TECHINICAL NOTES

Occupational Risk of COVID-19 Tool

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Background

Scientists from Public Health Ontario (PHO), Institute for Work and Health, University of Toronto and University of Alberta have developed the Occupational Risk of COVID-19 Tool to examine the unequal burden of exposure to COVID-19 risk at work. The tool combines data from the 2016 Census of Population, Occupational Information Network (O\*NET), and General Social Survey to estimate occupational exposure to COVID-19 risk.

Objectives

The overall goals of this project are to describe the differential burden of occupational exposure to COVID-19 risk in Canadian workers across age, sex, race/ethnicity, immigrant status, and income, and, to inform the design of equitable policies and interventions to mitigate inequities in exposure to COVID-19 risk**.**

Using a national, provincial/territorial or regional lens, this tool allows users to:

* Visualize occupational exposure to COVID-19 risk across occupations and industry
* Examine occupational exposure to COVID-19 risk related to essential services workers, age, sex, race/ethnicity, immigrant status, and income
* Explore occupational characteristics available to reduce occupational exposure to COVID-19 risk (i.e., working from home, paid sick leave)
* Build and estimate the impact economic reopening on occupational exposure to COVID-19 risk, both overall and across age, sex, race/ethnicity, immigrant status and income.

Data visualizations provide graphical illustrations data tables, the latter available for download through the tool’s interface.

Detailed information relating to the data, methods, and outputs of the project can be found in the chapters below.

Chapter I: Data Sources

Overview: The tool includes data on a representative sample of approximately 18.5 Million Canadian labour force participants (employed) age 15 and over in the 2016 Canadian Census. Measures from the Occupational Information Network (O\*NET) were collected a publically available data repository. Additional factors relevant to the work-context of Canadians were retrieved from the General Social Survey (2016), Canadians at Work and Home.

2016 Census of Population: The most recent Census was conducted in 2016 and included over 35 Million Canadians. The long-form Census collects additional detailed information related to demographic, social, and economic characteristics on a representative sample of approximately 25% of Canadian households. Through the tool, aggregated data is available across each combination of the following variables:

* Occupation: The National Occupational Classification 2016 (NOC) codes provides a 4-tiered hierarchical structure which includes 10 broad categories (level 1), 40 major groups (level 2), 140 minor groups (level 3) and 500 unit groups (level 4).
* Industry: The North American Industry Classification System (NAICS)–2012 provides a 4-tiered hierarchical structure of industries, which at the highest level divides the economy into 20 sectors, and at the lower levels further distinguishes the economic activities in which businesses are engaged.
* Age: The following age categories are included: 15-24; 25-34; 35-44; 45-54; 55-64; 65+ years.
* Sex: Categorized into female and male.
* Race/ethnicity: A proxy of visible minority status is being used to assess race/ethnicity, defined as ‘persons, other than Aboriginal peoples, who are non-Caucasian in race or non-white in colour’. Available categories include an ‘all visible minority’ classifications, as well as individual categories for: South Asian, East Asian (Chinese, Korean, Japanese), Black, Southeast Asian, Latin American, Middle Eastern (Arab, West Asian), visible minorities not included elsewhere (i.e., persons with a write-in response such as 'Guyanese,' 'West Indian,' 'Tibetan,' 'Polynesian,' 'Pacific Islander,' etc.) multiple visible minorities and not a visible minority.
* Immigrant status: 'Immigrants' includes persons who are, or who have ever been, landed immigrants or permanent residents, including individuals who have obtained Canadian citizenship by naturalization are included in this category. 'Non-permanent residents' includes persons from another country who have a work or study permit, or who are refugee claimants, and their family members sharing the same permit and living in Canada with them. Available categories include Non-immigrants, immigrants, and non-permanent residents.
* Median employment income: The median employment income for each occupation identified in aggregate data tables in 2015 CAD.
* Average employment income: The median employment income for each occupation identified in aggregate data tables in 2015 CAD.
* Income: Assessed using adjusted total income before tax, which divides total household income by the square root of the number of persons in the statistical unit to account for economies of scale and that the marginal increase in need decreases as the number of persons sharing resources increases.
* Province/territory: Available data can be stratified to examine occupational exposure to COVID-19 risk in each Canadian Province and Territory.
* Health regions: Available data can be stratified by health regions from 2018 within each Canadian Province and Territory. These include by Newfoundland and Labrador (4 regional health authorities); Prince Edward Island (1 region); Nova Scotia (4 zones); New Brunswick (7 zones); Quebec (18 Regions); Manitoba (5 Health Authorities); Saskatchewan (13 Regional Health Authorities); Alberta (4 Zones); Ontario (35 Public Health Units), British Columbia (16 Health Service Delivery Areas); Yukon (1 region); Northwest Territories (1 region); Nunavut (1 region).
* Health region peer groups: Health regions have been further classified into 8 Peer Groups by Statistics Canada for cross-national comparison. A full list is provided in Appendix A.

Occupational Information Network (O\*NET):O\*NET is a comprehensive database that includes characteristics (e.g., skills, knowledge, and abilities) on 974 occupations in the US. O\*NET is completely refreshed every few years, with nearly 600 occupations updated yearly. O\*NET has previously been used in research of the Canadian Labour Market.

* Frequency by which workers are exposed to diseases or infections: Using the question ‘How often does this job require exposure to disease/infections?’ a continuous weighted-average intensity score is available, from 0 to 100 equating to: never exposed (0), once a year (25); once a month (50); once a week (75); every day (100).
* Physical proximity to other workers in a typical workday: Using the question ‘How physically close to other people are you when you perform your current job?’) a continuous weighted-average intensity score is available, from 0 to 100 equating to: do not work near people (0); work with others, but not closely (25); slightly close, e.g., shared office (50); moderately close, e.g., arm’s length (75); very close, e.g., near touching (100).
* Working from home: As a proxies for ability to work from home, the importance of computer at work (‘how important is working with computers to the performance of your current job’) and working directly with the public (‘How important is performing for or working directly with the public to the performance of your current job?’) are included using a weighted average score: not important (0), somewhat important (25), important (50), very important (75), extremely important (100).
* Indoors, Environmentally Controlled: Using the question ‘How often does this job require working indoors in environmentally controlled conditions?’, a continuous weighted-average intensity score is available from 0 to 100 equating to: never (0), once a year (25); once a month (50); once a week (75); every day (100).
* Indoors, Not Environmentally Controlled: Using the question ‘How often does this job require working indoors in non-controlled environmental conditions (e.g., warehouse without heat)?’, a continuous weighted-average intensity score is available from 0 to 100 equating to: never (0), once a year (25); once a month (50); once a week (75); every day (100).

GENERAL SOCIAL SURVEY (2016) – CANADIANS AT WORK AND HOME: The General Social Survey (2016) is a population-representative survey that collects information from non-institutionalized individuals 15 years and over across the 10 Canadian provinces. Canadians at Work and Home (Cycle 30), focuses on themes related to Canadians’ perspectives of work, home, and leisure. The response rate for this survey was 50.8%, resulting in a sample size of 19,609 respondents representing 30,078,789 individuals.

* **Telework – Indicator:** Respondents were asked ‘Excluding overtime, do/did you usually work any of your scheduled hours at home?’, with four possible responses: 1) Yes, 2) No, 3) Your job cannot be done at home, 4) Your job can only be done at home. Responses were dichotomized to 1) Job can be done at home (including Yes, No, and Your job can only be done at home) or 2) Your job cannot be done at home.
* **Employment Benefits - Paid Sick Leave:** Respondents were asked ‘Which of the following employment benefits do you have access to as part of your employment?’, with two possible responses: 1) Yes, 2) No.
* The weighted proportions of the dichotomized responses for each Telework – Indicator and Employment Benefits - Paid Sick Leave were stratified by province and estimated across: Occupation (10 broad categories, NOC 2016), Industry (20 sectors, NAICS-2012), Visible Minority Status (Visible Minority; Not Visible Minority), Immigrant Status (Non-immigrant; Immigrant), and Sex (Female; Male).

Chapter II: Essential Services & Phased Re-opening

**Essential services:** Structured data extraction forms were used to identify essential services from publicly available policy documents. Essential services, defined at the provincial/territorial level, are services and functions deemed essential to preserving life, health and basic social functioning, for example, first responders, health care, critical infrastructure (e.g., hydro), and critical goods (e.g., food and medicine).

PHASED RE-OPENING PLANS:Structured data extraction forms were used to identify provincial and territorial plans to re-open non-essential services. Economic recovery plans were outlined based on the specific context and impact of the COVID-19 pandemic across provinces and territories. Given this, each jurisdiction identified a gradual staged approach for re-opening non-essential services as well as targeted timelines for each stage. Detailed information on each of the provincial/territorial economic re-opening plans can be found in Chapter III.

USER BESPOKE RE-OPENING PLANS: Due to the uncertainty of how the re-opening the economy would impact the burden of the novel coronavirus in the population, this project requires the flexibility in estimating the impact of re-opening specific industries on occupational risk of COVID-19. See Chapter V for how this method is used in the data visualization tools.

Chapter III: Detailed Re-opening Strategies

Overview: This section outlines Canada’s **stages** of gradual re-opening of businesses and services according to Canada’s Provinces and Territories during the 2020 COVID-19 pandemic after declaring a State of Emergency.

**Ontario:** As Ontario prepared to open businesses and services the Provincial Government outlined three stages of re-opening (according to health region) to recover from the implications of COVID-19 while maintaining the health and safety of Ontarians in the “**[Framework for Reopening our Province](https://www.ontario.ca/page/reopening-ontario)**”. **[Stage 1](https://www.ontario.ca/page/reopening-ontario-stages" \l "section-5)** (May 19th, 2020) outlined steps to protect and support the people of Ontario while allowing *some* *businesses and services* to return to operations, such as resuming all construction, or allowing motor vehicle dealerships to re-open. With the success of Stage 1, **[Stage 2](https://www.ontario.ca/page/reopening-ontario-stages" \l "section-4) (June 12th, 2020)** allowed the province to loosen restrictions gradually across health regions which allowed *more* *business* *and services* to re-open with strict guidelines such as hair services i.e., barbershops, salons, hairstylist with capacity limits and changes to personal services. After careful consideration, **[Stage 3](https://www.ontario.ca/page/reopening-ontario-stages" \l "section-3) (July 17th, 2020)** began for majority of the province on July 17th 2020, allowing *majority* *businesses* *and services* to open, following specific conditions and restrictions such as capacity limits, or health and safety protocol for personal protective equipment and disinfecting surfaces.

Link: <https://www.ontario.ca/page/reopening-ontario>

British Columbia**:** The Provincial Government of British Columbia developed “**[BC’s restart plan](https://www2.gov.bc.ca/gov/content/safety/emergency-preparedness-response-recovery/covid-19-provincial-support/bc-restart-plan)**” to allow businesses and services to gradually resume activities following health and safety guidelines ordered by the Provincial Health Officer. BC’s restart plan outlined a four phased approach: **[Phase 1)](https://www2.gov.bc.ca/gov/content/safety/emergency-preparedness-response-recovery/covid-19-provincial-support/phase-1)** ordered non-essential services to close according to sector, permitted essential travel, and adopted social and physical distancing to combat COVID-19 (ended May 18, 2020). **[Phase 2)](https://www2.gov.bc.ca/gov/content/safety/emergency-preparedness-response-recovery/covid-19-provincial-support/phase-2)** encouraged some businesses and services to re-open after being ordered to close in phase 1 (ended June 23, 2020). **[Phase 3)](https://www2.gov.bc.ca/gov/content/safety/emergency-preparedness-response-recovery/covid-19-provincial-support/phase-3)** allowed non-essential travel, and majority of sectors to re-open following strict guidelines for capacity limits, sanitizations, and personal protective equipment. Although, sectors are permitted to re-open, businesses and services can return to operations when they feel safe (June 24 2020-onward). During **[Phase 4)](https://www2.gov.bc.ca/gov/content/safety/emergency-preparedness-response-recovery/covid-19-provincial-support/phase-4)** residents of British Columbia are permitted to travel internationally and resume large public gatherings. Phase 4 remains conditional on the availability of a treatment for COVID-19.

Link: <https://www2.gov.bc.ca/gov/content/safety/emergency-preparedness-response-recovery/covid-19-provincial-support/bc-restart-plan>

**Alberta:** “**[Alberta’s Relaunch Strategy](https://www.alberta.ca/alberta-relaunch-strategy.aspx)”** was developed to protect Albertans against the fight of COVID-19. The Provincial Governments pandemic response ensured public health and safety, and provide guidance to reduce the spread of COVID-19. Alberta’s Relaunch Strategy outlined 3 stages of re-openings for business and services to help support the economy returning to business safely. **[Stage 1)](https://www.alberta.ca/alberta-relaunch-strategy.aspx" \l "stage1)** removed some restrictions placed during the pandemic response allowing some non-essential services to re-open at limited capacity with enhanced cleaning precautions on May 14th. **[Stage 2)](https://www.alberta.ca/alberta-relaunch-strategy.aspx" \l "stage2)** began on June 12th, and permitted additional businesses and services to re-open with flexible limits on capacity for casinos, restaurants, and places of worship etc., following public health guidelines. The launch of **[Stage 3)](https://www.alberta.ca/alberta-relaunch-strategy.aspx" \l "stage3)** has not been determined, however this Stage encourages re-opening of all businesses and services with health and safety restrictions in place.

Link: <https://www.alberta.ca/alberta-relaunch-strategy.aspx>

Quebec: The Provincial Government of Quebec released the “**[Deconfinement Planning, Subject to Changes in the Pandemic](https://www.quebec.ca/en/health/health-issues/a-z/2019-coronavirus/gradual-resumption-activities-covid19-related-pause/)**” document as a guideline for the public and private sectors. This document outlined a: **[Preliminary Phase](https://cdn-contenu.quebec.ca/cdn-contenu/sante/documents/Problemes_de_sante/covid-19/Plan_deconfinement/Deconfinement_planning_pandemic_covid-19.pdf?1590430413)**, **[Phase 1](https://cdn-contenu.quebec.ca/cdn-contenu/sante/documents/Problemes_de_sante/covid-19/Plan_deconfinement/Deconfinement_planning_pandemic_covid-19.pdf?1590430413)**, **[Phase 2](https://cdn-contenu.quebec.ca/cdn-contenu/sante/documents/Problemes_de_sante/covid-19/Plan_deconfinement/Deconfinement_planning_pandemic_covid-19.pdf?1590430413)**, **[Phase 3](https://cdn-contenu.quebec.ca/cdn-contenu/sante/documents/Problemes_de_sante/covid-19/Plan_deconfinement/Deconfinement_planning_pandemic_covid-19.pdf?1590430413)**, **[Phase 4](https://cdn-contenu.quebec.ca/cdn-contenu/sante/documents/Problemes_de_sante/covid-19/Plan_deconfinement/Deconfinement_planning_pandemic_covid-19.pdf?1590430413)**, **[Phase 5](https://cdn-contenu.quebec.ca/cdn-contenu/sante/documents/Problemes_de_sante/covid-19/Plan_deconfinement/Deconfinement_planning_pandemic_covid-19.pdf?1590430413),** and **[Phase 6](https://cdn-contenu.quebec.ca/cdn-contenu/sante/documents/Problemes_de_sante/covid-19/Plan_deconfinement/Deconfinement_planning_pandemic_covid-19.pdf?1590430413)** of re-openings within Quebec according to sector such as “mining sector, or manufacturing sector”. The guiding document outlined when sectors were able to return to operations following specific capacity guidelines such as 50% of workers, as well as health and safety guidelines such as frequent sanitization. Additionally, this document included “subsequent phases” for activities related to large gatherings, restaurants, gyms, and travel accommodations etc., the exact date of initiation has yet to be determined.

Link: <https://www.quebec.ca/en/health/health-issues/a-z/2019-coronavirus/gradual-resumption-activities-covid19-related-pause/>

**Manitoba:** Manitoba’s response to COVID-19 included developing a guiding document titled: “**[Restoring Safe Services:](https://www.gov.mb.ca/covid19/restoring/index.html)****[Manitoba’s Pandemic and Economic Roadmap for Recovery](https://www.gov.mb.ca/covid19/restoring/index.html)**” to gradually resume all businesses and services following health and safety guidelines. Restoring Safe Services included a Phased approach i.e., **[Phase 1](https://www.gov.mb.ca/covid19/restoring/phase-one.html)**, **[Phase 2](https://www.gov.mb.ca/covid19/restoring/phase-two.html)**, **[Phase 3](https://www.gov.mb.ca/covid19/restoring/phase-three.html)**, and **[Phase 4](https://www.gov.mb.ca/covid19/restoring/phase-four.html)** (underway) to gradually resume economic activities following capacity guidelines in public spaces such as casinos, stores, restaurants etc., and health and safety guidelines such as frequent sanitization, and wearing masks.

Link: <https://www.gov.mb.ca/covid19/restoring/index.html>

Prince Edward Island**:** The Provincial Government released the “**[Renew PEI Together](https://www.princeedwardisland.ca/en/information/health-and-wellness/renew-pei-together-chart-of-phases)**” document to respond to the COVID-19 pandemic and adopted a phased approach to re-opening businesses and services safely. Renew PEI together introduced four phases: **[Phase 1](https://www.princeedwardisland.ca/en/information/health-and-wellness/renew-pei-together-chart-of-phases)** (May 1 2020), **[Phase 2](https://www.princeedwardisland.ca/en/information/health-and-wellness/renew-pei-together-chart-of-phases)** (May 22, 2020), **[Phase 3](https://www.princeedwardisland.ca/en/information/health-and-wellness/renew-pei-together-chart-of-phases)** (June 1, 2020), and **[Phase 4](https://www.princeedwardisland.ca/en/information/health-and-wellness/renew-pei-together-chart-of-phases)** (June 26, 2020) to gradually re-open businesses and services. Within each phase, public health measures were relaxed to either allow businesses and services to re-open, or increase capacity. Furthermore Renew PEI Together, includes “Looking ahead” as a possible next step to further relax measures when the time permits.

Link: <https://www.princeedwardisland.ca/en/information/health-and-wellness/renew-pei-together-chart-of-phases>

**New Brunswick:** The Provincial Government developed the “**[New Brunswick’s Recovery Plan](https://www2.gnb.ca/content/gnb/en/corporate/promo/covid-19/recovery.html" \l "triggers)**” to respond to COVID-19 and safely and gradually re-open businesses and services. New Brunswick identified colour coded alert levels to help the community respond to COVID-19. **[Alert level Red](https://www2.gnb.ca/content/gnb/en/corporate/promo/covid-19/recovery.html" \l "triggers)**: allowed essential services to operate and enforced strict regulations to reduce the spread of COVID-19. **[Alert Level Orange](https://www2.gnb.ca/content/gnb/en/corporate/promo/covid-19/recovery.html" \l "triggers):** allowed the slow resumption of non-essential services. **[Alert level Yellow](https://www2.gnb.ca/content/gnb/en/corporate/promo/covid-19/recovery.html" \l "triggers)**: encouraged the re-opening of more businesses and services follow public health guidelines. **[Alert Level Green](https://www2.gnb.ca/content/gnb/en/corporate/promo/covid-19/recovery.html" \l "triggers)** (to be determined): this phase was developed to allow all businesses and services to re-open following production of a vaccine. However, health and safety guidelines will be in place such as wearing face masks, and frequent sanitization.

Link: [https://www2.gnb.ca/content/gnb/en/corporate/promo/covid-19/recovery.html#triggers](https://www2.gnb.ca/content/gnb/en/corporate/promo/covid-19/recovery.html" \l "triggers)

Newfoundland and Labrador**:** The Provincial Government of Newfoundland and Labrador developed the “**[Alert level System](https://www.gov.nl.ca/covid-19/alert-system/)**” to provide Newfoundlanders and Labradorians information on changes to public health measures undertaken by the government to responding to COVID-19. The Government advised businesses and services to move progressively from higher to lower alert levels based Public Health Advice. **[Alert](https://www.gov.nl.ca/covid-19/alert-system/alert-level-5/)****[level 5](https://www.gov.nl.ca/covid-19/alert-system/alert-level-5/)**: implemented health and safety measures to reduce the spread of COVID-19, essential services were only permitted to operate. **[Alert level 4](https://www.gov.nl.ca/covid-19/alert-system/alert-level-4/)**: encouraged businesses and services to gradually re-open according to sector specific guidelines such as capacity limits, frequent sanitization etc. **[Alert level 3](https://www.gov.nl.ca/covid-19/alert-system/alert-level-3/)**: encouraged more businesses and services to open (according to sector specific guidelines) following limited spread of COVID-19. **[Alert level 2](https://www.gov.nl.ca/covid-19/alert-system/alert-level-2/)**: encouraged additional re-opening of businesses and services (according to sector specific guidelines). **[Alert level 1](https://www.gov.nl.ca/covid-19/alert-system/alert-level-1/)**: Resumption of all activities while living with the possibility of COVID-19.

Link: <https://www.gov.nl.ca/covid-19/alert-system/>

**Saskatchewan:** The Provincial Government of Saskatchewan developed a guiding document titled: “**[Re-open Saskatchewan](https://www.saskatchewan.ca/government/health-care-administration-and-provider-resources/treatment-procedures-and-guidelines/emerging-public-health-issues/2019-novel-coronavirus/re-open-saskatchewan-plan/phases-of-re-open-saskatchewan)**” after declaring a State of Emergency. This document outlined a Phased approach, (**[Phase 1](https://www.saskatchewan.ca/government/health-care-administration-and-provider-resources/treatment-procedures-and-guidelines/emerging-public-health-issues/2019-novel-coronavirus/re-open-saskatchewan-plan/phases-of-re-open-saskatchewan/phase-one)**, **[Phase 2](https://www.saskatchewan.ca/government/health-care-administration-and-provider-resources/treatment-procedures-and-guidelines/emerging-public-health-issues/2019-novel-coronavirus/re-open-saskatchewan-plan/phases-of-re-open-saskatchewan/phase-two)**, **[Phase 3](https://www.saskatchewan.ca/government/health-care-administration-and-provider-resources/treatment-procedures-and-guidelines/emerging-public-health-issues/2019-novel-coronavirus/re-open-saskatchewan-plan/phases-of-re-open-saskatchewan/phase-three)**, and **[Phase 4](https://www.saskatchewan.ca/government/health-care-administration-and-provider-resources/treatment-procedures-and-guidelines/emerging-public-health-issues/2019-novel-coronavirus/re-open-saskatchewan-plan/phases-of-re-open-saskatchewan/phase-four)**) to encouraged the gradual resumption of activities following health and safety guidelines. Phase 1 and Phase 2 allowed re-openings of previously restricted services such as elective surgeries or personal care services. Phase 3 and Phase 4 encouraged additional re-openings of businesses and services and increased limits on capacity such as restaurants or fitness centers. Within each Phase businesses and services were allowed to resume activities when it was safe to do so. [Phase 5](https://www.saskatchewan.ca/government/health-care-administration-and-provider-resources/treatment-procedures-and-guidelines/emerging-public-health-issues/2019-novel-coronavirus/re-open-saskatchewan-plan/phases-of-re-open-saskatchewan/phase-five) (to be determined) will reflect lifting long-term restrictions.

Link: <https://www.saskatchewan.ca/government/health-care-administration-and-provider-resources/treatment-procedures-and-guidelines/emerging-public-health-issues/2019-novel-coronavirus/re-open-saskatchewan-plan/phases-of-re-open-saskatchewan>

Nova Scotia**:** The Provincial Government of Nova Scotia declared a Provincial State of Emergency which required all non-essential business to close. To re-open Nova Scotia’s businesses and services safely, sector associations were required to submit a [re-opening plan](https://novascotia.ca/reopening-nova-scotia/) complying with the Health Protection Act order, and comply with “workplace COVID-19 prevention plans” for their sector. Beginning May 1 2020 and onward, Nova Scotia began [opening businesses and services](https://novascotia.ca/coronavirus/restriction-updates/) and changing guidelines following sector specific regulations, and health and safety requirements. **Nova Scotia did not follow a Phased plan for re-openings**.

Link: <https://novascotia.ca/reopening-nova-scotia/>; Link: <https://novascotia.ca/coronavirus/restriction-updates/>.

**Greater Northwestern Territories:** The Northwestern Territories developed the “**[Emerging Wisely- Path to Eased Public Health Restrictions](https://www.gov.nt.ca/covid-19/en/services/public-health-orders/emerging-wisely)**” to gradually allow the resumption of businesses and services after declaring a State of Emergency. This document outlines four phases to ease public health measures. **[Phase 1)](https://www.gov.nt.ca/covid-19/en/services/relaxing-phase-1-first-steps)** relaxed public health measures to allow operation of businesses and services such as personal service establishments, or tourism operators with limited services and following strict public health guidelines (began May 15th, 2020). **[Phase 2)](https://www.gov.nt.ca/covid-19/en/services/relaxing-phase-2-next-steps-current-phase)** Began on June 12th, 2020, allowing additional services to open and increase capacity limits. **[Phase 3)](https://www.gov.nt.ca/covid-19/en/services/relaxing-phase-3-careful-steps-past-second-wave)** and **[Phase 4)](https://www.gov.nt.ca/covid-19/en/services/relaxing-phase-4-final-measures-lifted)** initiation is still undetermined, and will be based on prevalence of COVID-19 and a second wave. However, additional restrictions such as closures or capacity limits, will be removed for non-essential services.

Link: <https://www.gov.nt.ca/covid-19/en/services/public-health-orders/emerging-wisely>

Yukon**:** The Government of Yukon developed “**[A path forward: Yukon’s Plan for lifting COVID-19 restrictions](https://yukon.ca/en/path-forward-yukons-plan-lifting-covid-19-restrictions)**”. This plan helps the territory gradually ease restrictions for businesses and services according to four Phases. **[Phase 1)](https://yukon.ca/en/health-and-wellness/covid-19-information/summary-yukons-plan-lifting-covid-19-restrictions)** began May 15th 2020, to help the economy re-open safely, and allow limited business and services to operate. For example: restaurants were allowed dine-in at 50% capacity, or daycares were allowed to re-open for all workers. **[Phase 2)](https://yukon.ca/en/health-and-wellness/covid-19-information/summary-yukons-plan-lifting-covid-19-restrictions)** began July 1st, 2020 and allowed additional restrictions on non-essential businesses and services to be lifted. For example: restaurants could offer full capacity dine-in services. **[Phase 3)](https://yukon.ca/en/health-and-wellness/covid-19-information/summary-yukons-plan-lifting-covid-19-restrictions)** and **[Phase 4)](https://yukon.ca/en/health-and-wellness/covid-19-information/summary-yukons-plan-lifting-covid-19-restrictions)** have yet to commence, and will reflect the new normal living conditions in addition to life after a vaccine has been made available.

Link: <https://yukon.ca/en/health-and-ewellness/covid-19-information/summary-yukons-plan-lifting-covid-19-restrictions>

**Nunavut:** To ease restrictions in place due to the COVID-19 pandemic the Government of Nunavut developed “**[Nunavut’s Path: moving forward during COVID-19](https://gov.nu.ca/sites/default/files/nunavuts_path_final_framework_-_eng_sm.pdf)**” allowing businesses and services to re-open depending on level of risk rather than a “phased re-opening”. This document outlines **low risk measures** such as: opening outdoor camps, retail outlets, in person health care services etc. **Medium risk measures**: dining in restaurants at half the capacity or opening theaters etc.**,** and **higher risk measures**: opening drinking establishments and allowing outdoor community events etc. Following these classifications, businesses and services began to re-open on June 1st 2020 with re-assessments to ease measures every two weeks after.

Link: <https://gov.nu.ca/sites/default/files/nunavuts_path_final_framework_-_eng_sm.pdf>

Chapter IV: Data Linkage

**O\*NET OCCUPATIONAL MEASURES LINKED TO THE 2016 CANADIAN CENSUS:**

O\*NET was linked to aggregate Canadian 2016 Census data using the Brookfield Institute for Innovation & Entrepreneurship’s published crosswalk of 4-digit National Occupational Classification 2016 (NOC) codes to the Standard Occupational Classification System (SOC) used by O\*NET. Where multiple SOC occupations were mapped to a single NOC code, the simple average of O\*NET indicators was calculated to maintain one score for each NOC occupation unit group.

**INDUSTRY AND OCCUPATION CLASSIFICATION SYSTEMS LINKED TO PROVINCE/TERRITORIAL SERVICES:**

Services were mapped onto industries using 4-digit North American Industry Classification System (NAICS)–2012 codes and linked to the Canadian 2016 Census. Industries were categorized as ‘Essential’ or ‘Non-Essential’. Occupations that were considered non-essential were categorized from the 500 occupation unit groups using the National Occupational Classificafication (NOC)-2016 for a more accurate estimate of essential and non-essential workers. For example, if an industry code is considered essential, however an occupation code mapped to that industry is deemed non-essential, the aggregate number of individuals in the Canadian 2016 Census who reported the essential industry with the non-essential occupation are considered non-essential workers. See below for an illustrated example of how industries and occupations were mapped to provincial/territorial service lists. ‘Non-Essential’ services were included as the industries to re-open in the provincial/territorial phased strategies. Essential and Non-essential services differed by provincial/territorial authority.

Table 1: Mapping Industry to Occupation (Example)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Province/  Territory | Service listed by Province/  Territory | NAICS-2012 Industry | Essential Industry | NOC-2016 Occupation | Essential Occupation | Considered Essential |
| Ontario | Restaurants (take-out, drive-through and delivery service only) | 7224  Full-service restaurants and limited-service eating places | Yes | 6322  Cooks | Yes | **Yes** |
| Ontario | Restaurants (take-out, drive-through and delivery service only) | 7224  Full-service restaurants and limited-service eating places | Yes | 6513  Food and beverage servers | No | **No** |

Chapter V: Data Visualization Tools

This section describes the two data visualization tools, which can be used to estimate the occupational risk and burden of exposure to and transmission of COVID-19 with specific features related to essential services, phased-reopening, and additional occupation measures such as ability to work from home and employment benefits for paid sick leave. Both tools are designed to explore the burden of exposure to COVID-19 risk in Canadian workers, and, to inform the design of equitable policy and intervention strategies to mitigate inequities in exposure to COVID-19 risk.

Tool 1 – ‘Occupational Risk of COVID-19’

The **Occupational Risk of COVID-19 Tool** allows users to examine occupational risk of COVID-19 risk across all industries and occupations with unique features to estimate how this risk changes across:

* Preliminary policy phases of the pandemc, including; pre-pandemic (i.e. all services), essential services, and non-essential services.
* Level of geography, including by each province/territory and health regions, based on Statistics Canada’s 2018 health region boundaries.
* Population characteristics, including; age, sex, race/ethnicity, and immigrant status.

In this tool, there are 9 interactive tabs across the top border that enable users to examine occupational characteristics related to COVID-19 risk and mitigation as well as key demographics related to occupations. Each tab has subtabs that contain plots and/or tables along with a sidebar to allow users to interact with the information. The information in the table is searchable, either by sorting by row of interest or word searching to find a specific occupation. In addition, users can copy or download the table in .CSV or .XLSX formats.

Tab #1 – Occupational Risk:

The ‘Occupational Risk’ tab allows users to identify occupations based on geography, policy phase, demographic characteristics, and occupational-related measures.

* Sidebar: Users can stratify information based on the Province/territory of interest and Policy Phase (all services, essential services, non-essential services). In addition, a number of interactive sliders allow users to identify occupations based on key demographic and occupation-related factors including; visible minority status (%), immigrant status (%), sex (% female), age (% 65 years and over) and median income (CAD 2015). Occupational measures from O\*NET, which were mapped to the NOC-2016 codes in the 2016 Census can be selected in the X-axis and Y-axis ‘plot-only options’. The O\*NET measures include; 1) Exposure to Disease of Infection, 2) Physical Proximity, 3) Importance of Interacting with Public, 4) Importance of Using a Computer, 5) Indoors, Controlled Environment, and 6) Indoors, Not Controlled Environment. In addition to O\*NET measures, users can illustrate the Median Income in the Occupation (2015 CAD) and the broad occupation group (NOC-2016 level 1).
* Plot: The plot allows users to illustrate COVID-19 risk. Each ‘bubble’ represents an occupation based on the 4-digit NOC-2016 classifications. The size of each bubble is proportional to the size of the total workforce in each occupation. Users can hover over each bubble to view additional descriptive information related to the occupation. The plot is interactive with the slider measures, the shaded bubbles represent occupations that are within the user-defined slider range. Users can modify the plot based on the X- and Y-axis options, previously described. Finally, users can flip the axis options by selecting “Flip Axis Options”. Users can then revert to the axes as listed in the sidebars by selecting “Chosen Axis Options”.
* Table: The table displays the user-defined information related to province/territory, policy phase, and slider selections. Each row represents an occupation unit group from the NOC-2016. Users can view statistics related to each occupation across columns, which include the number of individuals working in the occupation, demographic details, median income in the occupation, and the O\*NET occupational measures.

Tab #2 – Sex & Age:

The ‘Sex & Age’ tab allows users to identify the burden of occupational risk of COVID-19 across sex and age (as described in the 2016 Census, Chapter I).

* Sidebar: Users can stratify information based on the Province/territory of interest and Policy Phase (all services, essential services, non-essential services). Users can subset the data by Sex and Age Group (years). The Sex options are unique, meaning that users can only select one of the three options provided (Female, Male, or Total – Sex). In the Age Group (years), users can select as many age groups of interest, but must select at least one. Occupational measures from O\*NET mapped to the NOC-2016 codes in the 2016 Census can be selected in the X-axis and Y-axis ‘plot-only options’.
* Plot: The plot allows users to illustrate COVID-19 risk. Each ‘bubble’ represents an occupation based on the 4-digit NOC-2016 classifications. The size of each bubble is proportional to the size of the total workforce in the selected sex and age demographics for each occupation. If users select multiple age groups, the sum of all selected age groups will be reflected in the plot. Users can hover over each bubble to view additional descriptive information related to the occupation. Users can modify the plot based on the X- and Y-axis options. The plot legend colours reflect the 10 Broad Occupation Groups that each Occupation Unit Group is mapped to, based on the hierarchial NOC-2016 structure.
* Table: The table displays the user-defined information related to province/territory and policy phase. Each row represents an occupation unit group from the NOC-2016, chosen sex category and selected age group(s). Users can view statistics related to each occupation and demographic group across columns, which include the number of individuals working in the occupation in selected sex and age groups, median income in the occupation, and the O\*NET occupational measures.
* Summary (Table 1): This table provides summary measures for sex and age. Each row represents the selected sex and age categories within the user-defined province/territory and industry. The columns show the total number of individuals represented in these demographics along with weighted O\*NET measures and Median Income (CAD 2015).

Tab #3 – Race/Ethnicity:

The ‘Race/Ethnicity’ tab allows users to identify the burden of occupational risk of COVID-19 across key demographic characteristics; sex, age, and visible minority status (as described in the 2016 Census, Chapter I).

* Sidebar: Users can stratify information based on the Province/territory of interest and Policy Phase (all services, essential services, non-essential services). Users can subset the data by Sex and Age Group (years) as described in the Sex & Age section. In addition, users can select specific Visible Minority Status groups as described in the 2016 Census. Occupational measures from O\*NET mapped to the NOC-2016 codes in the 2016 Census can be selected in the X-axis and Y-axis ‘plot-only options’.
* Plot: The plot allows users to illustrate COVID-19 risk. Each ‘bubble’ represents an occupation based on the 4-digit NOC-2016 classifications. The size of each bubble is proportional to the size of the total workforce in the selected sex, age and visible minority demographics for each occupation. If users select multiple age groups, the sum of all selected age groups will be reflected in the plot. Users can hover over each bubble to view additional descriptive information related to the occupation. Users can modify the plot based on the X- and Y-axis options. Users can flip the axis options by selecting “Flip Axis Options”. Users can then revert to the axes as listed in the sidebars by selecting “Chosen Axis Options”. The plot legend colours reflect the 10 Broad Occupation Groups that each Occupation Unit Group is mapped to, based on the hierarchial NOC-2016 structure.
* Table: The table displays the user-defined information related to province/territory and policy phase. Each row represents an occupation unit group from the NOC-2016, chosen sex category and selected age group(s). Users can view statistics related to each occupation across columns, which include the number of individuals working in the occupation in each sex, age, and visible minority group, median income in the occupation, and the O\*NET occupational measures.
* Summary (Table 1): This table provides summary measures for sex, age, and visible minority status. Each row represents the selected sex, age, and visible minority status categories within the user-defined province/territory and industry. The columns show the total number of individuals represented in these demographics along with weighted O\*NET measures and Median Income (CAD 2015).

Tab #4 – Immigrant Status:

The ‘Immigrant Status’ tab allows users to identify the burden of occupational risk of COVID-19 across key demographic characteristics; sex, age, and immigrant status (as described in the 2016 Census, Chapter I).

* Sidebar: Users can stratify information based on the Province/territory of interest and Policy Phase (all services, essential services, non-essential services). Users can subset the data by Sex and Age Group (years) as described in the Sex & Age section. In addition, users can select specific Immigrant Status groups as described in the 2016 Census. Occupational measures from O\*NET mapped to the NOC-2016 codes in the 2016 Census can be selected in the X-axis and Y-axis ‘plot-only options’.
* Plot: The plot allows users to illustrate COVID-19 risk. Each ‘bubble’ represents an occupation based on the 4-digit NOC-2016 classifications. The size of each bubble is proportional to the size of the total workforce in the selected sex, age and immigrant status demographics for each occupation. If users select multiple age groups, the sum of all selected age groups will be reflected in the plot. Users can hover over each bubble to view additional descriptive information related to the occupation. Users can modify the plot based on the O\*NET measures, Median Income (CAD 2015), and Broad Occupation Group by selecting from the dropdown menus in the X-axis and Y-Axis sections. Users can flip the axis options by selecting “Flip Axis Options”. Users can then revert to the axes as listed in the sidebars by selecting “Chosen Axis Options”. The plot legend colours reflect the 10 Broad Occupation Groups that each Occupation Unit Group is mapped to, based on the hierarchial NOC-2016 structure.
* Table: The table displays the user-defined information related to province/territory and policy phase. Each row represents an occupation unit group from the NOC-2016, chosen sex category and selected age group(s), Users can view statistics related to each occupation across columns, which include the number of individuals working in the occupation in each sex, age, and immigrant status group, median income in the occupation, and the O\*NET occupational measures.
* Summary (Table 1): This table provides summary measures for sex, age, and immigrant status. Each row represents the selected sex, age, and immigrant status categories within the user-defined province/territory and industry. The columns show the total number of individuals represented in these demographics along with weighted O\*NET measures and Median Income (CAD 2015).

TAB #5 – Work From Home:

The ‘Work from Home’ tab provides information from the General Social Survey 2016 on the work from home measure, previously described in Chapter 1.

* Sidebar: Users are able to select the province of interest.
* Tables: Each sub-tab provides tabular information regarding the ability to work from home (% yes; % no), stratified by 1) Occupation Group, 2) Industry Group, 3) Visible Minority Status, 4) Immigrant Status, and 5) Sex.

TAB #6 – paid sick leave:

The ‘Paid Sick Leave’ tab provides information from the General Social Survey 2016 on the employment benefits-paid sick leave measure, previously described in Chapter 1.

* Sidebar: Users are able to select the Province of interest.
* Tables: Each sub-tab provides tabular information regarding paid sick leave (% yes;% no), stratified by 1) Occupation Group, 2) Industry Group, 3) Visible Minority Status, 4) Immigrant Status, and 5) Sex.

TAB #7 – occupation/industry profiles:

The ‘Occupation/Industry Profiles’ tab provides summary measures across the 10 Broad Occupation Groups, from the NOC-2016 and the 20 Sectors, from the NAICS-2012.

* Sidebar: Users are able to select the Province/territory of interest as well as the Policy Phase.
* Occupational Profiles Table: provides summary information for each Broad Occupation Group, which represent a unique row.
* Industry Profiles Table: provides summary information for each Sector Group, which represent a unique row.

TAB #8 – health regions – occupational risk:

The ‘Health Regions – Occupational Risk’ tab displays information congruent with Tab#1 (Occupational Risk) at the regional level based on Statistics Canada 2018 Health Region boundaries.

* **Sidebar:** Users can stratify information based on the Province/territory of interest, Health Region, and Policy Phase (all services, essential services, non-essential services). In addition, a number of interactive sliders allow users to identify occupations based on key demographic and occupation-related factors including; visible minority (%), immigrant status (%), sex (% female), age (% 65 years and over) and median income (CAD 2015). Occupational measures from O\*NET, which were mapped to the NOC-2016 codes in the 2016 Census can be selected in the X-axis and Y-axis ‘plot-only options’. The O\*NET measures include; 1) Exposure to Disease of Infection, 2) Physical Proximity, 3) Importance of Interacting with Public, 4) Importance of Using a Computer, 5) Indoors, Controlled Environment, and 6) Indoors, Not Controlled Environment. In addition to O\*NET measures, users can illustrate the Median Income in the Occupation (2015 CAD) and the broad occupation group (NOC-2016 level 1).
* **Plot:** The plot allows users to illustrate COVID-19 risk. Each ‘bubble’ represents an occupation based on the 4-digit NOC-2016 classifications. The size of each bubble is proportional to the size of the total workforce in each occupation. Users can hover over each bubble to view additional descriptive information related to the occupation. The plot is interactive with the slider measures, the shaded bubbles represent occupations that are within the user-defined slider range. Users can modify the plot based on the X- and Y-axis options, previously described. Finally, users can flip the axis options by selecting “Flip Axis Options”. Users can then revert to the axes as listed in the sidebars by selecting “Chosen Axis Options”.
* **Table:** The table displays the user-defined information related to province/territory, policy phase, and slider selections. Each row represents an occupation unit group from the NOC-2016. Users can view statistics related to each occupation across columns, which include the number of individuals working in the occupation, demographic details, median income in the occupation, and the O\*NET occupational measures.

TAB #9 – HEALTH REGIONS – social stratifiers:

The ‘Health Regions – Occupational Risk’ tab displays information congruent with Tab#1 (Occupational Risk) at the regional level based on Statistics Canada 2018 Health Region boundaries. At the regional level, the information for visible minority status is more limited. For this indicator, 2 categories are present: ‘Visible Minority’, ‘Non-Visible Minority’. Given this, the information related to sex, age, visible minority status, and immigrant status are included together (as described in the 2016 Census, Chapter I).

* **Sidebar:** Users can stratify information based on the Province/territory of interest, Health Region, and Policy Phase (all services, essential services, non-essential services). Users can subset the data by Sex, Age Group (years) as described in the Sex & Age section. In addition, users can select specific Selected Characteristics, which allow users to select estimates for the Total Population, Visible Minority Population, Non-Visible Minority Population, Non-permanent Resident Population, or Non-Immigrant Population, from the 2016 Census. Occupational measures from O\*NET mapped to the NOC-2016 codes in the 2016 Census can be selected in the X-axis and Y-axis ‘plot-only options’.
* **Plot:** The plot allows users to illustrate occupational measures related to COVID-19 risk. Each ‘bubble’ represents an occupation based on the 4-digit NOC-2016 classifications. The size of each bubble is proportional to the size of the total workforce in the selected sex, age and selected characteristics for each occupation. If users select multiple age groups, the sum of all selected age groups will be reflected in the plot. Users can hover over each bubble to view additional descriptive information related to the occupation. Users can modify the plot based on the X- and Y-axis options. Users can flip the axis options by selecting “Flip Axis Options”. Users can then revert to the axes as listed in the sidebars by selecting “Chosen Axis Options”. The plot legend colours reflect the 10 Broad Occupation Groups that each Occupation Unit Group is mapped to, based on the hierarchial NOC-2016 structure.
* **Table:** The table displays the user-defined information related to province/territory and policy phase. Each row represents an occupation unit group from the NOC-2016, chosen sex category, selected age group(s). Users can view statistics related to each occupation across columns, which include the number of individuals working in the occupation in each sex, age, and selected characteristic group, median income in the occupation, and the O\*NET occupational measures.
* **Summary (Table 1):** This table provides summary measures for sex, age, and visible minority status. Each row represents the selected sex, age, and selected characteristic categories within the user-defined province/territory and industry. The columns show the total number of individuals represented in these demographics along with weighted O\*NET measures and Median Income (CAD 2015).

Tool 2 – ‘Economic Re-opening and Occupational Risk of COVID-19’

The **‘Economic Re-opening and Occupational Risk of COVID-19 Tool’** allows users to examine occupational risk of COVID-19 across industries and occupations with unique featues to estimate how this risk changes across:

* Re-opening of non-essential industries.
* Level of geography, including by each province/territory and health regions, based on Statistics Canada’s 2018 health region boundaries.
* Population characteristics, including; age, sex, race/ethnicity, and immigrant status.

In this tool, there are 7 interactive tabs across the top border that enable users to examine occupational characteristics related to COVID-19 risk and mitigation as well as key demographics related to occupations. Each tab has subtabs that contain plots and/or tables along with a sidebar to allow users to interact with the information. The information in the table is searchable, either by sorting by row of interest or word searching to find a specific occupation. In addition, users can copy or download the table in .CSV or .XLSX formats.

Tab #1 – province Risk:

The ‘Province Risk’ tab allows users to identify occupations based on geography, re-opening services, demographic characteristics, and occupational-related measures. This tab builds on ‘Occupational Risk’ Tab in Tool 1.

* Sidebar: Users can stratify information based on the Province/territory of interest and Select Industry to reopen, which includes a list of non-essential services by province/territory. Users can select multiple industries but must select at least one. Users must click/select “Update Above Selections” for the information to be displayed in the sub-tabs. The information presented in the plot and table will reflect occupations that are included in the user-selected industries to reopen. A number of interactive sliders allow users to identify re-opened occupations based on key demographic and occupation-related factors including; visible minority status (%), immigrant status (%), sex (% female), age (% 65 years and over) and median income (CAD 2015). Occupational measures from O\*NET, which were mapped to the NOC-2016 codes in the 2016 Census can be selected in the X-axis and Y-axis ‘plot-only options’. The O\*NET measures include; 1) Exposure to Disease of Infection, 2) Physical Proximity, 3) Importance of Interacting with Public, 4) Importance of Using a Computer, 5) Indoors, Controlled Environment, and 6) Indoors, Not Controlled Environment. In addition to O\*NET measures, users can illustrate the Median Income in the Occupation (2015 CAD) and the broad occupation group (NOC-2016 level 1).
* Plot: The plot allows users to illustrate the impact of economic re-opening on COVID-19 risk. Each ‘bubble’ represents an occupation based on the 4-digit NOC-2016 classifications. The size of each bubble is proportional to the size of the additional workforce added back into the economy, based on the province/territory, selected industry(ies) that are selected in the sidebar. Users can hover over each bubble to view additional descriptive information related to the occupation. The plot is interactive with the slider measures, the shaded bubbles represent occupations that are within the user-defined slider range. Users can modify the plot based on the X- and Y-axis options, previously described. Finally, users can flip the axis options by selecting “Flip Axis Options”. Users can then revert to the axes as listed in the sidebars by selecting “Chosen Axis Options”.
* Table: The table displays the user-defined information related to province/territory, select industries to re-open, and slider selections. Each row represents the selected industry(ies) (from NAICS-2012) and associated occupations (from NOC-2016) mapped to each industry. Users can view statistics related to each occupation mapped to selected industries across columns, which include the number of individuals working in the occupation, demographic details, median income in the occupation, and the O\*NET occupational measures.

TAB #2 – PROVINCE RISK – sex & age:

The ‘Province Risk – Sex & Age’ tab allows users to identify the burden of economic re-opening on occupational risk of COVID-19 across 2 key demographic characteristics; sex and age (as described in the 2016 Census, Chapter I). This tab builds on the ‘Sex & Age’ tab in Tool 1.

* **Sidebar:** Users can stratify information based on the Province/territory of interest and Select Industry to reopen, which includes a list of non-essential services by province/territory. Users can select multiple industries but must select at least one. Users can subset the data by Sex and Age Group (years). The Sex options are unique, meaning that users can only select one of the three options provided (Female, Male, or Total – Sex). In the Age Group (years), users can select as many age groups of interest, but must select at least one. Users must click/select “Update Above Selections” for the information to be displayed in the sub-tabs. Occupational measures from O\*NET mapped to the NOC-2016 codes in the 2016 Census can be selected in the X-axis and Y-axis ‘plot-only options’.
* **Plot:** The plot allows users to illustrate the impact of economic re-opening on COVID-19 risk. Each ‘bubble’ represents a re-opened occupation based on the 4-digit NOC-2016 classifications. The size of each bubble is proportional to the size of the additional workforce added back into the economy, based on the province/territory, selected industry(ies), selected sex and age demographics. If users select multiple age groups, the sum of all selected age groups will be reflected in the plot. Users can hover over each bubble to view additional descriptive information related to the occupation. Users can modify the plot based on the X- and Y-axis options. The plot legend colours reflect the 10 Broad Occupation Groups that each Occupation Unit Group is mapped to, based on the hierarchial NOC-2016 structure.
* **Table:** The table displays the user-defined information related to province/territory, select industries to re-open, sex, and age. Each row represents the selected industry(ies) (from NAICS-2012) and associated occupations (from NOC-2016) mapped to each industry, chosen sex category and selected age group(s). Users can view statistics related to each occupation and demographic group across columns, which include the number of individuals working in the occupation in selected sex and age groups, median income in the occupation, and the O\*NET occupational measures.
* **Summary (Table 1):** This table provides summary measures for sex and age. Each row represents the selected sex and age categories within the user-defined province/territory and selected industry to re-open. The columns show the total number of individuals represented in these demographics along with weighted O\*NET measures and Median Income (CAD 2015).

TAB #2 – PROVINCE RISK – race/ethnicity:

The ‘Province Risk – Race/Ethnicity’ tab allows users to identify the burden of economic re-opening on occupational risk of COVID-19 across key demographic characteristics; sex, age, and visible minority status (as described in the 2016 Census, Chapter I). This tab builds on the ‘Race/Ethnicity’ tab in Tool 1.

* **Sidebar:** Users can stratify information based on the Province/territory of interest and Select Industry to reopen, which includes a list of non-essential services by province/territory. Users can select multiple industries but must select at least one. Users can subset the data by Sex and Age Group (years). The Sex options are unique, meaning that users can only select one of the three options provided (Female, Male, or Total – Sex). In the Age Group (years), users can select as many age groups of interest, but must select at least one. Users must click/select “Update Above Selections” for the information to be displayed in the sub-tabs. In addition, users can select specific Visible Minority Status groups as described in the 2016 Census. Occupational measures from O\*NET mapped to the NOC-2016 codes in the 2016 Census can be selected in the X-axis and Y-axis ‘plot-only options’.
* **Plot:** The plot allows users to illustrate the impact of economic re-opening on COVID-19 risk. Each ‘bubble’ represents a re-opened occupation based on the 4-digit NOC-2016 classifications. The size of each bubble is proportional to the size of the additional workforce added back into the economy, based on the province/territory, selected industry(ies), selected sex, age, and visible minority status demographics. If users select multiple age groups, the sum of all selected age groups will be reflected in the plot. Users can hover over each bubble to view additional descriptive information related to the occupation. Users can modify the plot based on the X- and Y-axis options. The plot legend colours reflect the 10 Broad Occupation Groups that each Occupation Unit Group is mapped to, based on the hierarchial NOC-2016 structure.
* **Table:** The table displays the user-defined information related to province/territory, select industries to re-open, sex, age, and visible minority status. Each row represents the selected industry(ies) (from NAICS-2012) and associated occupations (from NOC-2016) mapped to each industry, chosen sex category and selected age group(s). Users can view statistics related to each occupation and demographic group across columns, which include the number of individuals working in the occupation in selected sex and age groups, median income in the occupation, and the O\*NET occupational measures.
* **Summary (Table 1):** This table provides summary measures for sex, age, and visible minority status. Each row represents the selected sex and age categories within the user-defined province/territory and selected industry to re-open. The columns show the total number of individuals represented in these demographics along with weighted O\*NET measures and Median Income (CAD 2015).

**TAB #3 – PROVINCE RISK – immigrant status:**

The ‘Province Risk – Immigrant Status’ tab allows users to identify the burden of economic re-opening on occupational risk of COVID-19 across key demographic characteristics; sex, age, and immigrant status (as described in the 2016 Census, Chapter I). This tab builds on the ‘Immigrant Status’ tab in Tool 1.

* **Sidebar:** Users can stratify information based on the Province/territory of interest and Select Industry to reopen, which includes a list of non-essential services by province/territory. Users can select multiple industries but must select at least one. Users can subset the data by Sex and Age Group (years). The Sex options are unique, meaning that users can only select one of the three options provided (Female, Male, or Total – Sex). In the Age Group (years), users can select as many age groups of interest, but must select at least one. Users must click/select “Update Above Selections” for the information to be displayed in the sub-tabs. In addition, users can select specific Immigrant Status groups as described in the 2016 Census. Occupational measures from O\*NET mapped to the NOC-2016 codes in the 2016 Census can be selected in the X-axis and Y-axis ‘plot-only options’.
* **Plot:** The plot allows users to illustrate the impact of economic re-opening on COVID-19 risk. Each ‘bubble’ represents a re-opened occupation based on the 4-digit NOC-2016 classifications. The size of each bubble is proportional to the size of the additional workforce added back into the economy, based on the province/territory, selected industry(ies), selected sex, age, and immigrant status demographics. If users select multiple age groups, the sum of all selected age groups will be reflected in the plot. Users can hover over each bubble to view additional descriptive information related to the occupation. Users can modify the plot based on the X- and Y-axis options. The plot legend colours reflect the 10 Broad Occupation Groups that each Occupation Unit Group is mapped to, based on the hierarchial NOC-2016 structure.
* **Table:** The table displays the user-defined information related to province/territory, select industries to re-open, sex, age, and immigrant status. Each row represents the selected industry(ies) (from NAICS-2012) and associated occupations (from NOC-2016) mapped to each industry, chosen sex category and selected age group(s). Users can view statistics related to each occupation and demographic group across columns, which include the number of individuals working in the occupation in selected sex and age groups, median income in the occupation, and the O\*NET occupational measures.
* **Summary (Table 1):** This table provides summary measures for sex, age, and immigrant status. Each row represents the selected sex and age categories within the user-defined province/territory and selected industry to re-open. The columns show the total number of individuals represented in these demographics along with weighted O\*NET measures and Median Income (CAD 2015).

TAB #5 – province total (all industries):

The ‘Province Total (All Industries) tab allows users to estimate the total burden and risk of re-opening the economy on the occupational risk for COVID-19. Users will be able to model the impact of re-opening selected industries on the number of essential & re-opened sector workers, and non-essential workers across occupations. This tab builds on the ‘Occupational Risk’ tab from Tool 1 along with the ‘Province Risk’ tab in Tool 2.

* Sidebar: Users can stratify information based on the Province/territory of interest and Select Industry to reopen, which includes a list of non-essential services by province/territory. Users can select multiple industries but must select at least one. Users then must select the Policy Phase of interest, which includes options for All Industries, Essential & Selected Industries to re-open, or Non-essential Industries. Users must click/select “Update Above Selections” for the information to be displayed in the sub-tabs. The information presented in the plot and table will reflect occupations included in the user-selected industries to reopen. A number of interactive sliders allow users to identify re-opened occupations based on key demographic and occupation-related factors including; visible minority status (%), immigrant status (%), sex (% female), age (% 65 years and over) and median income (CAD 2015). Occupational measures from O\*NET mapped to the NOC-2016 codes in the 2016 Census can be selected in the X-axis and Y-axis ‘plot-only options’.
* Plot: The plot allows users to illustrate the impact of economic re-opening on COVID-19 risk. Each ‘bubble’ represents an occupation based on the 4-digit NOC-2016 classifications. The size of each bubble is proportional to the size of the workforce, based on the province/territory, selected industry(ies), and policy that are selected in the sidebar. Users can hover over each bubble to view additional descriptive information related to the occupation. The plot is interactive with the slider measures, the shaded bubbles represent occupations that are within the user-defined slider range. Users can modify the plot based on the X- and Y-axis options, previously described. Finally, users can flip the axis options by selecting “Flip Axis Options”. Users can then revert to the axes as listed in the sidebars by selecting “Chosen Axis Options”.
* Table: The table displays the user-defined information related to province/territory, select industries to re-open, policy phase and slider selections. Each row represents occupations (from NOC-2016) mapped to each policy phase. Users can view statistics related to each occupation mapped, which include the number of individuals working in the occupation, demographic details, median income in the occupation, and the O\*NET occupational measures.

TAB #6 – health regions RISK:

The ‘Health Regions Risk’ tab allows users to identify occupations based on geography, re-opening services, demographic characteristics, and occupational-related measures. This tab builds on ‘Health Regions - Occupational Risk’ Tab in Tool 1.

* Sidebar: Users can stratify information based on the Province/territory, Health Region and Select Industry to reopen, which includes a list of non-essential services by province/territory. Users can select multiple industries but must select at least one. Users must click/select “Update Above Selections” for the information to be displayed in the sub-tabs. The information presented in the plot and table will reflect occupations included in the user-selected industries to reopen. A number of interactive sliders allow users to identify re-opened occupations based on key demographic and occupation-related factors including; visible minority status (%), immigrant status (%), sex (% female), age (% 65 years and over) and median income (CAD 2015). Occupational measures from O\*NET, which were mapped to the NOC-2016 codes in the 2016 Census can be selected in the X-axis and Y-axis ‘plot-only options’. The O\*NET measures include; 1) Exposure to Disease of Infection, 2) Physical Proximity, 3) Importance of Interacting with Public, 4) Importance of Using a Computer, 5) Indoors, Controlled Environment, and 6) Indoors, Not Controlled Environment. In addition to O\*NET measures, users can illustrate the Median Income in the Occupation (2015 CAD) and the broad occupation group (NOC-2016 level 1).
* Plot: The plot allows users to illustrate the impact of economic re-opening on COVID-19 risk. Each ‘bubble’ represents an occupation based on the 4-digit NOC-2016 classifications. The size of each bubble is proportional to the size of the additional workforce added back into the economy, based on the province/territory, health region, and industry(ies) that are selected in the sidebar. Users can hover over each bubble to view additional descriptive information related to the occupation. The plot is interactive with the slider measures, the shaded bubbles represent occupations that are within the user-defined slider range. Users can modify the plot based on the X- and Y-axis options, previously described. Finally, users can flip the axis options by selecting “Flip Axis Options”. Users can then revert to the axes as listed in the sidebars by selecting “Chosen Axis Options”.
* Table: The table displays the user-defined information related to province/territory, health region, select industries to re-open, and slider selections. Each row represents the selected industry(ies) (from NAICS-2012) and associated occupations (from NOC-2016) mapped to each industry. Users can view statistics related to each occupation mapped to selected industries across columns, which include the number of individuals working in the occupation, demographic details, median income in the occupation, and the O\*NET occupational measures.

TAB #6 – HEALTH REGIONS – social stratifiers:

The ‘Health Regions – Social Stratifiers’ tab allows users to identify occupations based on geography, re-opening services, demographic characteristics, and occupational-related measures. This tab builds on ‘Health Regions – Social Stratifiers’ Tab in Tool 1. This tab displays information congruent with Tab#1 (Province Risk) at the regional level based on Statistics Canada 2018 Health Region boundaries. At the regional level, the information for visible minority status is more limited. For this indicator, 2 categories are present: ‘Visible Minority’, ‘Non-Visible Minority’. Given this, the information related to sex, age, visible minority status, and immigrant status are included together (as described in the 2016 Census, Chapter I).

* Sidebar: Users can stratify information based on the Province/territory, Health Region and Select Industry to reopen, which includes a list of non-essential services by province/territory. Users can select multiple industries but must select at least one. Users must click/select “Update Above Selections” for the information to be displayed in the sub-tabs. The information presented in the plot and table will reflect occupations included in the user-selected industries to reopen. In addition, users can select specific Selected Characteristics, which allow users to select estimates for the Total Population, Visible Minority Population, Non-Visible Minority Population, Non-permanent Resident Population, or Non-Immigrant Population, from the 2016 Census. Occupational measures from O\*NET mapped to the NOC-2016 codes in the 2016 Census can be selected in the X-axis and Y-axis ‘plot-only options’.
* **Plot:** The plot allows users to illustrate occupational measures related to the impact of economic re-opening on COVID-19 risk. Each ‘bubble’ represents a re-opened occupation based on the 4-digit NOC-2016 classifications. The size of each bubble is proportional to the size of the the additional workforce added back into the economy, based on the province/territory, health region, selected industry(ies), selected sex, age and selected characteristics for each occupation. If users select multiple age groups, the sum of all selected age groups will be reflected in the plot. Users can hover over each bubble to view additional descriptive information related to the occupation. Users can modify the plot based on the X- and Y-axis options. Users can flip the axis options by selecting “Flip Axis Options”. Users can then revert to the axes as listed in the sidebars by selecting “Chosen Axis Options”. The plot legend colours reflect the 10 Broad Occupation Groups that each Occupation Unit Group is mapped to, based on the hierarchial NOC-2016 structure.
* **Table:** The table displays the user-defined information related to province/territory, health region, select industries to re-open, and slider selections. Each row represents the selected industry(ies) (from NAICS-2012) and associated occupations (from NOC-2016) mapped to each industry. Users can view statistics related to each occupation mapped to selected industries across columns, which include the number of individuals working in the occupation, demographic details, median income in the occupation, and the O\*NET occupational measures.
* Summary (Table 1): This table provides summary measures for sex, age, and selected characteristics. Each row represents the selected sex, age, and selected characteristic categories within the user-defined province/territory and industry. The columns show the total number of individuals represented in these demographics along with weighted O\*NET measures and Median Income (CAD 2015).

Chapter VI: Data Limitations

This section describes the data limitations for the 3 primary data sources used in for this project.

2016 Census:

* 2016 Census data was provided by Statistics Canada, at the request of PHO researchers, in the form of tables
  + All tables included data that was provided at aggregate level and therefore only ecological associations can be infered
    - potential for inferences with aggregate-level data to suffer from ecological fallacy
  + For confidentiality and privacy considerations, Statistics Canada transforms aggregate data by random rounding
    - Each aggregate value are randomly rounded up or down to a multiple of ‘5’, or ‘10’
      * When data are summed or grouped, the total value may not match the sum of the individual values.
      * Percentages calculated may not add up to 100%
    - For this project, the Total sum of individuals provided may not directly add to the sum of all Visible Minority Groups or the sum of all Immigrant Status Groups
  + Global non-response for Provinces/Territories and Health Regions for long-form questionnaire
    - Province/territories: Range from 4.3% in Quebec to 8.8% in NWT
  + Population is for year 2016
    - Assume consistent population size for workforce
  + Median income includes total workforce (part/full-time)
* In addition, Statistics Canada has enumerated a list of potential sources of error in the Census
  + Coverage errors
  + Non-response errors
  + Response errors
  + Processing errors
  + Sampling errors

O\*NET:

* The Occupational Information Network (O\*NET) is a database designed and maintained in the United States.
  + O\*NET uses the Standard Occupational Classification (SOC) system that is a hierarchial system which classifies workers in 867 occupation groups at the most granular level. In Canada, the 2016 Census used the National Occupational Classification (NOC) System, with 500 occupation groups at the most granular level.
    - To reconcile this, published crosswalks between SOC and NOC occupations were retrieved and used. We relied on a crosswalk published by the Brookfield Institute (<https://brookfieldinstitute.ca/>).
      * Potential source of error: misclassification of occupations
* Additional considerations have been published:
  + Responses are averaged across respondents (within-person variation)
  + Distribution of respondents by background characteristics unavailable
  + The survey is voluntary and demographic representativeness was not considered
  + O\*NET is a mailout-mailback survey that makes significant literacy demands on respondents, it is likely that responses are skewed toward the more educated, those with higher cognitive abilities, citizens and legal residents

GSS:

* The General Social Survey (GSS) 2016, Canadians at Work and Home is a population-representative cross-sectional survey. There are a few limitations to be considered when analyzing and interpreting results
  + The GSS 2016 is population-representative to the Canadian provinces, however it does not include information from individuals living in the three territories.
  + The information collected in the GSS 2016 is self-reported. There is a risk of biases associated with this type of data, such as social desireability bias.
  + The GSS 2016 survey is cross-sectional, meaning that individuals should not infer cause and effect between exposure and outcome variables.
  + The GSS 2016, as with many surveys, may have a risk of non-response bias. The response rate for this cycle of GSS 2016 is 50.8%.
  + This survey is separate from the 2016 Census and results should be interpreted independently.

Disclaimer

This document was developed by Public Health Ontario (PHO). PHO provides scientific and technical advice to Ontario’s government, public health organizations and health care providers. PHO’s work is guided by the current best available evidence at the time of publication.

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Appendix A: Health Region Peer Groups

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| --- | --- |
| Peer Group | Health Regions (2018 Boundaries) |
| **Peer Group A** | 4710 Prairie North Regional Health Authority  4833 Central Zone  4835 North Zone  5953 Northeast Health Service Delivery Area  6001 Yukon  6101 Northwest Territories |
| **Peer Group B** | 1204 Zone 4 - Central  2403 Région de la Capitale-Nationale  2407 Région de l'Outaouais  2413 Région de Laval  2416 Région de la Montérégie  3530 Durham Regional Health Unit  3536 Halton Regional Health Unit  3537 City of Hamilton Health Unit  3544 Middlesex-London Health Unit  3551 City of Ottawa Health Unit  3565 Waterloo Health Unit  3568 Windsor-Essex County Health Unit  4601 Winnipeg Regional Health Authority  4704 Regina Qu'Appelle Regional Health Authority  4706 Saskatoon Regional Health Authority  4832 Calgary Zone  4834 Edmonton Zone  5921 Fraser East Health Service Delivery Area  5941 South Vancouver Island Health Service Delivery Area |
| **Peer Group C** | 1011 Eastern Regional Health Authority  1100 Prince Edward Island  1201 Zone 1 - Western  1202 Zone 2 - Northern  1301 Zone 1 (Moncton area)  1302 Zone 2 (Saint John area)  1303 Zone 3 (Fredericton area)  1304 Zone 4 (Edmundston area)  2401 Région du Bas-Saint-Laurent  2402 Région du Saguenay--Lac-Saint-Jean  2404 Région de la Mauricie et du Centre-du-Québec  2405 Région de l'Estrie  3526 The District of Algoma Health Unit  3527 Brant County Health Unit  3535 Haliburton, Kawartha, Pine Ridge District Health Unit  3538 Hastings and Prince Edward Counties Health Unit /  3540 Chatham-Kent Health Unit  3541 Kingston, Frontenac and Lennox and Addington Health Unit  3542 Lambton Health Unit  3546 Niagara Regional Area Health Unit  3547 North Bay Parry Sound District Health Unit  3555 Peterborough County-City Health Unit  3556 Porcupine Health Unit  3558 The Eastern Ontario Health Unit  3561 Sudbury and District Health Unit  3562 Thunder Bay District Health Unit  3563 Timiskaming Health Unit  4709 Prince Albert Parkland Regional Health Authority  5912 Kootenay-Boundary Health Service Delivery Area  5913 Okanagan Health Service Delivery Area  5914 Thompson/Cariboo Health Service Delivery Area  5942 Central Vancouver Island Health Service Delivery Area  5943 North Vancouver Island Health Service Delivery Area |
| **Peer Group D** | 2408 Région de l'Abitibi-Témiscamingue  2410 Région du Nord-du-Québec  2412 Région de la Chaudière-Appalaches  2414 Région de Lanaudière  2415 Région des Laurentides  3533 Grey Bruce Health Unit  3534 Haldimand-Norfolk Health Unit  3539 Huron County Health Unit / Circonscription sanitaire du comté de Huron  3543 Leeds, Grenville and Lanark District Health Unit  3549 Northwestern Health Unit  3554 Perth District Health Unit  3557 Renfrew County and District Health Unit  3560 Simcoe Muskoka District Health Unit  3566 Wellington-Dufferin-Guelph Health Unit  3575 Oxford Elgin St. Thomas Health Unit  4602 Prairie Mountain Health  4603 Interlake-Eastern Regional Health Authority  4605 Southern Health  4701 Sun Country Regional Health Authority  4702 Five Hills Regional Health Authority  4703 Cypress Regional Health Authority  4705 Sunrise Regional Health Authority  4707 Heartland Regional Health Authority  4708 Kelsey Trail Regional Health Authority  4831 South Zone  5911 East Kootenay Health Service Delivery Area  5951 Northwest Health Service Delivery Area  5952 Northern Interior Health Service Delivery Area |
| **Peer Group E** | 1012 Central Regional Health Authority  1013 Western Regional Health Authority  1014 Labrador-Grenfell Regional Health Authority  1203 Zone 3 - Eastern  1305 Zone 5 (Campbellton area)  1306 Zone 6 (Bathurst area)  1307 Zone 7 (Miramichi area)  2409 Région de la Côte-Nord  2411 Région de la Gaspésie--Îles-de-la-Madeleine |
| **Peer Group F** | 2417 Région du Nunavik  2418 Région des Terres-Cries-de-la-Baie-James  4604 Northern Regional Health Authority  4714 Mamawetan/Keewatin/Athabasca  6201 Nunavut |
| **Peer Group G** | 2406 Région de Montréal  3595 City of Toronto Health Unit  5932 Vancouver Health Service Delivery Area |
| **Peer Group H** | 3553 Peel Regional Health Unit  3570 York Regional Health Unit  5922 Fraser North Health Service Delivery Area  5923 Fraser South Health Service Delivery Area  5931 Richmond Health Service Delivery Area  5933 North Shore/Coast Garibaldi Health Service Delivery Area |