Planning Tool Guidance

Project Big Life

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Contents

Chapter 1

Welcome to Project Big Life's Planning Tool

1.1 What is the Project Big Life Planning Tool

To do: Develop video showcasing the platform including what it is and why someone should use the platform

1.2 Who made the Project Big Life Planning Tool?

The Project Big Life Planning Tool was developed by the Project Big Life Team. The Project Big Life Team is part of the ICES. The below video explains what ICES is.

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## PhantomJS not found. You can install it with webshot::install_phantomjs(). If it is installed, pleas
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Chapter 2

Introduction

The Project Big Life Planning Tool was developed in order to support health professionals: research, plan, develop, and evaluate evidence-based health interventions.

For instance Project Big Life Planning Tool helps:

- Public health professionals: assess the impact of a preventative intervention on a health behaviour
- Health planners: assess the need for palliative care

What types of questions can it answer?

The Project Big Life Planning Tool can answer the following types of questions:

- What is the burden of smoking on life expectancy?
- How many deaths would be prevented if everyone met their daily excersize requirements?

How does it work?

- This tool provides health planners with access to multivariable predictive risk algorithms, created and housed by the Project Big Life Team.
- The multivariable predictive risk algorithms use distinct characteristics and health profiles of groups of people to assess the risk of a health outcome (e.g. Life Expectancy).
- The multivariable predictive risk algorithms are developed and validated using data routinely collected by Statistics Canada and provincial health agencies, and the algorithms have been published in various journals.
- More information about multivariable predictive risk algorithms can be found in the key concepts (Chapter 6).

Why should I used it?

- It is **easy** and **flexible** to use.
  - The user only needs to upload their data and choose which calculation to run.
  - It can be used to assess the future risk of a health outcome.
  - It can be used to assess the effectiveness of different intervention scenarios (e.g. policy) on a health outcome.

- It generates **accurate** predictions.
  - It can be used to accurately assess the risk of a health outcome in populations that were not used in its developement, and groups of people that account for only a fraction of the population.
- It is **Private**.
  - Uploaded data remains on your computer and is not uploaded or sent anywhere.

Chapter 3

Getting Started

To help you get started with Project Big Life's Planning Tool quickly, we built a Tutorial directly onto the platform.

The tutorial takes you through step-by-step how to use Project Big Life's Planning Tool. The tutorial will not explain the steps in detail (Chapter 4) nor will it provide reference material (Chapter 7), but it will give you an understanding of how easy it is to use the Planning Tool!

To access the tutorial, go onto Project Big Life's Planning Tool (http://policy.projectbiglife.ca/) and click on the Tutorial button in the top right corner!

Chapter 4

How To

These guides will cover similar topics as the tutorials but in greater detail.

- Customize Data
- Import Data
- Select Outcome
- Filter Data
- Stratify Data
- Calculate Outcomes
- Generate Intervention Scenarios
- Visualize Data
- Export Data
- Resolve Error Messages

4.1 Customize Data

Prior to using the Project Big Life Planning Tool you may want to manipulate your dataset. Reasons for data manipulation may include: custom filter or custom stratification.

Data manipulation can occur on any programming software: R, SAS, STATA, etc, provided you output your dataset as a .csv file.

The following table shows the example R, SAS, STATA code for the following:

Put example in to the Consult with Doug To clarify: Not sure whether to continue with this section, as there are multiple ways to manipulate the data. Could provide an example

4.2 Upload Data

To Do: determine what terminology to use Uploaded vs. Imported

Data *uploaded* to the Project Big Life Planning Tool remains on your computer and is not uploaded or sent anywhere.

Note The Project Big Life Planning Tool can currently only support .csv data files from the 2013/2014 Canadian Community Health Survey *TBD - whether it's shared.*

There are two options for your data: use a sample file or upload your own file.

4.2.1 Use a sample file

If you don't have your own data or want to explore the platform capabilities prior to your data you can use the sample files already on the There are **X** sample files you may use to complete your calculations:

- MockPUMF2013.csv is the Public Use Microdata File from the [2013 Canadian Community Health Survey] (https://www150.statcan.gc.ca/n1/en/catalogue/82M0013X).

Click on the file name under the **Sample files** to select it.

4.2.2 Upload your own file

Click the browse button under **Select a file to use in calculations**. Locate the file on your computer, select, and open.

If the imported file has all of the variables required and recommended for calculation, you will be able to continue with the planning tool.

- If the imported file does **not** have all the variables **required** for the calculation you will not be able to continue with the planning tool.
- If the imported file does **not** have all the variables **recommended** for calculation you will be able to continue with the planning tool, however the calculations may be less accurate.

4.3 Select Outcome

Click on box beside the calculation name under **Select initial calculations**.

TO Do: add details about the calculations can be found in the glossary and key concepts

4.4 Filter Data

Click on the + Add filter button.

Select the variable that you want to filter on.

To Clarify: CAT vs. Continous - what are we letting them filter on *Clarify with Luke if this is done, WKLY ALCOHOL Consumption**

To add another filter repeat the steps above. A maximum of three filters are recommended to maintain statistical power (added filters reduce sample sizes and reduces statistical power).

You are able to filter on all types of variables: required for calculation, recommended for calculation, and ignore variables (includes customized variables).

4.4.1 Remove a filter

To remove a filter entirely, click on the trash can beside the filter you want to delete.

To remove a level within a filtered variable, click on the 'x' beside the variable level.

4.5 Stratify data

Select the variables you want to stratify on Under 'Stratifications'. A maximum of 3 stratifications are recommended to maintain statistical power (added strata reduce strata sample size and reduces statistical power).

You are able to stratify on categorical variables, but not continous.

You are able to stratify on all types of categorical variables: required for calculation, recommended for calculation, and ignore variables (includes customized variables).

With Luke - prevent stratification of continous variables

4.6 Calculate Outcomes

Name your calculation to quickly differentiate multiple calculations.

Note the larger the data file is the longer the calculations will take. It may take a few minutes for the calculation to complete. *TBD: There has been discussion on changing the current method. Once a method has been selected then Indicate how they know that the calculation is being preformed.*

4.7 Generate Intervention Scenarios

TBD: How much of it will be included in the platform. Will inform how to write this section

4.8 Visualize Data

TBD: Need plots on the platform to work through the steps below - export - create your own(?)

4.9 Export Data

Click on the **Download results** button under the **Results** section.

Select which calculations you'd like to download.

To Do: Screenshot of all the calculation options once the platform is fixed.

4.10 Resolve Warning or Error Messages

TO DO: confirm with Luke possible error messages and what they mean

- Invalid category
- Out of range
- Not a number
- Sample Size is too small

Chapter 5

Applications

This chapter provides you with examples of how Project Big Life's Planning Tool can be used in your day-to-day operations. The examples will cover: cause-deletion, generating a health status report and determining the impact of a local and national policy.

5.1 Cause-deleted life expectancy

What would be the life expectancy of a population if be no one in the population ever smoked? This scenario is a cause-deleted scenario.

Cause-deleted life expectancy is the estimated life expectancy of a population if a specific cause (e.g. smoking) did not exist in that population. This population is known as the counterfactual population.

Cause-deleted effect of life expectancy is calculated by comparing the population with the current exposure status of smoking status and pack-years of smoking to a counterfactual population where these two variables are: smoking status = never smoker, and pack-years of smoking = 0. It is measured in life years lost. This calculation can also be preformed with the health outcome: risk of mortality. Further explaination of cause-deleted risk and cause-deleted effect of a risk can be found in key concepts (Chapter **??**keyconcepts)).

Cause-deleted effect of the risk for the probability of death % of risk that is due to smoking is the difference in the risk

Lets walk through this scenario step-by-step!

5.2 Health Status Report

5.3 Diet

5.4 Transportation

Chapter 6

Key Concepts

This section explains some key concepts in Project Big Life's Planning Tool. This section will explain how it works rather then how to do things.

- Multivariable Predictive Risk Algorithms
- Calculations
  - Life Expectancy
  - Cause-Deleted
- Health Intervention Scenarios

6.1 Multivariable Predictive Risk Algorithms

Multivariable predictive risk algorithms predict the future risk of health outcomes (e.g. Life Expectancy) for a population using routinely collected health data.

Multivariable predictive risk algorithms can be used to:

- Project the number of new cases of the health outcome
- Estimate the contribution of specific risk factors of the health outcome
- Evaluate effectiveness of health interventions
- Describe the distribution of risk in the population (diffused or concentrated)

Multivariable predictive risk algorithms are able to assess equity issues compared to competing population risk methods (e.g. World Health Organization Global Burden of Disease).

More information on what multivariable predictive risk algorithms are and how they can be used can be found the journal article: *Predictive risk algorithms in a population setting: an overview* (Manuel D, 2012)

6.1.1 Development of multivariable predictive risk models

Data:

- Multivariable predictive risk models are created using routinely collected data that includes information about risk factors (exposure) and health events (outcomes).

- Data is collected at an individual level through population health surveys (e.g. Canadian Community Health Survey) and administrative databases (e.g. Vital Statistics). Data sources are linked together when the individual has given permission too.
- Individuals are followed overtime until the health event (e.g. death or disease) occurs.
- Separate data is collected to create a derivation cohort and validation cohort(s).
  - Note: The risk factors that are collected are from population health surveys and are self-reported; no clinical data (e.g. blood pressure) is collected. Risk factors focus on health behaviours (e.g. smoking) and sociodemographic factors, commonly associated with health outcome.

Model Generation:

- Multivariable predictive risk models are developed and validated in 4 stages:
  - Model derivation: the predictive risk model is created using data from the derivation cohort
  - Model validation: the predictive risk model is applied to the validation cohort
  - Final Model Generation: validation and derivation cohorts are combined to estimate the final application of the predictive risk model
  - Derivation of the application model: creation of a parsimonous (fewer predictors) model that maintained discrimination, calibration, and overall model performance
- In each stage of the model development and validation, model performance is assessed using measures of discrimination and calibration.

6.1.2 Multivariable predictive risk algorithms built in Project Big Life Planning Tool

- There is currently 1 multivariable predictive risk model is built into to Project Big Life planning tool.

Title

Outcomes

Information

Mortality Population Risk Tool

5 year risk of death, Life Expectancy, Cause deleted

Appendix A

6.2 Calculations

6.2.1 Life expectancy calculation

Life expectancy is calculated using abridge life-tables.

TO DO: further develop this section

6.2.2 Cause-deleted and cause-deleted effect calculation

Cause-deleted : A cause-deleted health outcome is the estimated health outcome of a population if a specific cause (e.g. smoking) did not exist in that population. - A cause-deleted health outcome is the estimated health outcome of a population if a specific cause (e.g. smoking) did not exist in that population.

Cause-deleted effect: The health outcome (e.g. Life Expectancy) is calculated for both the: population with the current exposure status of the exposure (e.g. smoking status and pack-years of smoking) and a counterfactual population where these the exposures are at their reference values (e.g. smoking status = never smoker and pack-years of smoking = 0).

The comparison of the health outcomes from the two populations are the cause-deleted effect or the health outcome attributable to that exposure.

The following table describes the terminology used for each calculation:

Original_outcome

Counterfactual_outcome

Difference_in_outcome

Measure_of_difference

Life expectancy

Cause-deleted life expectancy

Cause-deleted effect of life expectancy

Life years lost

Risk of mortality

Cause-deleted mortality risk

Cause-deleted effect of mortality risk

TBD

To Do: Generate a table of the reference categories for each of the variables that can be adjusted.

Calculations

1) The 5-year risk of mortality of the population is calculated using current health behaviour levels, e.g. your population will have individuals that never smoked, current smoker, former smoker who quit < 5 years ago, and former smokers that quit $>= 5$ years ago.

2) The "cause-deleted 5-yr mortality risk" is calculated by setting the exposure of interest (e.g. smoking status) to its reference level.

3) *To clarify: How these steps work*

6.3 Health interventions scenarios

TBD: whether this will be built into the platform or not. Depending on the outcome will dictate how I write the following section (e.g. do they have to manipulate thier data)

Chapter 7

Glossary

5-year mortality risk

The probability that an individual will die in the next 5 years.

Body Mass Index (BMI)

A weight-to-height ratio used as an indicator of obesity and underweight. BMI is calculated by dividing an individual's body weight in kilograms by the square of height in metres (kg/m2).

Burden

The impact or size of a health problem in an area, measured by cost, mortality, morbidity or other indicators. The burden of unhealthy behaviour is calculated by the differences in life expectancy based on individuals' exposure to four health behavioural risks for poor health relative to the healthy category.

By Row Measures

When selected, the output '.csv' file will include the result of the calculation for each row (e.g. individual) of the dataset.

Calibration

The agreement between predicted risk generated from the model and observed risk generated from the data.

Canadian Community Health Survey

An annual survey preformed by Statistics Canada that collects information related to health status, health care utilization and health determinants for the Canadian population. Details about the survey can be found on Statistic Canada website (http://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&Id=795204).

Cause-deleted life expectancy

A cause-deleted health outcome is the estimated health outcome of a population if a specific cause (e.g. smoking) did not exist in that population.

Discrimination

The ability of the model to differentiate between high risk individuals and low risk individuals.

Error Message

Error messages will occur when variables that are **"Required for Calculation"** are missing in the data. If the entire column for the variable is missing then the calculation cannot be performed on the data. If there are missing row entries for the variable then the entire row will not be used in the calculation.

Exposure

In the risk algorithms the exposure refers to the level of the predictor varaible, e.g. for the predictor variable EDUDR04 there are four levels of exposure: (1) Post-Secondary, (2) Some Post-Secondary, (3) High School, (4) Less then High School.

Filter

Chooses part of your dataset for analysis. If you filter on 'Sex' and then 'Male', calculations will only be performed on individuals that are 'Male' and 'Females' will be excluded. For example, when calculating Life Expectancy on the filter variable 'Sex' then 'Male' there will be a Life Expectancy estimate for 'Males' and *no* Life Expectancy estimate for 'Females'.

Health Behaviour

Actions people do that may affect their health, positively or negatively. Health behaviours are among the determinants of health and are influenced by the social, cultural and physical environments in which people live and work.(Statistics Canada, 2010) They are also shaped by individual choices and external constraints.(Statistics Canada, 2010) The four health behaviours of **smoking, alcohol consumption, diet,** and **physical activity** are specified in Project Big Life's planning tool.

Ignored Variables

Are not included in the calculation. It does not matter if your dataset includes these variables or not. Ignored variables can used for filter and stratification.

Life Expectancy (LE)

Life expectancy is a calculation of how long a person or population would be expected to live, on average, given unchanging risk of death from a specific point in time.

Metabolic Equivalent of Task (MET)

The metabolic equivalent of task (MET) is a measure of the rate of energy expenditure from an activity; a measure of calories burned by type, duration and frequency of physical activity. The reference value of 1 MET is defined as the energy expediture rate at rest which is equal to 1kcal/kg/day.

Predictor

A variable that is used in the algorithm to predict the outcome.

Recommend for calculation

Variables that are included in the calculation but not necessary for the calculation to run. Rather these variables increase the accuracy of the results.

Required for calculation

Variables that are included in the calculations and are necessary for the calculation to run. If a dataset does not have these variables then the calculation will not run.

Risk

The probability ofa health event occuring at some point of time in the future.

Socioeconomic Position

People in poorer socioeconomic circumstances generally have poorer health. Deprivation measures identify those who experience material or social disadvantage compared to others in their community. The Deprivation Index for Health in Canada developed by the Institut national desanté publique du Québec (INSPQ)(Pampalon R, Raymond G, 2000) is used in this plannning tool. The index includes education, employment and income as measures of material deprivation; and single-parent families, living alone, or being divorced, widowed or separated as measures of social deprivation. The deprivation index was used to assign geographical areas into socioeconomic position groups (low, middle and high) based on material and social quintiles. High-deprivation neighbourhoods were those in the top two quintiles for both social and material deprivation. Low-deprivation neighbourhoods were those in the bottom two quintiles.

Stratification

The seperation of data into smaller strata (levels or classes which individuals are assigned too). If the variable 'Sex' is stratified it creates two strata: 'Male' and 'Female'. Calculations are performed on each strata (level or class) and the outcome will be specific to that strata. For example, when calculating Life Expectancy on the stratified variable 'Sex' there will be a Life Expectancy estimate for 'Males' and a different Life Expectancy estimate for 'Females'.

Summary Measures

When selected, the output .csv file will include the calculation result for the entire population of the dataset.

Warning Message

Warning messages will occur when variables that are **"Recommended for Calculation"** are missing in the data. If the entire column for the variable is missing the calculation will still be performed on the data. If there are missing row entries for the variable the row will still be used in the calculation.

Appendix A

Mortality Population Risk Tool (MPoRT)

Outcomes: 5-yr risk of death, Life Expectancy, Cause-deleted Life Expectancy

Calculations

Using MPoRT you are able to calculate:

- 5 year mortality risk
- Number of deaths
- Life Expectancy
- Cause-deleted deaths and life expectancy
- Burden of health behaviour in deaths and on life expectancy

Types of Questions

- What is the burden of smoking on life expectancy?
- How many deaths would be prevented if everyone met their daily excercise requirements?

Description: A multivariable predictive risk model that estimates the future risk of all-cause death in Canada. It adjusts for health behaviours: smoking, unhealthy alcohol consumption, poor diet, and physical inactivity, and a wide range of other risk factors.

Versions of MPoRT have been developed since 2012 and used in various studies. Each version of MPoRT (v1.0, v1.2, v2.0) used the Ontario subset of the Canadian Community Health Survey (CCHS) for development and the survey respondents were linked to personal death records. In later versions of MPoRT (v1.2, v2.0) the following changes were made:, (a) algorithm variables were adjusted to improve predictions, and (b) the algorithms were validated using: the Ontario subset of CCHS of the years that were not used in development and the National CCHS dataset (excluding Ontario).

MPoRTv1.0 Was used in the "Seven More Years" report, a joint report with Public Health Ontario and IC/ES (https://www.ices.on.ca/Publications/Atlases-and-Reports/2012/Seven-More-Years). In summary, the algorithm estimated the risk of death associated with health behaviours: smoking, unhealthy alcohol consumption, poor diet, physical inactivity and stress. There were approximately 550,000 person-years of follow up and over 6000 deaths in the development dataset. The algorthim used categorical predictor variables for health behaviours and sociodemographic factors.

MPoRTv1.2 Was published in PLoS (https://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1002082). In summary, the algorithm estimated the risk of death associated with health behaviours:

smoking, unhealthy alcohol consumption, poor diet, and physical inactivity (stress was removed due to its low prediction ability). There were approximately 1 million person-years of follow up and over 9000 deaths in the development and validation datasets. The algorithm used multiple continous predictor variables, and added chronic disease predictor variables and interaction terms.

MPoRTv2.0 - The version used in Project Big Life's Planning Tool This version of MPoRT has not yet been published.

Development: This predictive risk model was developed using Ontario subsets of the 2001 to 2008 CCHS and participants were linked to personal health records. There were approximately 1.3 million person-years of follow-up and over 15,000 deaths in the developmental dataset.

Validation: This predictive risk model was validated using three different datasets: Ontario subset of the 2009 to 2012 CCHS, National dataset (except Ontario) of the 2003 to 2008 CCHS, and the National dataset of the 2000 and 2005 National Health Interview Survey in the United States of America. In all validation datasets individuals were linked to personal health records.

Parameters: The parameters used in this predictive risk model are:

Category

Variable

Scale

Description

Demographic

Age*

Continous

5 knot spline. Valid range 20 to 102

Sex

Dichotomous

Stratified Female/Male

Health Behaviour

Pack years of smoking

Continous

3 knot spline. Valid range: 0 to 78 (Female), 0 to 112.5 (Male)

Smoking Status

Categorical

Non-smoker

Current Smoker

Former Smoker <= 5 years

Former > 5 years

Alcohol (number of drinks per week)

Continous

4 knot spline (Females) and 3 knot spline (Males). Valid range: 0 to 25 (Female), 0 to 50 (Male)

Former/non-drinker

Dichotomous

Yes/No

Simplified diet score

Continous

3 knot spline. Valid range: -18.9 to 20.7 (Female), -16.8 to 18.4 (Male)

Leisure physical activity (MET)

Continous

3 knot spline. Valid range: 0 to 12.4 (Female), 0 to 16 (Male)

Socio-demographic

Ethnicity

Categorical

White

Black

Chinese

Arab; South Asian; West Asian

Filipino; Japanese; Korean; Southeach Asian

Other; Indigenous; Latin American; Multiple origin; unknown

Immigrant

Dichotomous

Yes/No

Fraction of lifetime in Canada

Continous

3 knot spline†. Valid range: 0 to 1

Education

Categorical

Less than secondary

Secondary School Graduation

Some Post-Secondary

Post-Secondary Graduation

Neighbourhood social and material deprivation

Ordinal

Low (1st or 2nd quantile

High (4th or 5th quantile)

Moderate (all others)

Chronic Conditions

Diabetes

Dichotomous

Yes/No

High Blood Pressure

Dichotomous

Yes/No

Chronic Respiratory Disease

Dichotomous

Yes/No

Mood Disorder

Dichotomous

Yes/No

Cancer

Dichotomous

Yes/No

Dementia

Dichotomous

Yes/No

Heart Disease

Dichotomous

Yes/No

Stroke

Dichotomous

Yes/No

Epilepsy

Dichotomous

Yes/No‡

BMI

Continous

3 knot spline. Valid range: 8.9 to 47.2 (Female), 8.6 to 43.7 (Male)

* Age interaction included for all variables exept immigrant, fraction of time in Canada, and ethnicity † Excluded in the male model, remains in the female model ‡ Excluded in the female model, remains in the male model

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Manuel D, e. a. (2012). Predictive risk algorithms in a population setting: an overview. *Journal of Epidemiology & Community Health*, 66(10):859–865.

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