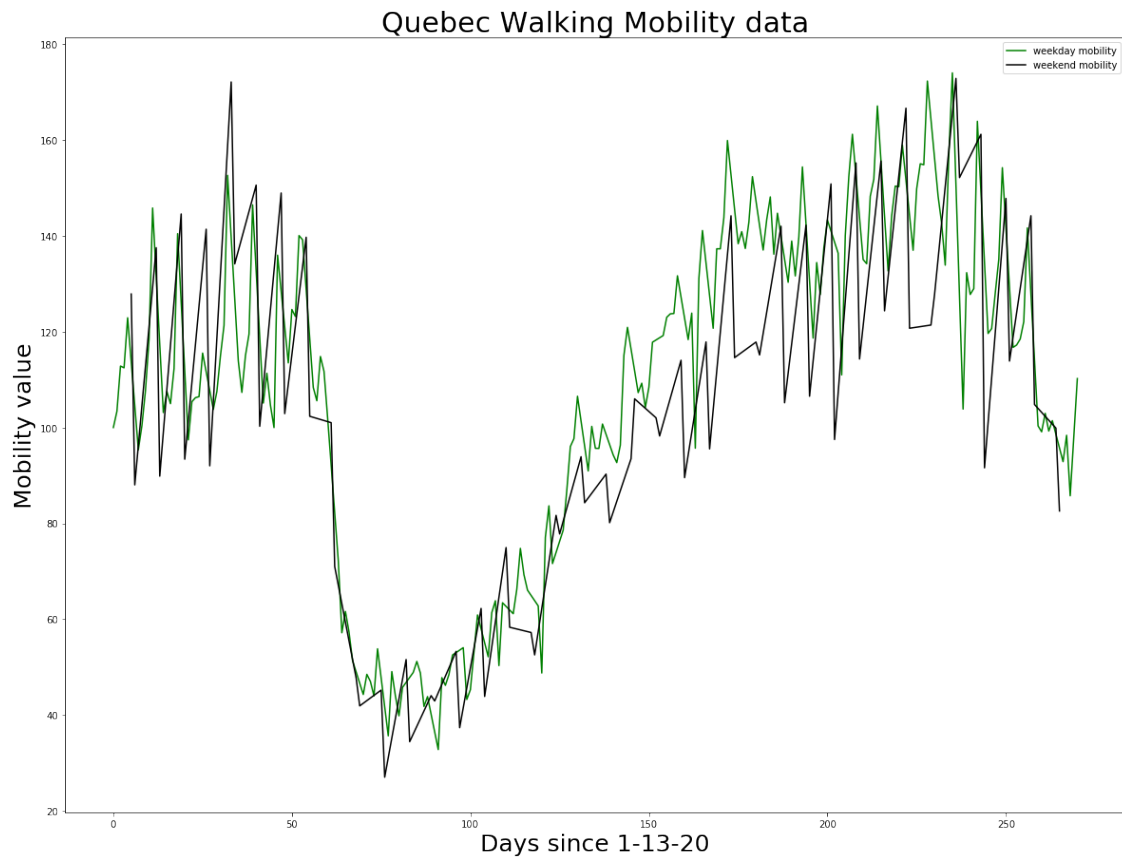


C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

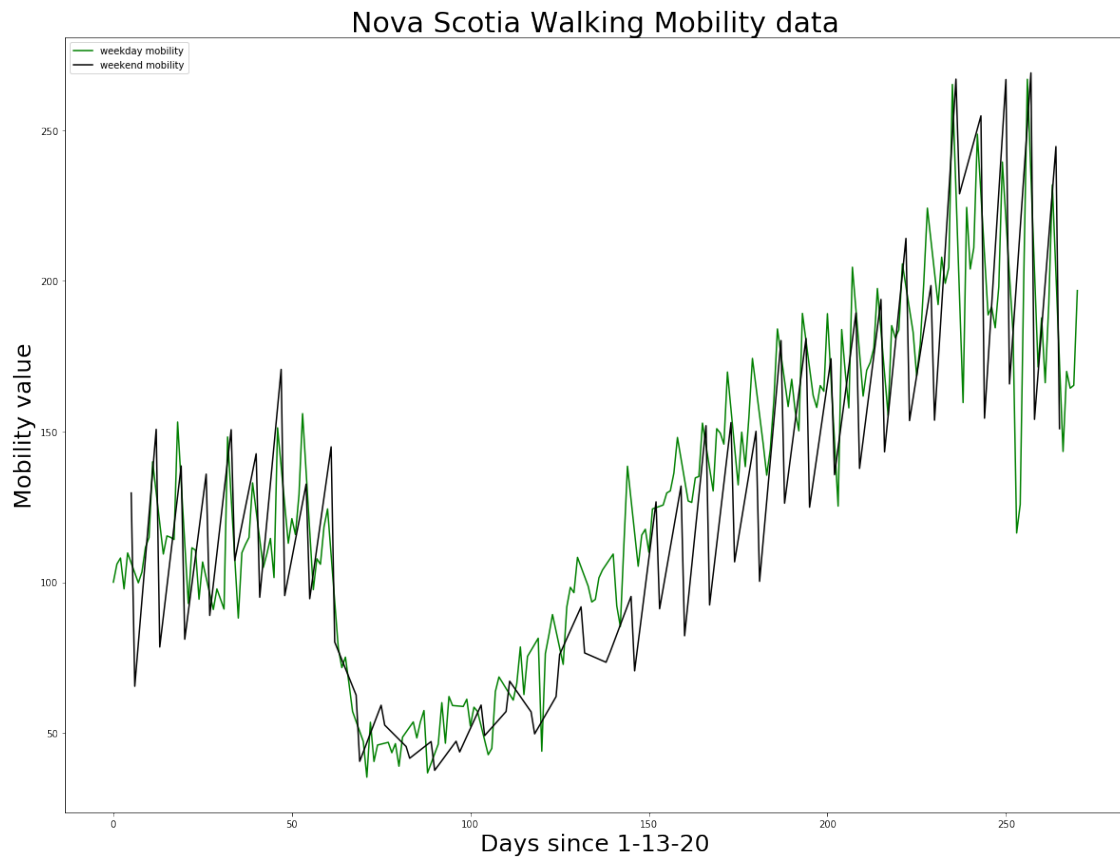


```
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:  
Boolean Series key will be reindexed to match DataFrame index.
```

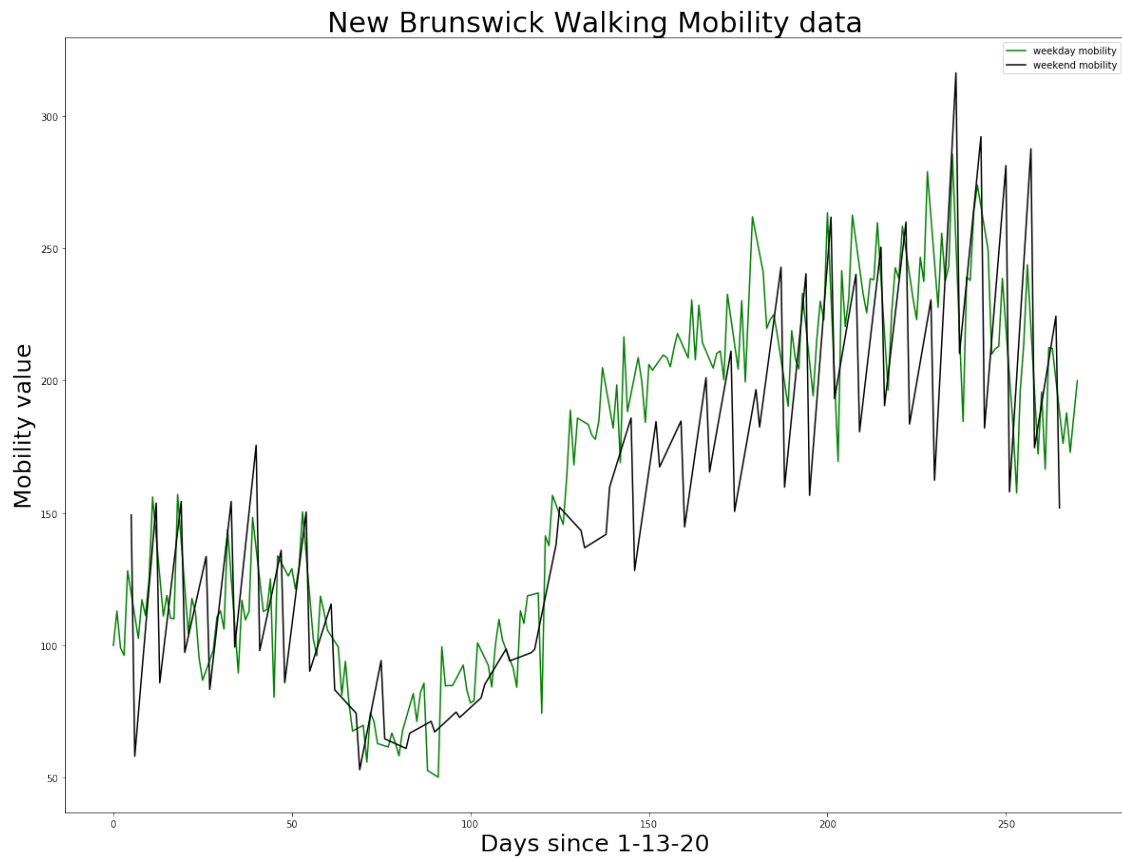


C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

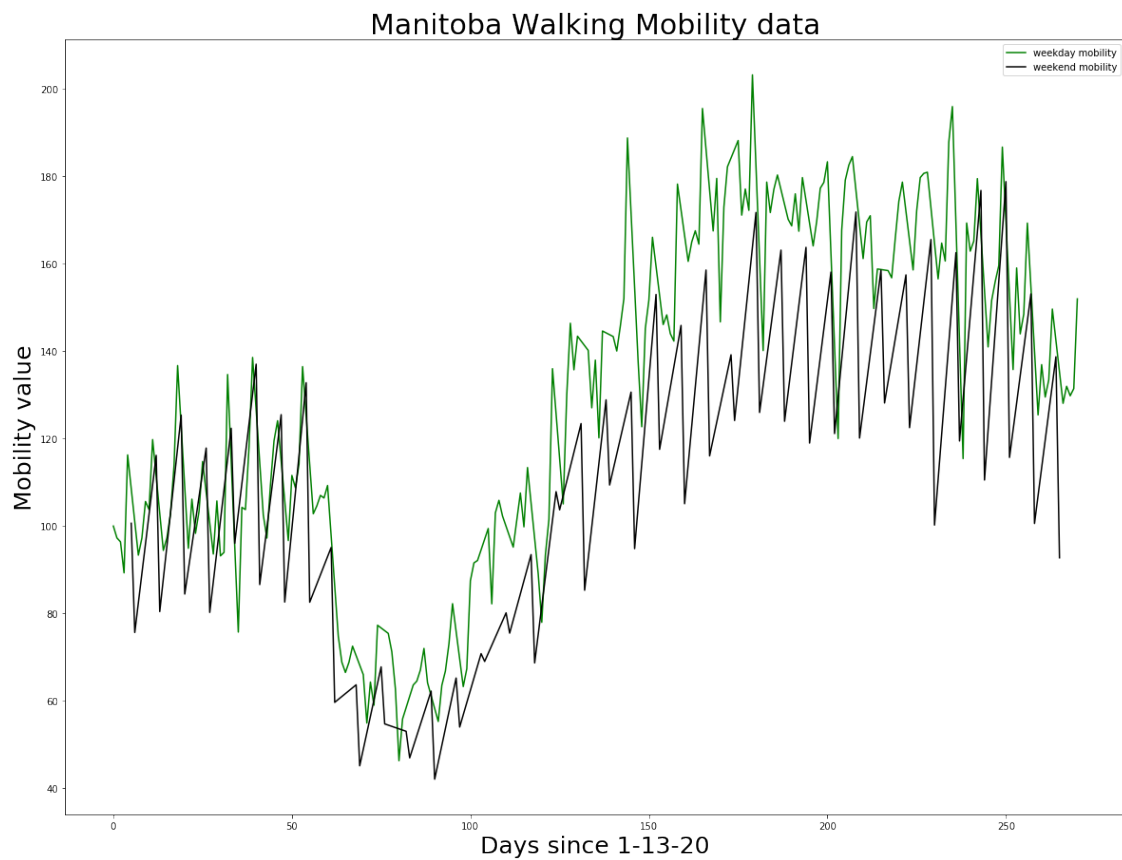


```
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:  
Boolean Series key will be reindexed to match DataFrame index.
```

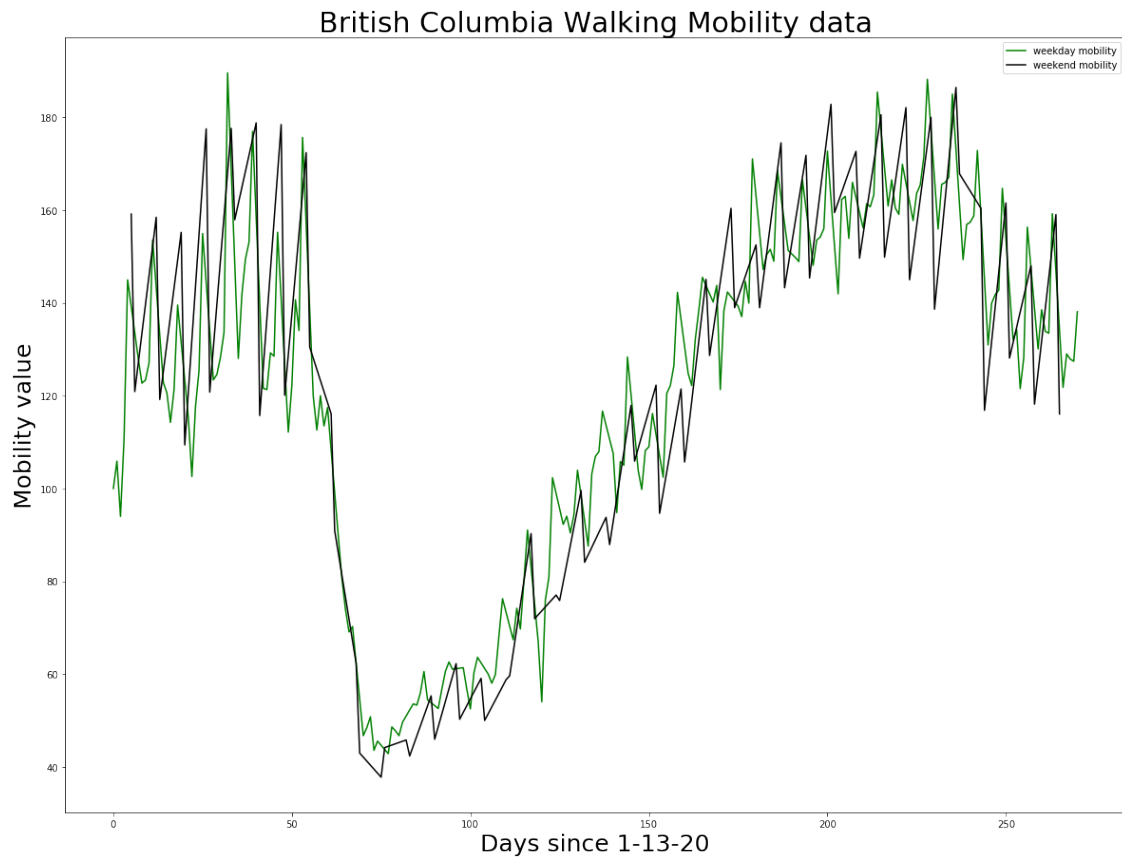


C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

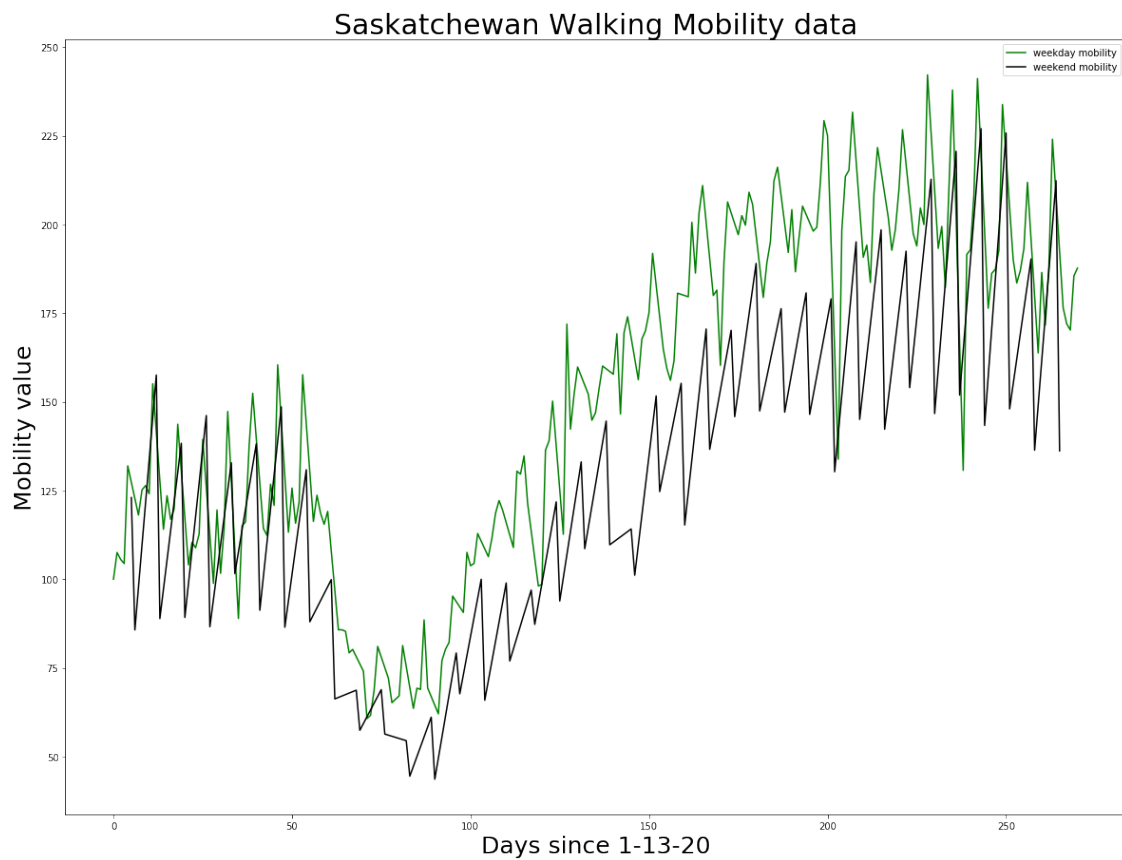


```
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:  
Boolean Series key will be reindexed to match DataFrame index.
```

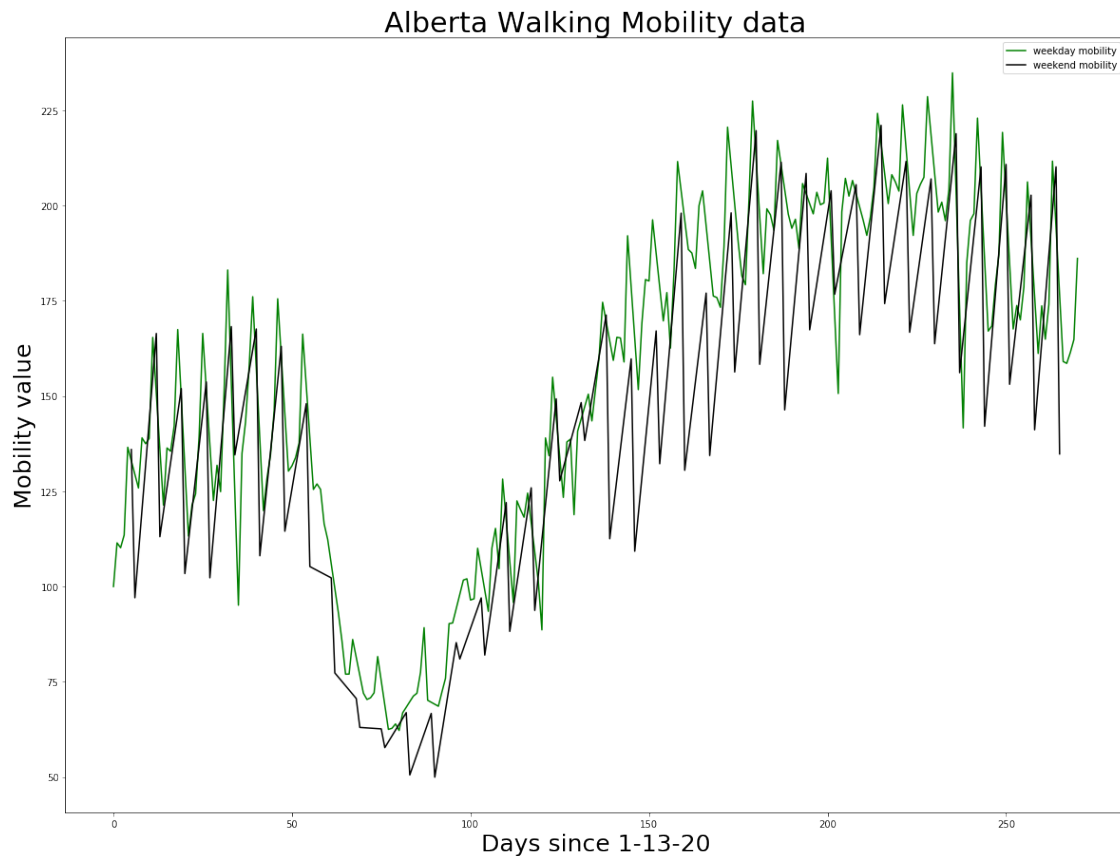


C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.



```
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:  
Boolean Series key will be reindexed to match DataFrame index.
```

```
[229]: # sample testing for driving data
provincelist = ['Newfoundland and Labrador','Ontario','Quebec','Nova_
↳Scotia','New Brunswick','Manitoba','British Columbia','Prince Edward_
↳Island','Saskatchewan','Alberta']

for province in provincelist:
    print(get_mobility_by_province('transit',province,'2020-10-09'))
```

```
0.0
50.36
50.31
76.08
0.0
70.29
51.01
0.0
53.27
68.78
```

C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

- Here we can see Newfoundland and Labrador, New Brunswick, and prince edward island doesn't have transit mobility data. we will remove them from the list and plot the transit data for the rest.

```
[230]: import matplotlib.dates as mdates

# updated list

provincelist = ['Ontario', 'Quebec', 'Nova Scotia', 'Manitoba', 'British_Columbia', 'Saskatchewan', 'Alberta']

mobility_latest_date = mobility_data.columns[-1]
mobility_latest_index = date_obj.index(mobility_latest_date)

for province in provincelist:

    weekday_mobility = []
    weekend_mobility = []
    weekday_dates = []
    weekend_dates = []

    for i in range(len(date_obj)):

        if i <= mobility_latest_index:

            if weekday_or_weekend(date_obj[i]):
                weekend_mobility.append(get_mobility_by_province('transit', province, date_obj[i]))
                weekend_dates.append(i)

            else:
                weekday_mobility.append(get_mobility_by_province('transit', province, date_obj[i]))
                weekday_dates.append(i)

    for i in range(len(weekend_mobility)):
        if weekend_mobility[i]==0 and i!=0:
            weekend_mobility[i] = weekend_mobility[i-1]
        elif weekend_mobility[i] == 0 and i==0:
            weekend_mobility[i] = weekend_mobility[i+1]
        else:
            pass
```

```

for i in range(len(weekday_mobility)):
    if weekday_mobility[i]==0 and i!=0:
        weekday_mobility[i] = weekday_mobility[i-1]
    elif weekday_mobility[i] == 0 and i ==0:
        weekday_mobility[i] = weekday_mobility[i+1]
    else:
        pass

plt.figure(figsize=(20,15))
# plt.bar(weekday_dates,weekday_mobility, color='cornflowerblue')
plt.plot(weekday_dates,weekday_mobility, color='green')

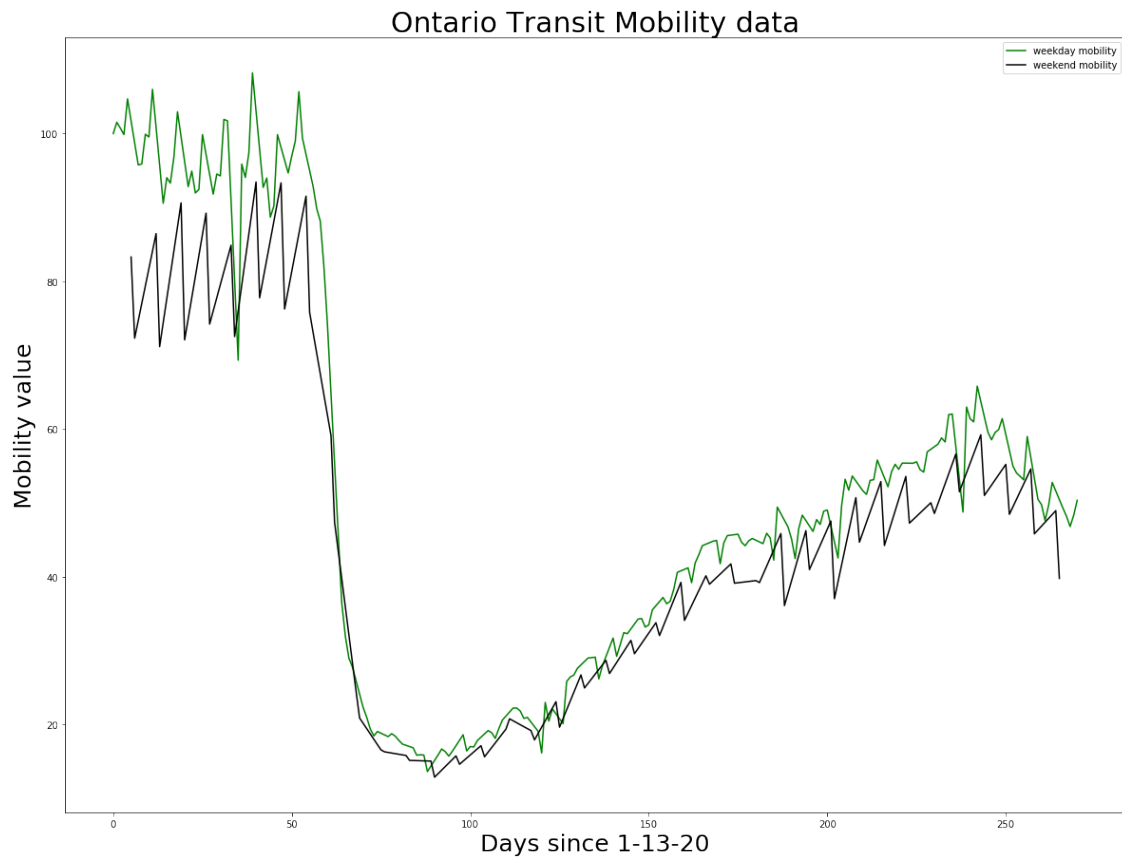
# plt.bar(weekend_dates,weekend_mobility, color='salmon')
plt.plot(weekend_dates,weekend_mobility, color='black')

plt.legend(['weekday mobility','weekend mobility'])
plt.title('{} Transit Mobility data'.format(province),size=30)
plt.xlabel('Days since 1-13-20', size=25)
plt.ylabel('Mobility value', size = 25)
plt.show()

```

C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:

Boolean Series key will be reindexed to match DataFrame index.

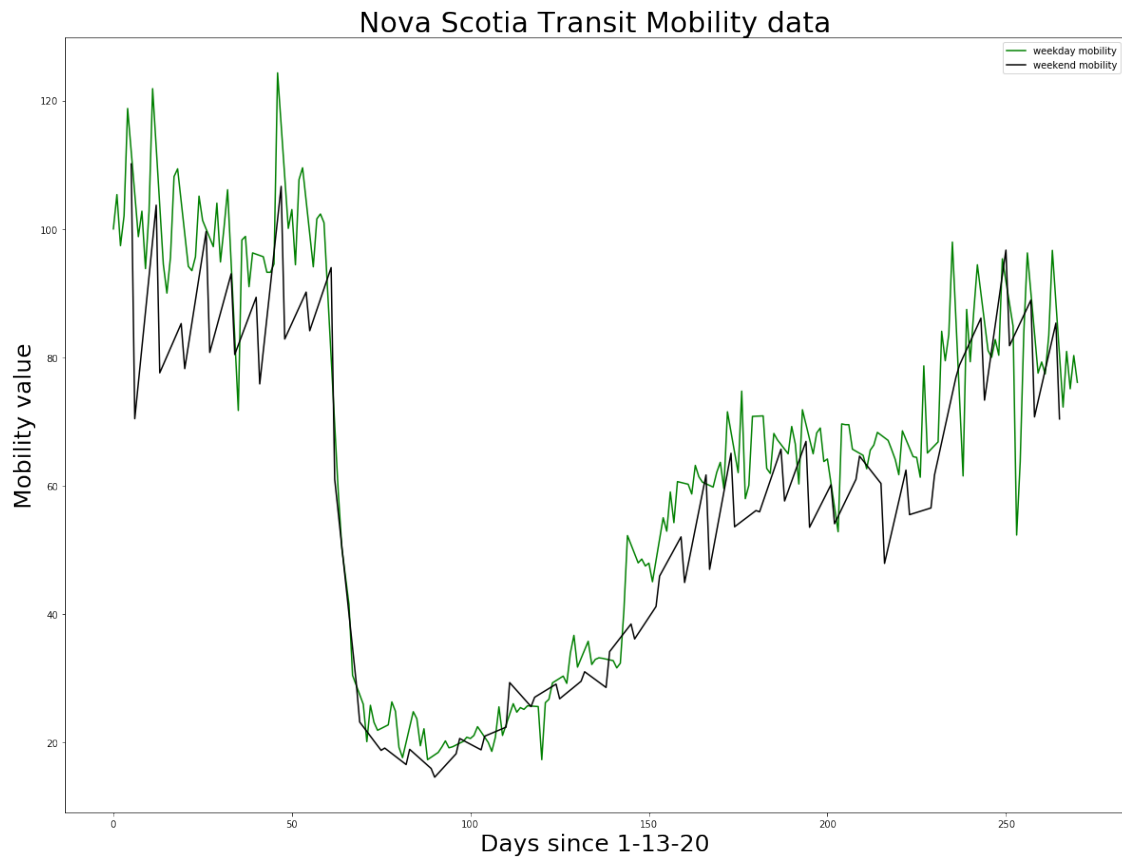


```
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:  
Boolean Series key will be reindexed to match DataFrame index.
```

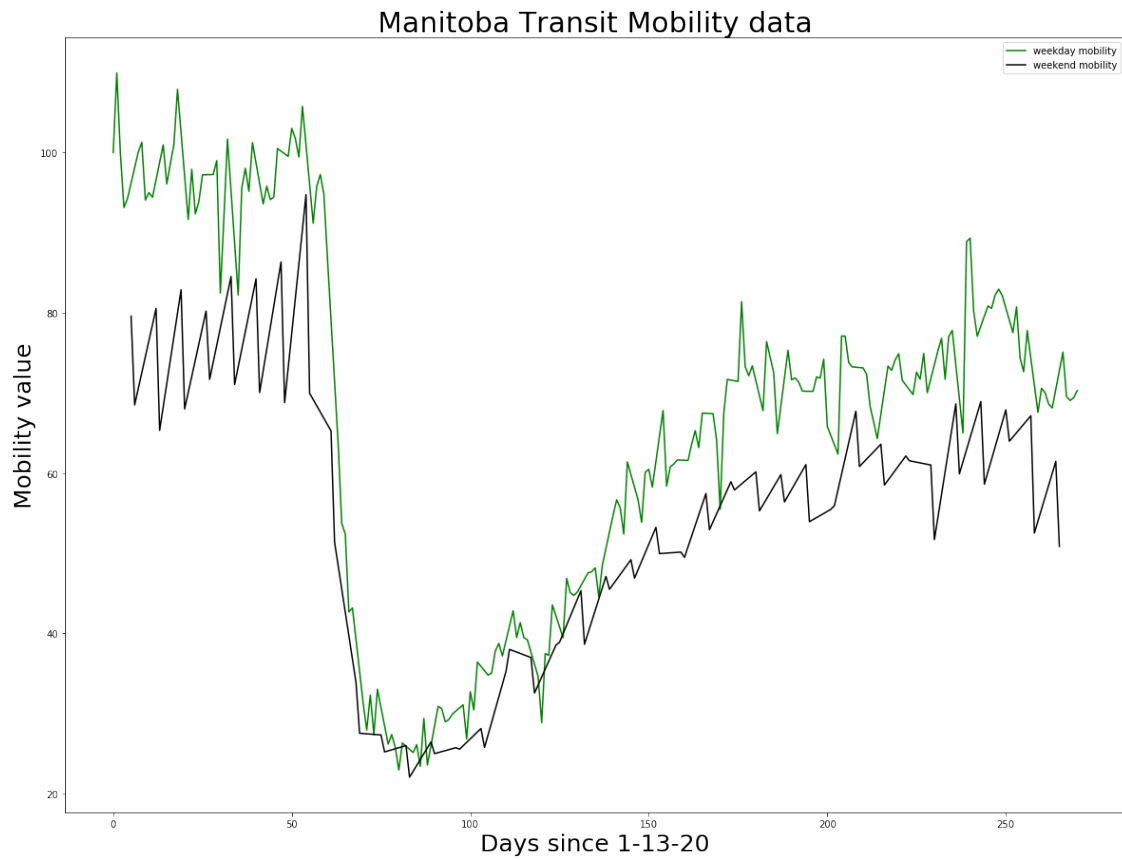


C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:

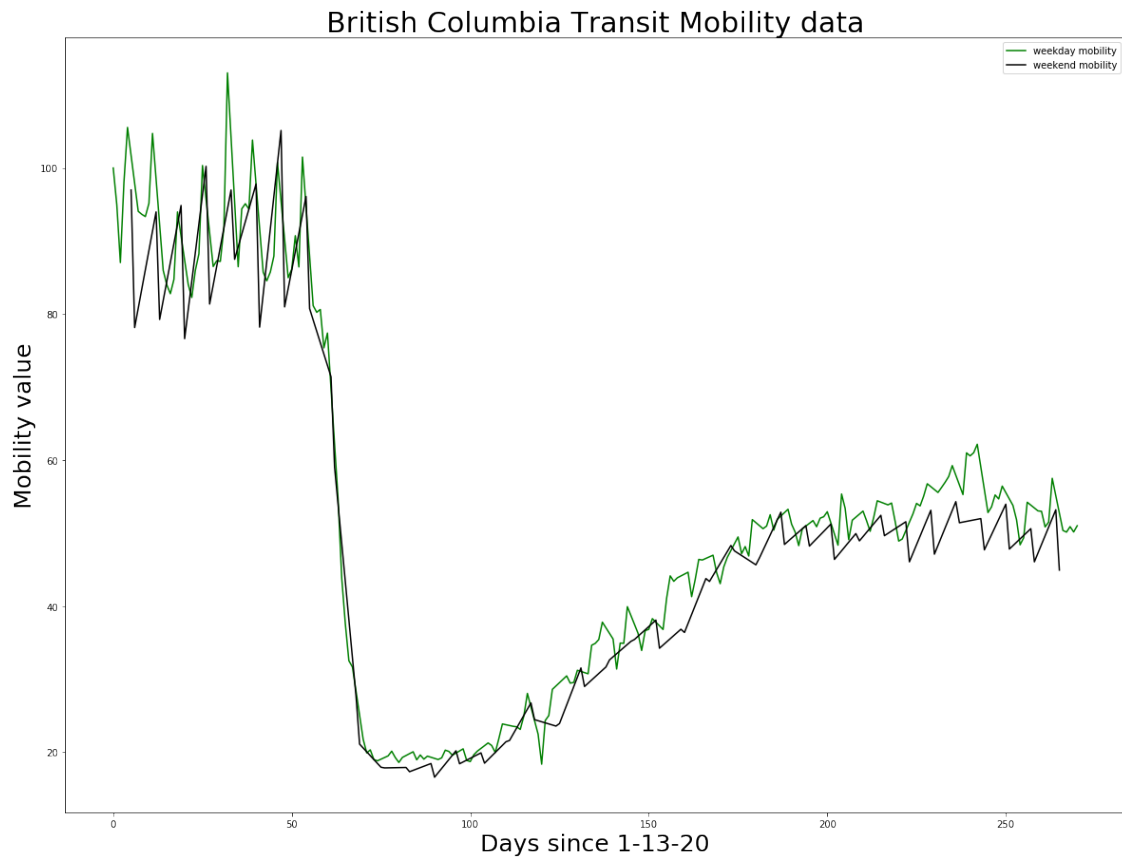
Boolean Series key will be reindexed to match DataFrame index.



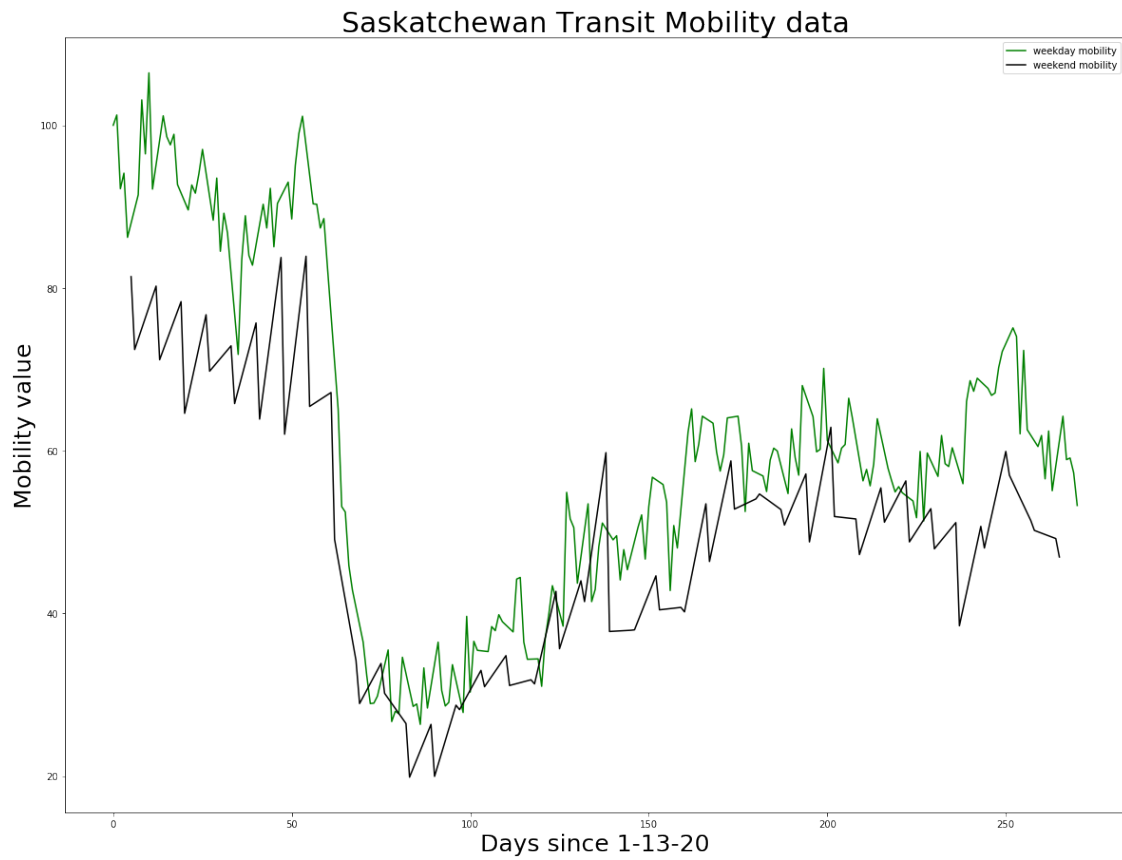
```
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:  
Boolean Series key will be reindexed to match DataFrame index.
```



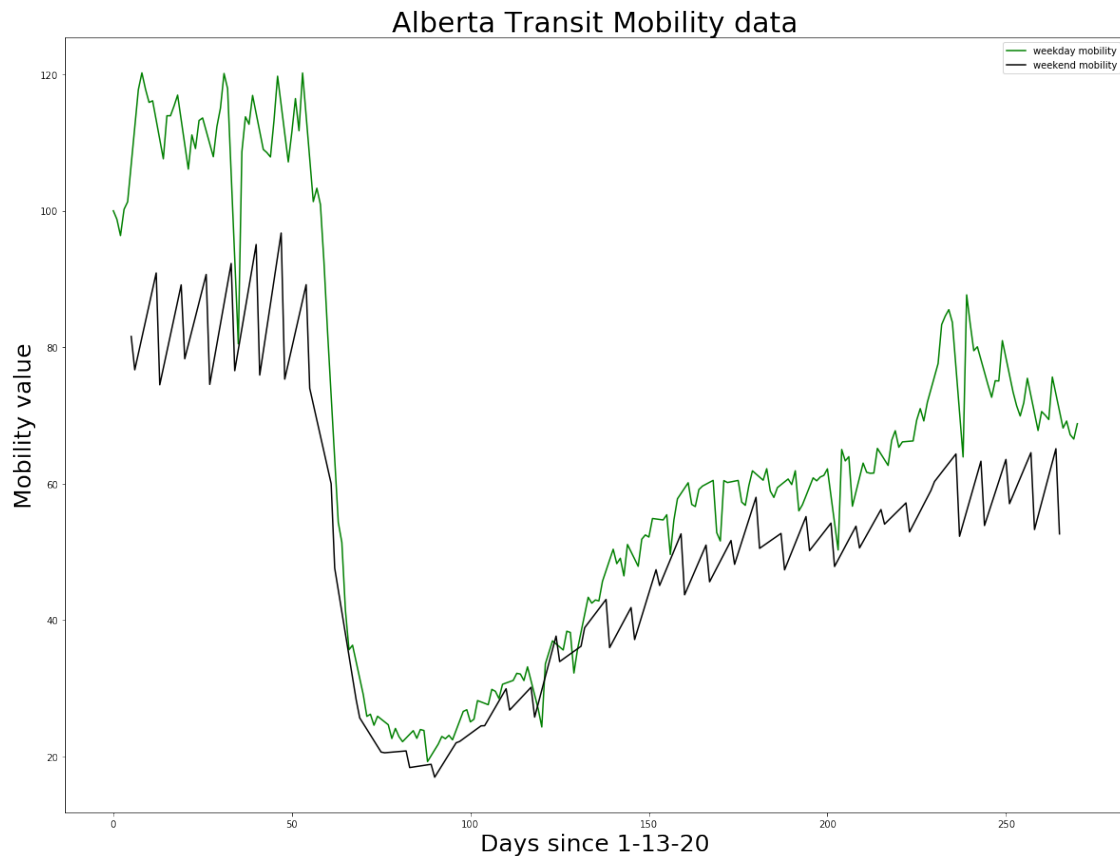
```
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:  
Boolean Series key will be reindexed to match DataFrame index.
```



```
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:  
Boolean Series key will be reindexed to match DataFrame index.
```

```
C:\ProgramData\Anaconda3\lib\site-packages\ipykernel_launcher.py:2: UserWarning:  
Boolean Series key will be reindexed to match DataFrame index.
```



- From these graphs we can see how various travel restrictions helped in curbing the spread of the virus.
- These mobility graph gives us better visualization of the fact that inner travel restrictions policies did help to slow spread of covid as people were not that active.
- Mobility saw a significant ~75% to 80% drop based on the transportation type.
- A study that concluded that the travel quarantine introduced in Wuhan in January 2020 only delayed the epidemic progression by 3 to 5 days within china, but international travel restrictions did help to slow the spread elsewhere in the world until mid-february. For more information.
- The study also concluded that early detection, hand washing, self-isolation, and household quarantine will likely be more efficient than travel restrictions at mitigating the pandemic.