World Health Organization
REGIONAL OFFICE FOR Europe

NCDprime

Modelling the impact of national policies on noncommunicable disease (NCD) mortality using PRIME: a policy scenario modelling tool

Address requests about publications of the WHO Regional Office for Europe to:

Publications

WHO Regional Office for Europe

UN City, Marmorvej 51

DK-2100 Copenhagen Ø, Denmark

Alternatively, complete an online request form for documentation, health information, or for permission to quote or translate, on the Regional Office website:

http://www.euro.who.int/pubrequest

KEYWORDS

Noncommunicable diseases
Smoking
Modelling
Alcohol
Policy impact
Physical inactivity
Cardiovascular disease
Salt
Cancer
Obesity
Diabetes
Diet

CONTENTS

FOREWORD

The **World Health Organization** (WHO) has **nine voluntary global targets** for noncommunicable diseases (NCDs). Sustainable Development Goal (SDG) 3.4 aims to achieve, by 2030, a **reduction of one third in premature mortality from NCDs** through prevention and treatment and to promote mental health and well-being. Member States are choosing policy options recommended by WHO to achieve these targets. Based on the national context of states, the impact of these interventions differs from country to country. Scientific figures generated using local data help policy-makers to prioritize implementation of national interventions.

The **Preventable Risk Integrated ModEl** (PRIME) is an openly available NCD scenario model which **helps to estimate the impact of changes in NCD risk factors on NCD mortality**. We hope this model will be helpful to Member States, as they undertake the challenge of achieving SDG 3.4, in designing interventions, setting national targets, and estimating the impact of policy interventions. The WHO Regional Office for Europe will work with countries to use this manual and provide further technical support.

João Breda, Head, WHO European Office for the Prevention and Control of Noncommunicable Diseases, Division of Noncommunicable Diseases and Promoting Health through the Life-course, WHO Regional Office for Europe

Bente Mikkelsen, Director, Division of Noncommunicable Diseases and Promoting Health through the Life-course, WHO Regional Office for Europe

ACKNOWLEDGEMENTS

This manual was prepared by the WHO European Office for the Prevention and Control of Noncommunicable Diseases (NCD Office) in Moscow, Russian Federation.

WHO acknowledges the generous contribution of Professor Peter Scarborough (WHO Collaborating Centre on Population Approaches for NCD Prevention at the University of Oxford, United Kingdom) and his team, who developed the PRIME model as an open-source tool and made it available through the WHO Regional Office for Europe to share with Member States and stakeholders.

The WHO Regional Office would like to acknowledge the expert groups involved in piloting the use of the PRIME manual in the Russian Federation, Portugal and Turkey. We are grateful to Luke Allen, who drafted the PRIME manual, and intern Bianca Løge (WHO European Office for the Prevention and Control of NCDs).

This manual was developed under the guidance of Kremlin Wickramasinghe and João Breda (Head, WHO European Office for the Prevention and Control of NCDs). Further guidance was provided by Bente Mikkelsen (Director, Division of Noncommunicable Diseases and Promoting Health through the Life-course).

ABBREVIATIONS

BMI	body mass index
CI	confidence interval
MC analysis	Monte Carlo analysis
MET	metabolic equivalent (of task)
MUFA	monounsaturated fatty acid
MVPA	moderate/vigorous physical activity
NCD	noncommunicable disease
PRIME	Preventable Risk Integrated ModEl
PUFA	polyunsaturated fatty acid
RR	risk ratio
SD	standard deviation
SDG	Sustainable Development Goal
WHO	World Health Organization

EXECUTIVE SUMMARY

Reductions in modifiable noncommunicable disease (NCD) risk factors are likely to decrease NCD-related deaths. The Preventable Risk Integrated ModEl (PRIME), an openly available NCD scenario model, uses age/sex, diet and behavioural risk factor data and a population's NCD mortality rates to estimate the impact of counterfactual changes in NCD risk factors on annual deaths from NCDs.

This manual outlines specific instructions for inputting baseline values (your country's current data) **and counterfactual values** (from hypothetical national policy interventions) **into PRIME's Excel sheets.** Online sources to acquire population and mortality values are suggested to complete the input data set.

The hypothetical NCD-related mortality rate is automatically computed using the inputted data to estimate the number of averted or delayed deaths. This is useful as it determines the impact of a national policy to change NCD risk factors on NCD-related deaths. This could be used to estimate the likely impact of one or more policy options considered to address multiple NCD risk factors and to prioritize them based on the number of deaths averted.

OVERVIEW

What is PRIME?

PRIME is an Excel-based modelling tool for estimating the impact of population-level changes in NCD risk factors on annual deaths from NCDs. It is developed by researchers at WHO Collaborating Centre on Population Approaches for NCD Prevention, Nuffield Department of Population Health, University of Oxford.

How to use PRIME?

3

The operator needs to input three sets of data and is then able to create a counterfactual scenario by modifying the demographic distribution of one or more risk factors. PRIME computes the impact of these changes on NCD mortality rates, i.e. how many deaths would have been averted or delayed. The three sets of data are:

age and sex distribution of the population

NCD mortality rates for a given year

smoking status
alcohol consumption
physical activity
diet

How does PRIME work?

The values determining changes in mortality for a given NCD risk factor have been derived from peer-reviewed meta-analyses. A full description of the model, the statistical underpinnings, and meta-analyses that inform assumptions can be found in this review article[1]. An example of Portugal using PRIME to model a change in dietary risk factors can be found here[2].

PRIME IN ACTION

Investigators in country X are concerned by the high rates of lung cancer. They believe that introducing **a new tobacco tax would reduce smoking prevalence by 10%** and want to find out how many lives the policy would save.

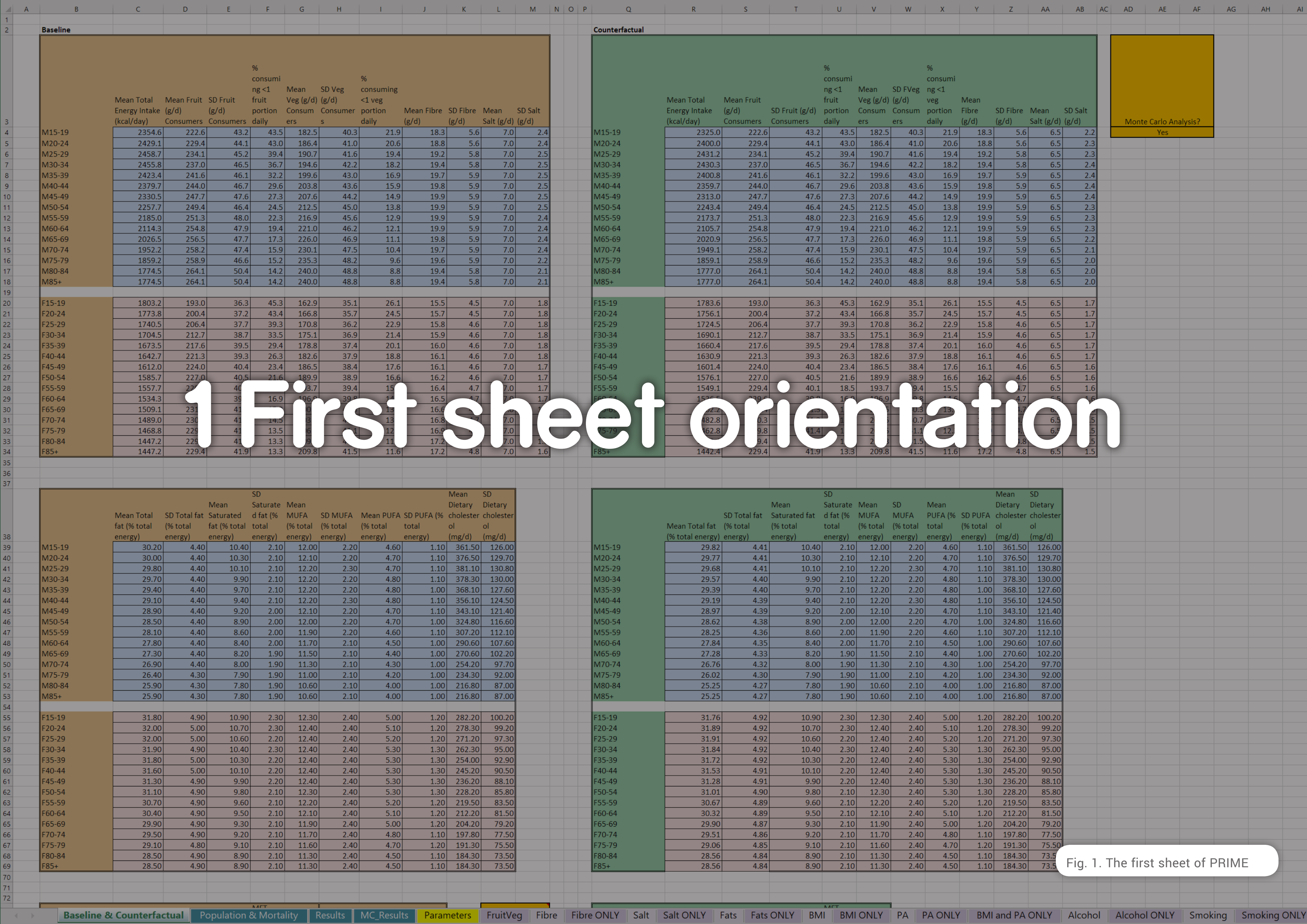
They **use PRIME to model the impact of reducing smoking prevalence by 10%**. After inputting details of their population distribution, current NCD mortality rates, and current smoking rates from national survey data, the investigators set up a counterfactual scenario in which smoking prevalence falls by 10%.

PRIME estimates that **10 000 lives would be saved every year**.

1 Scarborough P, Harrington RA, Mizdrak A, Zhou LM, Doherty A. The Preventable Risk Integrated ModEl and its use to estimate the health impact of public health policy scenarios. Scientifica. 2014;2014:748750.
2 Goiana-da-Silva F, Cruz-e-Silva D, Allen L, Gregorio MJ, Severo M, Nogueira PJ et al. Modelling impacts of food industry co-regulation on noncommunicable disease mortality, Portugal. Bull World Health Organ. BLT.18.220566.


Walkthrough
Baseline
Counterfactual

1 First sheet orientation



Baseline

	Mean Total Energy Intake (kcal/day)	Mean Fruit (g/d) Consumers	SD Fruit (g/d) Consumers	% consuming <1 fruit portion daily	Mean Veg (g/d) Consumers	SD Veg (g/d) Consumers	% consuming <1 veg portion daily	Mean Fibre (g/d)	SD Fibre (g/d)	Mean Salt (g/d)	SD Salt (g/d)
M15-19	2354.6	222.6	43.2	43.5	182.5	40.3	21.9	18.3	5.6	7.0	2.4
M20-24	2429.1	229.4	44.1	43.0	186.4	41.0	20.6	18.8	5.6	7.0	2.4
M25-29	2458.7	234.1	45.2	39.4	190.7	41.6	19.4	19.2	5.8	7.0	2.5
M30-34	2455.8	237.0	46.5	36.7	194.6	42.2	18.2	19.4	5.8	7.0	2.5
M35-39	2423.4	241.6	46.1	32.2	199.6	43.0	16.9	19.7	5.9	7.0	2.5
M40-44	2379.7	244.0	46.7	29.6	203.8	43.6	15.9	19.8	5.9	7.0	2.5
M45-49	2330.5	247.7	47.6	27.3	207.6	44.2	14.9	19.9	5.9	7.0	2.5
M50-54	2257.7	249.4	46.4	24.5	212.5	45.0	13.8	19.9	5.9	7.0	2.5
M55-59	2185.0	251.3	48.0	22.3	216.9	45.6	12.9	19.9	5.9	7.0	2.4
M60-64	2114.3	254.8	47.9	19.4	221.0	46.2	12.1	19.9	5.9	7.0	2.4
M65-69	2026.5	256.5	47.7	17.3	226.0	46.9	11.1	19.8	5.9	7.0	2.4
M70-74	1952.2	258.2	47.4	15.9	230.1	47.5	10.4	19.7	5.9	7.0	2.4
M75-79	1859.2	258.9	46.6	15.2	235.3	48.2	9.6	19.6	5.9	7.0	2.2
M80-84	1774.5	264.1	50.4	14.2	240.0	48.8	8.8	19.4	5.8	7.0	2.1
M85+	1774.5	264.1	50.4	14.2	240.0	48.8	8.8	19.4	5.8	7.0	2.1
F15-19	1803.2	193.0	36.3	45.3	162.9	35.1	26.1	15.5	4.5	7.0	1.8
F20-24	1773.8	200.4	37.2	43.4	166.8	35.7	24.5	15.7	4.5	7.0	1.8
F25-29	1740.5	206.4	37.7	39.3	170.8	36.2	22.9	15.8	4.6	7.0	1.8
F30-34	1704.5	212.7	38.7	33.5	175.1	36.9	21.4	15.9	4.6	7.0	1.8
F35-39	1673.5	217.6	39.5	29.4	178.8	37.4	20.1	16.0	4.6	7.0	1.8
F40-44	1642.7	221.3	39.3	26.3	182.6	37.9	18.8	16.1	4.6	7.0	1.8
F45-49	1612.0	224.0	40.4	23.4	186.5	38.4	17.6	16.1	4.6	7.0	1.7
F50-54	1585.7	227.0	40.5	21.6	189.9	38.9	16.6	16.2	4.6	7.0	1.7
F55-59	1557.7	[illegible]	[illegible]	[illegible]	[illegible]	39.4	[illegible]	16.4	4.7	7.0	1.7
F60-64	1534.3	[illegible]	[illegible]	16.9	[illegible]	[illegible]	[illegible]	16.5	[illegible]	[illegible]	1.7
F65-69	1509.1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	16.6	[illegible]	[illegible]	[illegible]
F70-74	1489.0	[illegible]	[illegible]	14.5	[illegible]	[illegible]	[illegible]	16.8	[illegible]	7.0	[illegible]
F75-79	1468.8	[illegible]	[illegible]	13.5	[illegible]	[illegible]	[illegible]	16.9	[illegible]	7.0	[illegible]
F80-84	1447.2	[illegible]	[illegible]	13.3	[illegible]	[illegible]	[illegible]	17.2	[illegible]	7.0	[illegible]
F85+	1447.2	229.4	41.9	13.3	209.8	41.5	11.6	17.2	4.8	7.0	1.6

Counterfactual

	Mean Total Energy Intake (kcal/day)	Mean Fruit (g/d) Consumers	SD Fruit (g/d) Consumers	% consuming <1 fruit portion daily	Mean Veg (g/d) Consumers	SD FVeg (g/d) Consumers	% consuming <1 veg portion daily	Mean Fibre (g/d)	SD Fibre (g/d)	Mean Salt (g/d)	SD Salt (g/d)
M15-19	2325.0	222.6	43.2	43.5	182.5	40.3	21.9	18.3	5.6	6.5	2.2
M20-24	2400.0	229.4	44.1	43.0	186.4	41.0	20.6	18.8	5.6	6.5	2.3
M25-29	2431.2	234.1	45.2	39.4	190.7	41.6	19.4	19.2	5.8	6.5	2.3
M30-34	2430.3	237.0	46.5	36.7	194.6	42.2	18.2	19.4	5.8	6.5	2.4
M35-39	2400.8	241.6	46.1	32.2	199.6	43.0	16.9	19.7	5.9	6.5	2.4
M40-44	2359.7	244.0	46.7	29.6	203.8	43.6	15.9	19.8	5.9	6.5	2.4
M45-49	2313.0	247.7	47.6	27.3	207.6	44.2	14.9	19.9	5.9	6.5	2.4
M50-54	2243.4	249.4	46.4	24.5	212.5	45.0	13.8	19.9	5.9	6.5	2.3
M55-59	2173.7	251.3	48.0	22.3	216.9	45.6	12.9	19.9	5.9	6.5	2.3
M60-64	2105.7	254.8	47.9	19.4	221.0	46.2	12.1	19.9	5.9	6.5	2.3
M65-69	2020.9	256.5	47.7	17.3	226.0	46.9	11.1	19.8	5.9	6.5	2.2
M70-74	1949.1	258.2	47.4	15.9	230.1	47.5	10.4	19.7	5.9	6.5	2.1
M75-79	1859.1	258.9	46.6	15.2	235.3	48.2	9.6	19.6	5.9	6.5	2.0
M80-84	1777.0	264.1	50.4	14.2	240.0	48.8	8.8	19.4	5.8	6.5	2.0
M85+	1777.0	264.1	50.4	14.2	240.0	48.8	8.8	19.4	5.8	6.5	2.0
F15-19	1783.6	193.0	36.3	45.3	162.9	35.1	26.1	15.5	4.5	6.5	1.7
F20-24	1756.1	200.4	37.2	43.4	166.8	35.7	24.5	15.7	4.5	6.5	1.7
F25-29	1724.5	206.4	37.7	39.3	170.8	36.2	22.9	15.8	4.6	6.5	1.7
F30-34	1690.1	212.7	38.7	33.5	175.1	36.9	21.4	15.9	4.6	6.5	1.7
F35-39	1660.4	217.6	39.5	29.4	178.8	37.4	20.1	16.0	4.6	6.5	1.7
F40-44	1630.9	221.3	39.3	26.3	182.6	37.9	18.8	16.1	4.6	6.5	1.7
F45-49	1601.4	224.0	40.4	23.4	186.5	38.4	17.6	16.1	4.6	6.5	1.6
F50-54	1576.1	227.0	40.5	21.6	189.9	38.9	16.6	16.2	4.6	6.5	1.6
F55-59	1549.1	229.4	40.1	18.5	193.7	[illegible]	15.5	[illegible]	[illegible]	6.5	1.6
F60-64	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.7	[illegible]	[illegible]
F65-69	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
F70-74	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6.5	[illegible]
F75-79	[illegible]	[illegible]	41.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
F80-84	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
F85+	1442.4	229.4	41.9	13.3	209.8	41.5	11.6	17.2	4.8	6.5	1.5

Monte Carlo Analysis?
Yes

	Mean Total fat (% total energy)	SD Total fat (% total energy)	Mean Saturated fat (% total energy)	SD Saturated fat (% total energy)	Mean MUFA (% total energy)	SD MUFA (% total energy)	Mean PUFA (% total energy)	SD PUFA (% total energy)	Mean Dietary cholesterol (mg/d)	SD Dietary cholesterol (mg/d)
M15-19	30.20	4.40	10.40	2.10	12.00	2.20	4.60	1.10	361.50	126.00
M20-24	30.00	4.40	10.30	2.10	12.10	2.20	4.70	1.10	376.50	129.70
M25-29	29.80	4.40	10.10	2.10	12.20	2.30	4.70	1.10	381.10	130.80
M30-34	29.70	4.40	9.90	2.10	12.20	2.20	4.80	1.10	378.30	130.00
M35-39	29.40	4.40	9.70	2.10	12.20	2.20	4.80	1.00	368.10	127.60
M40-44	29.10	4.40	9.40	2.10	12.20	2.30	4.80	1.10	356.10	124.50
M45-49	28.90	4.40	9.20	2.00	12.10	2.20	4.70	1.10	343.10	121.40
M50-54	28.50	4.40	8.90	2.00	12.00	2.20	4.70	1.00	324.80	116.60
M55-59	28.10	4.40	8.60	2.00	11.90	2.20	4.60	1.10	307.20	112.10
M60-64	27.80	4.40	8.40	2.00	11.70	2.10	4.50	1.00	290.60	107.60
M65-69	27.30	4.40	8.20	1.90	11.50	2.10	4.40	1.00	270.60	102.20
M70-74	26.90	4.40	8.00	1.90	11.30	2.10	4.30	1.00	254.20	97.70
M75-79	26.40	4.30	7.90	1.90	11.00	2.10	4.20	1.00	234.30	92.00
M80-84	25.90	4.30	7.80	1.90	10.60	2.10	4.00	1.00	216.80	87.00
M85+	25.90	4.30	7.80	1.90	10.60	2.10	4.00	1.00	216.80	87.00
F15-19	31.80	4.90	10.90	2.30	12.30	2.40	5.00	1.20	282.20	100.20
F20-24	32.00	5.00	10.70	2.30	12.40	2.40	5.10	1.20	278.30	99.20
F25-29	32.00	5.00	10.60	2.20	12.40	2.40	5.20	1.20	271.20	97.30
F30-34	31.90	4.90	10.40	2.30	12.40	2.40	5.30	1.30	262.30	95.00
F35-39	31.80	5.00	10.30	2.20	12.40	2.40	5.30	1.30	254.00	92.90
F40-44	31.60	5.00	10.10	2.20	12.40	2.40	5.30	1.30	245.20	90.50
F45-49	31.30	4.90	9.90	2.20	12.40	2.40	5.30	1.30	236.20	88.10
F50-54	31.10	4.90	9.80	2.10	12.30	2.40	5.30	1.30	228.20	85.80
F55-59	30.70	4.90	9.60	2.10	12.20	2.40	5.20	1.20	219.50	83.50
F60-64	30.40	4.90	9.50	2.10	12.10	2.40	5.10	1.20	212.20	81.50
F65-69	29.90	4.90	9.30	2.10	11.90	2.40	5.00	1.20	204.20	79.20
F70-74	29.50	4.90	9.20	2.10	11.70	2.40	4.80	1.10	197.80	77.50
F75-79	29.10	4.80	9.10	2.10	11.60	2.40	4.70	1.20	191.30	75.50
F80-84	28.50	4.90	8.90	2.10	11.30	2.40	4.50	1.10	184.30	73.50
F85+	28.50	4.90	8.90	2.10	11.30	2.40	4.50	1.10	184.30	73.50

	Mean Total fat (% total energy)	SD Total fat (% total energy)	Mean Saturated fat (% total energy)	SD Saturated fat (% total energy)	Mean MUFA (% total energy)	SD MUFA (% total energy)	Mean PUFA (% total energy)	SD PUFA (% total energy)	Mean Dietary cholesterol (mg/d)	SD Dietary cholesterol (mg/d)
M15-19	29.82	4.41	10.40	2.10	12.00	2.20	4.60	1.10	361.50	126.00
M20-24	29.77	4.41	10.30	2.10	12.10	2.20	4.70	1.10	376.50	129.70
M25-29	29.68	4.41	10.10	2.10	12.20	2.30	4.70	1.10	381.10	130.80
M30-34	29.57	4.40	9.90	2.10	12.20	2.20	4.80	1.10	378.30	130.00
M35-39	29.39	4.40	9.70	2.10	12.20	2.20	4.80	1.00	368.10	127.60
M40-44	29.19	4.39	9.40	2.10	12.20	2.30	4.80	1.10	356.10	124.50
M45-49	28.97	4.39	9.20	2.00	12.10	2.20	4.70	1.10	343.10	121.40
M50-54	28.62	4.38	8.90	2.00	12.00	2.20	4.70	1.00	324.80	116.60
M55-59	28.25	4.36	8.60	2.00	11.90	2.20	4.60	1.10	307.20	112.10
M60-64	27.84	4.35	8.40	2.00	11.70	2.10	4.50	1.00	290.60	107.60
M65-69	27.28	4.33	8.20	1.90	11.50	2.10	4.40	1.00	270.60	102.20
M70-74	26.76	4.32	8.00	1.90	11.30	2.10	4.30	1.00	254.20	97.70
M75-79	26.02	4.30	7.90	1.90	11.00	2.10	4.20	1.00	234.30	92.00
M80-84	25.25	4.27	7.80	1.90	10.60	2.10	4.00	1.00	216.80	87.00
M85+	25.25	4.27	7.80	1.90	10.60	2.10	4.00	1.00	216.80	87.00
F15-19	31.76	4.92	10.90	2.30	12.30	2.40	5.00	1.20	282.20	100.20
F20-24	31.89	4.92	10.70	2.30	12.40	2.40	5.10	1.20	278.30	99.20
F25-29	31.91	4.92	10.60	2.20	12.40	2.40	5.20	1.20	271.20	97.30
F30-34	31.84	4.92	10.40	2.30	12.40	2.40	5.30	1.30	262.30	95.00
F35-39	31.72	4.92	10.30	2.20	12.40	2.40	5.30	1.30	254.00	92.90
F40-44	31.53	4.91	10.10	2.20	12.40	2.40	5.30	1.30	245.20	90.50
F45-49	31.28	4.91	9.90	2.20	12.40	2.40	5.30	1.30	236.20	88.10
F50-54	31.01	4.90	9.80	2.10	12.30	2.40	5.30	1.30	228.20	85.80
F55-59	30.67	4.89	9.60	2.10	12.20	2.40	5.20	1.20	219.50	83.50
F60-64	30.32	4.89	9.50	2.10	12.10	2.40	5.10	1.20	212.20	81.50
F65-69	29.90	4.87	9.30	2.10	11.90	2.40	5.00	1.20	204.20	79.20
F70-74	29.51	4.86	9.20	2.10	11.70	2.40	4.80	1.10	197.80	77.50
F75-79	29.06	4.85	9.10	2.10	11.60	2.40	4.70	1.20	191.30	75.50
F80-84	28.56	4.84	8.90	2.10	11.30	2.40	4.50	1.10	184.30	[illegible]
F85+	28.56	4.84	8.90	2.10	11.30	2.40	4.50	1.10	184.30	[illegible]

Fig. 1. The first sheet of PRIME

Double-click on the PRIME Excel file icon to open the spreadsheet (Fig. 2). The first sheet of the spreadsheet is depicted in Fig. 1.

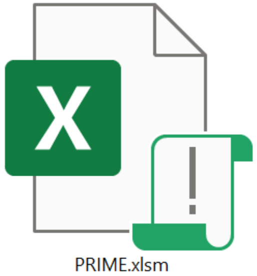


Fig. 2 The PRIME file icon

PRIME is a spreadsheet built in Microsoft Excel. It extends over 22 sheets, the first of which is entitled **Baseline & Counterfactual**, the last **Notes**. Only the first three sheets are actually used by the operator – the other 19 sheets are there to show how the model operates, e.g. underlying formulae, assumptions and confidence intervals. This guide works best if you have the spreadsheet open in front of you so that you can click along with the walkthrough.

Fig. 3 shows the main elements on the first sheet. The first tab is selected. The orange tables on the left of the screen are where the operator enters data on the current (baseline) national distribution of NCD risk factors. From top to bottom, they cover diet, physical activity, BMI, alcohol and smoking. Scroll down to view the lower tables.

The column headings show which input data are required, e.g. mean fibre g/day. The rows are divided into male (blue) and female (pink) and into 5-year age bands. For example, cell J10 (column J, row 10) requires information on how much fibre is consumed per day by males aged 45–49 years. As another example, cell D20 requires information on how much fruit (in grams per day) is consumed by females aged 15–19 years. Cells on subsequent tables may require population information – for example, cell H125 requires information on the proportion of females aged 15–19 years that are current smokers. You may notice that the values in the green counterfactual tables are identical; we will come to this later (Section 3.1 below).

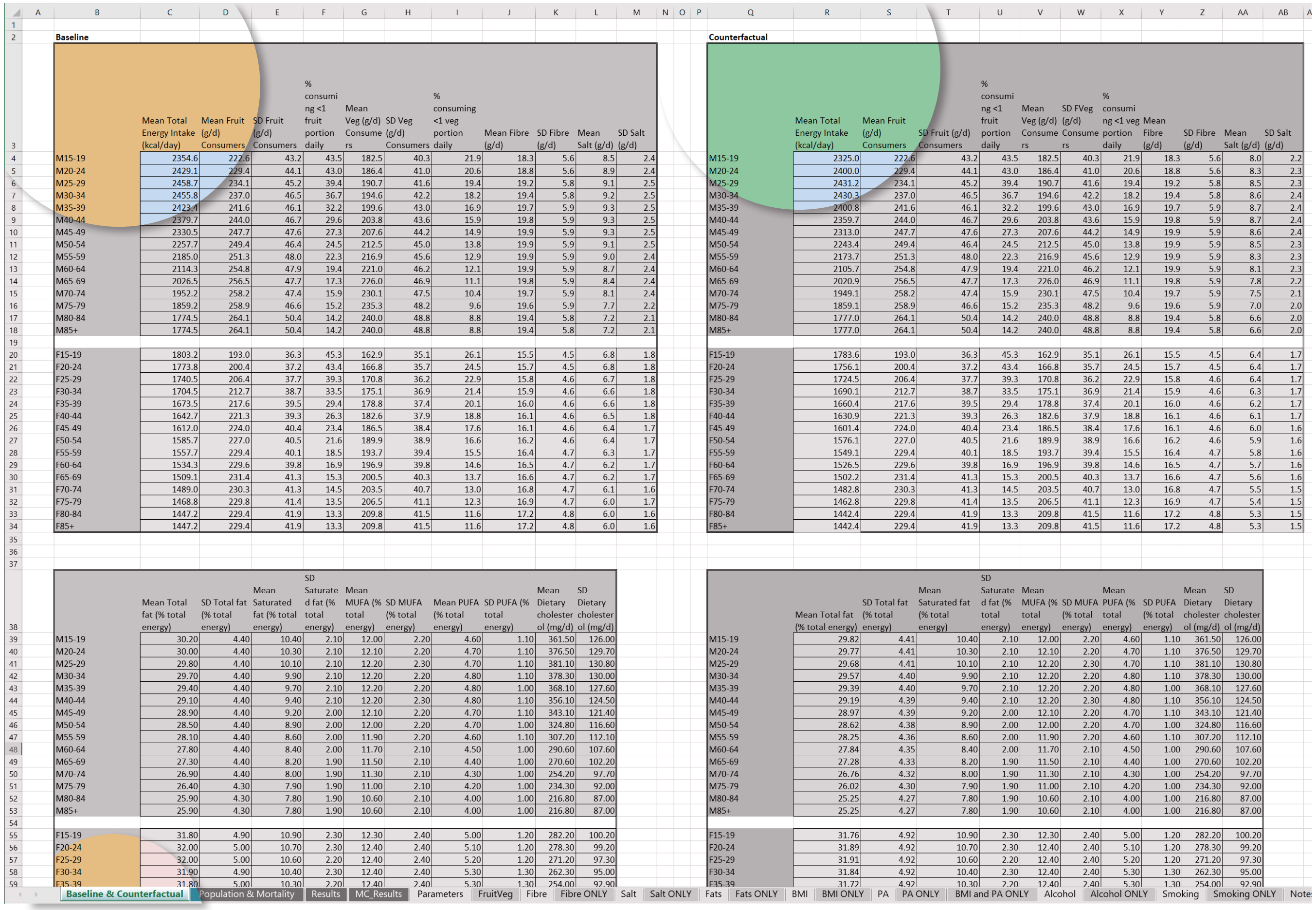


Fig. 3. Selecting the first sheet and locating the baseline and counterfactual tables

2 Inputting baseline risk factor data

Baseline

	Mean Total Energy Intake (kcal/day)	Mean Fruit (g/d) Consumers	SD Fruit (g/d) Consumers	% consuming <1 fruit portion daily	Mean Veg (g/d) Consumers	SD Veg (g/d) Consumers	% consuming <1 veg portion daily	Mean Fibre (g/d)	SD Fibre (g/d)	Mean Salt (g/d)	SD Salt (g/d)
M15-19	2354.6	222.6	43.2	43.5	182.5	40.3	21.9	18.3	5.6	8.5	2.4
M20-24	2429.1	229.4	44.1	43.0	186.4	41.0	20.6	18.8	5.6	8.9	2.4
M25-29	2458.7	234.1	45.2	39.4	190.7	41.6	19.4	19.2	5.8	9.1	2.5
M30-34	2455.8	237.0	46.5	36.7	194.6	42.2	18.2	19.4	5.8	9.2	2.5
M35-39	2423.4	241.6	46.1	32.2	199.6	43.0	16.9	19.7	5.9	9.3	2.5
M40-44	[illegible]	[illegible]	46.7	[illegible]	[illegible]	43.6	[illegible]	19.8	5.9	[illegible]	2.5
M45-49	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
M50-54	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
M55-59	[illegible]	[illegible]	48.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
M60-64	2114.3	254.8	47.9	19.4	221.0	46.2	12.1	19.9	5.9	8.7	2.4
M65-69	2026.5	256.5	[illegible]	[illegible]	226.0	[illegible]	11.1	[illegible]	5.9	8.4	2.4
M70-74	1952.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.4
M75-79	1859.2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.2
M80-84	1774.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.1
M85+	1774.5	264.1	50.4	14.2	240.0	48.8	8.8	19.4	5.8	7.2	2.1
F15-19	1803.2	193.0	36.3	45.3	162.9	35.1	26.1	15.5	4.5	6.8	1.8
F20-24	1773.8	200.4	37.2	43.4	166.8	35.7	24.5	15.7	4.5	6.8	1.8
F25-29	1740.5	206.4	37.7	39.3	170.8	36.2	22.9	15.8	4.6	6.7	1.8
F30-34	1704.5	212.7	38.7	33.5	175.1	36.9	21.4	15.9	4.6	6.6	1.8
F35-39	1673.5	217.6	39.5	29.4	178.8	37.4	20.1	16.0	4.6	6.6	1.8
F40-44	1642.7	221.3	39.3	26.3	182.6	37.9	18.8	16.1	4.6	6.5	1.8
F45-49	1612.0	224.0	40.4	23.4	186.5	38.4	17.6	16.1	4.6	6.4	1.7
F50-54	1585.7	227.0	40.5	21.6	189.9	38.9	16.6	16.2	4.6	6.4	1.7
F55-59	1557.7	229.4	40.1	18.5	193.7	39.4	15.5	16.4	4.7	6.3	1.7
F60-64	1534.3	229.6	39.8	16.9	196.9	39.8	14.6	16.5	4.7	6.2	1.7
F65-69	1509.1	231.4	41.3	15.3	200.5	40.3	13.7	16.6	4.7	6.2	1.7
F70-74	1489.0	230.3	41.3	14.5	203.5	40.7	13.0	16.8	4.7	6.1	1.6
F75-79	1468.8	229.8	41.4	13.5	206.5	41.1	12.3	16.9	4.7	6.0	1.7
F80-84	1447.2	229.4	41.9	13.3	209.8	41.5	11.6	17.2	4.8	6.0	1.6
F85+	1447.2	229.4	41.9	13.3	209.8	41.5	11.6	17.2	4.8	6.0	1.6

SD

Counterfactual

	Mean Tota Energy Inta (kcal/day)
M15-19	2
M20-24	2
M25-29	2
M30-34	2
M35-39	2
M40-44	2
M45-49	2
M50-54	2
M55-59	2
M60-64	2
M65-69	2
M70-74	1
M75-79	1
M80-84	1
M85+	1
F15-19	1
F20-24	1
F25-29	1
F30-34	1
F35-39	1
F40-44	1
F45-49	1
F50-54	1
F55-59	1
F60-64	1
F65-69	1
F70-74	1
F75-79	1
F80-84	1
F85+	1

Baseline & Counterfactual | Population & Mortality | Results | MC_Results | Parameters | FruitVeg | Fibre | Fibre ONLY | Salt | Salt ONLY | Fats | Fats ONLY | BMI | BMI ONLY | PA | PA ONLY | BMI and PA ONLY | Alcohol | Alcohol ONLY | Smoking | Smoking ONLY

2.1 GENERAL PRINCIPLES

You should only ever input data in the cells that are coloured pink or blue. Do not alter the column or row headings (i.e. values in cells coloured orange or green). You will notice that the cells coloured blue or pink in the tables illustrated here are already filled with values; for instance, J10 has the value 15.5, while D20 has 188.6. These are example data that you will replace with the values from your own country.

You only have to change values for the risk factor that you are interested in. For instance, if you are only addressing tobacco use, then once you have inputted your national tobacco data in the baseline data table, you can leave the rest of the example values in place (diet, physical activity, BMI, alcohol). This also holds true within the diet table: if you are only interested in, say, fruit and salt, then you do not need to input data for every other subcategory (vegetables, fibre, total fat, saturated fat, MUFAs, PUFAs, cholesterol). This is possible because the model works by comparing the baseline value for each cell with the corresponding value in the counterfactual scenario. The model "ignores" any risk factor where there has been no change between baseline and counterfactual values. The spreadsheet is set up so that the baseline and counterfactual scenarios are identical.

2.1.1 Standard deviation values

Standard deviation (SD) is a mathematical measure of the spread of values around the mean. It provides PRIME with information on the population distribution of the risk factors and has a direct bearing on mortality rates. You may struggle to find the SD around means for some risk factors; however, it is possible to work out the SD from other values that are commonly available, including standard error and confidence intervals. If you absolutely cannot obtain SD values, then leave the example values in place. Note that your results will be seriously flawed.

2.1.2 Age banding

The rows are divided into 5-year age bands. You may not be able to find data that provide this level of granularity. For example, you may have data on the proportion of low alcohol consumers (cell C108) only for men aged below 50 years and above 50 years. Let's imagine that 30% of men below 50 are low consumers and 70% of men above 50 are low consumers. Enter "30" into cells C109 to C115, and "70" into C116 to C123, as shown in Fig. 4.

	Q	R	S	T
108	Alcohol consumption (	% low alcohol consumers (<1g/d)	Mean alcohol consumption (g/d), drinkers	SD alcohol consumption (g/d), drinkers
109	M15-19	30.00	10.00	10.48
110	M20-24	30.00	10.00	10.48
111	M25-29	30.00	10.00	10.48
112	M30-34:	30.00	10.00	10.48
113	M35-39	30.00	10.00	10.48
114	M40-44	30.00	10.00	10.48
115	M45-49	30.00	10.00	10.48
116	M50-54	70.00	10.00	10.48
117	M55-59	70.00	10.00	10.48
118	M60-64	70.00	10.00	10.48
119	M65-69	70.00	10.00	10.48
120	M70-74	70.00	10.00	10.48
121	M75-79	70.00	10.00	10.48
122	M80-84	70.00	10.00	10.48
123	M85+	70.00	10.00	10.48

Fig. 4. Example of inputting data with only two age bandings

If you don't have any age bandings at all, simply enter the same value in each age band. This is already the case for "Mean alcohol consumption (g/d)" among men in Fig. 4: in every age category the cell value has been set to 10 g ethanol per day.

2.2 SPECIFIC RISK FACTOR INPUTS

This section details the exact data that are required for each column. As previously noted, you only have to add new values for the risk factors of interest. If your focus is the impact of reducing salt consumption, then you can leave the cells for tobacco, alcohol, physical activity, fruit, vegetables, fibre, and fat completely untouched.

2.2.1 Diet

Fig. 5 shows the first baseline table, containing example data for the following dietary elements: energy (calories), fruit, vegetables, fibre and salt.

Calories

C3 Mean total energy intake (kcal/d)

Enter the total number of kilocalories (kcal) consumed by each age group per day into the cells of column C. The example data are set at 2000 kcal per day for all males and females. Note that policies that reduce sugar consumption will be mediated through calorie reduction.

Fruit

D3 Mean fruit (g/d) consumers
E3 SD fruit (g/d) consumers
F3 % consuming <1 fruit portion daily

Fruit consumption is not normally distributed around the mean because there is often a subsection of the population that does not eat any fruit at all. As a result, the fruit subcategory requires three pieces of information:

(1) the amount of fruit consumed daily by those people who do eat fruit (mean g/day among consumers) in column D (note that this is not the population average);

(2) the SD around the mean (the values in column D) for those who eat fruit, entered in column E; and

(3) the percentage of the total population that does not consume any fruit (characterized as <1 portion per day), entered as a whole number (10% should be entered as "10.0") in column F (one portion is 106 g).

Salt

L3 Mean salt (g/d)
M3 SD salt (g/d)

As with fibre, it is hard to avoid consuming any salt on a daily basis. Enter the mean daily intake of salt (g/d) for the population in column L and the SD for these values in column M.

Vegetables

G3 Mean veg (g/d) consumers
H3 SD veg (g/d) consumers
I3 % consuming <1 veg portion daily

As with fruit, so with vegetables; the mean daily intake of vegetables (g/d) and the SD refer only to those consuming at least one portion per day. The proportion of the population not consuming any vegetables (characterized as "<1 portion") is captured in column I.

Fibre

J3 Mean fibre (g/d)
K3 SD fibre (g/d)

Unlike fruit and vegetables, it is difficult to avoid consuming fibre because small amounts exist in many different products. As such, there is a more normal distribution of intake and the model assumes that the percentage of the population consuming no fibre per day is zero.

Enter the mean daily intake of fibre (g/d) for the population in column J and the SD around this mean for each age group in column K.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1													
2		Baseline											
3			Mean Total Energy Intake (kcal/day)	Mean Fruit (g/d) Consumers	SD Fruit (g/d) Consumers	% consuming <1 fruit portion daily	Mean Veg (g/d) Consumers	SD Veg (g/d) Consumers	% consuming <1 veg portion daily	Mean Fibre (g/d)	SD Fibre (g/d)	Mean Salt (g/d)	SD Salt (g/d)
4		M15-19	2354.6	222.6	43.2	43.5	182.5	40.3	21.9	18.3	5.6	8.5	2.
5		M20-24	2429.1	229.4	44.1	43.0	186.4	41.0	20.6	18.8	5.6	8.9	2.
6		M25-29	2458.7	234.1	45.2	39.4	190.7	41.6	19.4	19.2	5.8	9.1	2.
7		M30-34	2455.8	237.0	46.5	36.7	194.6	42.2	18.2	19.4	5.8	9.2	2.
8		M35-39	2423.4	241.6	46.1	32.2	199.6	43.0	16.9	19.7	5.9	9.3	2.
9		M40-44	2379.7	244.0	46.7	29.6	203.8	43.6	15.9	19.8	5.9	9.3	2.
10		M45-49	2330.5	247.7	47.6	27.3	207.6	44.2	14.9	19.9	5.9	9.3	2.

Fig. 5. First baseline table, with example data for energy, fruit, vegetables, fibre and salt

Fig. 6 shows the baseline table containing example data for various kinds of fat.

Total fat

C38 Mean total fat (% total energy)

D38 SD total fat (% total energy)

In column C, enter the proportion of total energy intake that comes from fat for each age group. This should be a percentage – for instance, the example data show that fat constitutes 37.3% of total energy intake for the example baseline population. Then enter the SD around the mean for each age group in column D.

Saturated fat

E38 Mean saturated fat (% total energy)

F38 SD saturated fat (% total energy)

In column E, enter the proportion of total energy intake that comes from saturated fat for each age group. This should be a percentage – for instance, the example data show that fat constitutes 14.1% of total energy intake for the example baseline population. The value should be smaller than the mean total fat value in column C. Then enter the SD around the mean for each age group in column F.

Monounsaturated fatty acids (MUFAs)

G38 Mean MUFA (% total energy)

H38 SD MUFA (% total energy)

In column G, enter the proportion of total energy intake that comes from MUFAs for each age group. This should be a percentage – for instance, the example data show that MUFAs constitute 13.7% of total energy intake for the example baseline population. The value should be smaller than the mean total fat value in column C. Then enter the SD around the mean for each age group in column H.

Polyunsaturated fatty acids (PUFAs)

I38 Mean PUFA (% total energy)

J38 SD PUFA (% total energy)

In column I, enter the proportion of total energy intake that comes from PUFAs for each age group. This should be a percentage – for instance, the example data show that PUFAs constitute 6.8% of total energy intake for the example baseline population. The value should be smaller than the mean total fat value in column C. Then enter the SD around the mean for each age group in column J.

Cholesterol

K38 Mean dietary cholesterol (mg/d)

L38 SD dietary cholesterol (mg/d)

In column K, enter the total amount of cholesterol consumed per day in milligrams (mg) for each age group. Then enter the SD around the mean for each age group in column L. The example data show (unrealistic) values of 0 mg/day for all males and females.

38		Mean Total fat (% total energy)	SD Total fat (% total energy)	Mean Saturated fat (% total energy)	SD Saturated fat (% total energy)	Mean MUFA (% total energy)	SD MUFA (% total energy)	Mean PUFA (% total energy)	SD PUFA (% total energy)	Mean Dietary cholesterol (mg/d)	SD Dietary cholesterol (mg/d
39	M15-19	30.20	4.40	10.40	2.10	12.00	2.20	4.60	1.10	361.50	126.0
40	M20-24	30.00	4.40	10.30	2.10	12.10	2.20	4.70	1.10	376.50	129.7
41	M25-29	29.80	4.40	10.10	2.10	12.20	2.30	4.70	1.10	381.10	130.8
42	M30-34	29.70	4.40	9.90	2.10	12.20	2.20	4.80	1.10	378.30	130.0
43	M35-39	29.40	4.40	9.70	2.10	12.20	2.20	4.80	1.00	368.10	127.6
44	M40-44	29.10	4.40	9.40	2.10	12.20	2.30	4.80	1.10	356.10	124.5
45	M45-49	28.90	4.40	9.20	2.00	12.10	2.20	4.70	1.10	343.10	121.4
46	M50-54	28.50	4.40	8.90	2.00	12.00	2.20	4.70	1.00	324.80	116.6
47	M55-59	28.10	4.40	8.60	2.00	11.90	2.20	4.60	1.10	307.20	112.1

Fig. 6. Baseline fat table, with example data

2.2.2 Physical activity and energy balance

Fig. 7 shows the baseline table containing example data for physical activity and BMI.

Physical activity

C73 Mean MET hrs/wk in active pop
D73 SD MET hrs/wk in active pop
E73 % sedentary
F73 MET value for non-MVPA time
G73 MET value for MVPA time

This section is based on metabolic equivalent (MET) hours. One MET is the energy cost of sitting quietly; this is an approximation of basal metabolic rate roughly equivalent to 1 kcal/kg/hour. Moderate activity is commonly defined as expending 3–6 times as much energy as would be used when sitting quietly (3–6 METs); vigorous activity as more than six times as much energy as would be used when sitting quietly (>6 METs). The same activity requires different energy expenditures for different groups; for example, climbing two flights of stairs is easier for 15–19-year-olds than it is for 80–84-year-olds.

The first step in this section is to enter in column E the proportion of each age group that is sedentary. There is no consistent definition of "sedentary" in the literature, so use the data you feel are most appropriate and make your choices explicit when you present your workings. In the example data, this value is set to 0% for each age group in both sexes.

Next enter in column C the mean number of METs expended per week by the non-sedentary population for each age group (note that this is not the same as mean METs for the entire population, unless the prevalence of sedentary is 0). In column D, enter the SDs for the values in column C. The example values are preset to 30 METs per week for all groups, with an SD of 35.

Not all non-active time is spent sitting quietly; it involves sleeping, eating, walking, etc. The average MET value for this time is likely to be higher than 1, especially for younger groups. Column F requires an estimation of the energy expenditure for this non-MVPA (non-moderate/vigorous physical activity) time for each age group. The example value is 1.1 for each age group. The model creators strongly recommend using a value of 1.5 unless you have country-specific data.

The model creators also recommend setting the MVPA (moderate/vigorous physical activity) time value at 4.5 for all groups (column G).

Body mass index (BMI)

H73 Mean height (m)
I73 Mean BMI
J73 SD BMI

Enter mean height in metres (m) for each age group into column H; the mean BMI in column I; and the SD for these values in column J. In the example data everyone has a height of 1.78 m and a BMI of 20, with an SD of 5 for every mean.

	B	C	D	E	F	G	H	I	J
73	Physical Activity (hrs/week) and Energy Balance	Mean METhrs/wk in active pop	SD METhrs/wk in active pop	% sedentary	MET value for non-MVPA time	MET value for MVPA time	Mean height (m)	Mean BMI	SD BMI
74	M15-19	30.71	4.18	22.81	1.00	5.70	1.74	22.44	4.29
75	M20-24	30.19	4.73	34.48	1.00	5.19	1.77	23.51	3.23
76	M25-29	30.42	5.13	19.39	1.00	5.28	1.76	24.22	3.65
77	M30-34:	32.16	5.93	26.58	1.00	5.43	1.75	26.67	3.90
78	M35-39	32.12	6.39	41.22	1.00	4.92	1.75	26.92	4.07
79	M40-44	31.40	5.77	44.90	1.00	4.85	1.73	26.75	4.03
80	M45-49	30.47	5.10	54.35	1.00	4.47	1.73	28.53	4.70
81	M50-54	31.29	6.05	44.79	1.00	4.51	1.69	27.58	4.17
82	M55-59	29.62	4.95	40.16	1.00	4.36	1.69	27.94	4.17
83	M60-64	29.47	5.07	44.11	1.00	4.18	1.68	28.04	4.02
84	M65-69	28.89	3.98	45.84	1.00	4.20	1.67	28.54	3.91
85	M70-74	28.38	3.71	46.35	1.00	4.09	1.66	29.55	4.55
86	M75-79	28.43	3.87	45.98	1.00	4.05	1.66	28.45	3.89
87	M80-84	27.96	3.07	56.10	1.00	4.00	1.64	27.59	4.11
88	M85+	27.96	3.07	56.10	1.00	4.00	1.64	27.59	4.11
89									
90	F15-19	28.79	3.12	39.14	1.00	5.04	1.61	22.37	3.34
91	F20-24	28.59	3.82	51.61	1.00	4.42	1.62	23.21	4.20
92	F25-29	29.74	4.38	39.82	1.00	4.67	1.61	24.13	3.94
93	F30-34	29.99	4.24	50.37	1.00	4.39	1.61	24.95	4.00
94	F35-39	30.04	4.61	40.98	1.00	4.40	1.61	25.77	4.33
95	F40-44	30.05	4.12	47.07	1.00	4.09	1.59	26.85	5.44
96	F45-49	29.30	4.21	47.30	1.00	4.09	1.59	28.13	5.68
97	F50-54	29.41	4.54	43.64	1.00	4.00	1.57	27.91	4.79
98	F55-59	29.58	4.23	39.14	1.00	3.93	1.56	29.39	6.20
99	F60-64	29.74	4.81	33.80	1.00	4.04	1.55	30.32	5.42
100	F65-69	29.03	3.82	51.85	1.00	4.02	1.55	29.44	4.77
101	F70-74	28.19	3.37	32.11	1.00	3.95	1.53	30.30	4.54
102	F75-79	27.43	2.81	62.66	1.00	3.84	1.52	29.71	4.26
103	F80-84	27.46	2.91	53.26	1.00	3.60	1.52	25.46	5.56
104	F85+	27.46	2.91	53.26	1.00	3.60	1.52	25.46	5.56

Fig. 7. Baseline table for physical activity and BMI, with example data

2.2.3 Alcohol and tobacco

Fig. 8 shows the baseline tables containing example data for alcohol and tobacco.

Alcohol

C108 % low alcohol consumers (<1g/d)

D108 Mean alcohol consumption (g/d), drinkers

E108 SD alcohol consumption (g/d), drinkers

As in the case of fruit and vegetables, all countries have non-trivial segments of the population that do not consume any alcohol. In column C, enter the proportion of the population that does not drink alcohol (characterized as consuming <1 g ethanol per day). In the example data, 20% of males and females are classified as "low alcohol consumers". In column D, enter the mean daily intake of ethanol (g/d) by drinkers (note that this is drinkers, not the entire population). In the example data, this value is set at 10 g per day for all ages. In column E, enter the SD for the values in column D.

Tobacco

H108 Never smoked

I108 Former smokers

J108 Current smokers

In column H, enter the prevalence of those who have never smoked for each age band as a decimal (the example value is set to 0.5 for all ages, i.e. 50%). In column I, enter the proportion of former smokers, and in column J the proportion of current smokers (any current tobacco use). For any given row, the sum of the values in columns H, I and J should equal 1.0 (i.e 100%).

	B	C	D	E	F	G	H	I	J
108	Alcohol consumption	% low alcohol consumers (<1g/d)	Mean alcohol consumption (g/d), drinkers	SD alcohol consumption (g/d), drinkers		Smoking prevalence (%)	Never smoked	Former smokers	Current smokers
109	M15-19	69.30	2.91	0.48		M15-19	70.16	14.03	15.81
110	M20-24	52.50	5.04	0.86		M20-24	44.67	29.13	26.20
111	M25-29	35.20	8.50	1.55		M25-29	29.21	24.02	46.77
112	M30-34:	22.90	13.68	2.61		M30-34:	30.97	30.98	38.05
113	M35-39	11.40	23.97	4.63		M35-39	34.17	25.77	40.06
114	M40-44	6.30	34.45	6.80		M40-44	36.14	37.05	26.81
115	M45-49	3.80	47.45	9.54		M45-49	19.12	51.51	29.37
116	M50-54	2.20	63.37	12.75		M50-54	32.72	35.94	31.34
117	M55-59	1.40	76.23	15.79		M55-59	21.52	48.82	29.65
118	M60-64	1.10	83.65	17.36		M60-64	26.68	55.06	18.26
119	M65-69	1.00	83.24	17.52		M65-69	27.33	60.60	12.07
120	M70-74	1.30	76.02	15.93		M70-74	28.13	60.20	11.67
121	M75-79	2.00	61.69	12.32		M75-79	43.60	51.43	4.98
122	M80-84	3.30	42.79	8.81		M80-84	48.58	49.22	2.21
123	M85+	3.30	42.79	8.81		M85+	48.58	49.22	2.21
124									
125	F15-19	84.10	1.99	0.22		F15-19	73.11	13.00	13.89
126	F20-24	78.50	2.81	0.30		F20-24	63.66	14.67	21.68
127	F25-29	73.00	4.04	0.37		F25-29	48.05	26.85	25.10
128	F30-34	66.80	5.76	0.52		F30-34	53.29	30.92	15.80
129	F35-39	61.30	7.49	0.67		F35-39	51.84	26.83	21.33
130	F40-44	56.70	9.85	0.89		F40-44	56.03	21.89	22.08
131	F45-49	53.10	11.30	1.04		F45-49	57.35	20.78	21.86
132	F50-54	50.90	13.06	1.19		F50-54	57.84	17.90	24.26
133	F55-59	50.40	14.28	1.26		F55-59	61.93	22.74	15.33
134	F60-64	50.70	14.56	1.33		F60-64	83.12	9.99	6.90
135	F65-69	53.70	13.54	1.26		F65-69	81.89	14.98	3.12
136	F70-74	57.60	12.04	1.11		F70-74	86.73	9.01	4.26
137	F75-79	64.10	8.97	0.82		F75-79	81.93	18.07	0.00
138	F80-84	71.80	6.61	0.59		F80-84	77.30	13.41	9.29
139	F85+	71.80	6.61	0.59		F85+	77.30	13.41	9.29

Fig. 8. Baseline tables for alcohol and tobacco, with example data

3 Setting up the counterfactual scenario

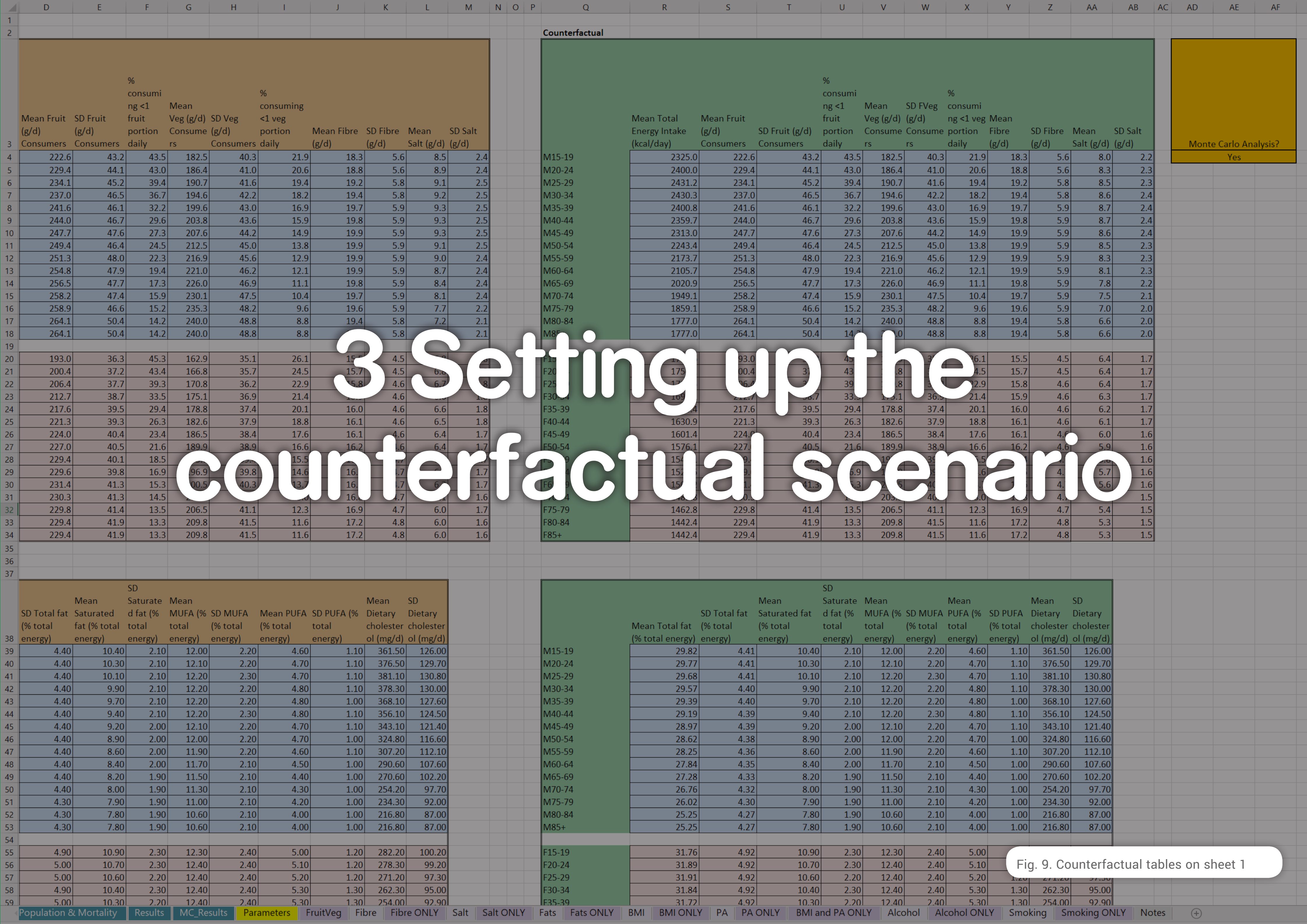


Fig. 9. Counterfactual tables on sheet 1

3.1 POPULATING THE GREEN COUNTERFACTUAL TABLES

Once the baseline data have been added, **the next stage is to populate the green tables on the right-hand side of the first sheet**, which can be seen in Fig. 9.

The green counterfactual tables have exactly the same layout, titles and starting example values as the orange baseline tables. The only difference is that the three BMI columns are not repeated. This is because policy-makers may be able to influence food intake and energy expenditure, but they cannot directly change the population's BMI – this is a byproduct of the energy balance variables. As previously mentioned, it is the differences between the counterfactual and baseline values that PRIME uses to estimate averted deaths.

To set up the counterfactual scenario, **first copy any new values from the orange tables into the corresponding cells in the green tables. Then amend the values in the green tables to produce the scenario of interest**. For instance, you could increase the proportion of former smokers and reduce the number of current smokers by 10%, as shown in Fig. 10; or you could reduce salt intake values by 0.5 g for the entire population, as shown in Fig. 11.

	G	H	I	J
108	Smoking prevalence (%)	Never smoked	Former smokers	Current smokers
109	M15-19	0.50	0.20	0.30
110	M20-24	0.50	0.20	0.30
111	M25-29	0.50	0.20	0.30
112	M30-34:	0.50	0.20	0.30
113	M35-39	0.50	0.20	0.30
114	M40-44	0.50	0.20	0.30
115	M45-49	0.50	0.20	0.30
116	M50-54	0.50	0.20	0.30
117	M55-59	0.50	0.20	0.30
118	M60-64	0.50	0.20	0.30
119	M65-69	0.50	0.20	0.30
120	M70-74	0.50	0.20	0.30
121	M75-79	0.50	0.20	0.30
122	M80-84	0.50	0.20	0.30
123	M85+	0.50	0.20	0.30
124				
125	F15-19	0.50	0.20	0.30
126	F20-24	0.50	0.20	0.30
127	F25-29	0.50	0.20	0.30
128	F30-34	0.50	0.20	0.30
129	F35-39	0.50	0.20	0.30
130	F40-44	0.50	0.20	0.30
131	F45-49	0.50	0.20	0.30
132	F50-54	0.50	0.20	0.30
133	F55-59	0.50	0.20	0.30
134	F60-64	0.50	0.20	0.30
135	F65-69	0.50	0.20	0.30
136	F70-74	0.50	0.20	0.30
137	F75-79	0.50	0.20	0.30
138	F80-84	0.50	0.20	0.30
139	F85+	0.50	0.20	0.30

	V	W	X	Y
108	Smoking prevalence (%)	Never smoked	Former smokers	Current smokers
109	M15-19	0.50	0.30	0.20
110	M20-24	0.50	0.30	0.20
111	M25-29	0.50	0.30	0.20
112	M30-34:	0.50	0.30	0.20
113	M35-39	0.50	0.30	0.20
114	M40-44	0.50	0.30	0.20
115	M45-49	0.50	0.30	0.20
116	M50-54	0.50	0.30	0.20
117	M55-59	0.50	0.30	0.20
118	M60-64	0.50	0.30	0.20
119	M65-69	0.50	0.30	0.20
120	M70-74	0.50	0.30	0.20
121	M75-79	0.50	0.30	0.20
122	M80-84	0.50	0.30	0.20
123	M85+	0.50	0.30	0.20
124				
125	F15-19	0.50	0.30	0.20
126	F20-24	0.50	0.30	0.20
127	F25-29	0.50	0.30	0.20
128	F30-34	0.50	0.30	0.20
129	F35-39	0.50	0.30	0.20
130	F40-44	0.50	0.30	0.20
131	F45-49	0.50	0.30	0.20
132	F50-54	0.50	0.30	0.20
133	F55-59	0.50	0.30	0.20
134	F60-64	0.50	0.30	0.20
135	F65-69	0.50	0.30	0.20
136	F70-74	0.50	0.30	0.20
137	F75-79	0.50	0.30	0.20
138	F80-84	0.50	0.30	0.20
139	F85+	0.50	0.30	0.20

Fig. 10. Reducing smoking rates by 10%

	B	C	D	E	F	G	H	I	J	K	L	M
2	**Baseline**											
3		Mean Total Energy Intake (kcal/day)	Mean Fruit (g/d) Consumers	SD Fruit (g/d) Consumers	% consuming <1 fruit portion daily	Mean Veg (g/d) Consumers	SD Veg (g/d) Consumers	% consuming <1 veg portion daily	Mean Fibre (g/d)	SD Fibre (g/d)	Mean Salt (g/d)	SD Salt (g/d)
4	M15-19	2354.6	222.6	43.2	43.5	182.5	40.3	21.9	18.3	5.6	7.0	2.4
5	M20-24	2429.1	229.4	44.1	43.0	186.4	41.0	20.6	18.8	5.6	7.0	2.4
6	M25-29	2458.7	234.1	45.2	39.4	190.7	41.6	19.4	19.2	5.8	7.0	2.5
7	M30-34	2455.8	237.0	46.5	36.7	194.6	42.2	18.2	19.4	5.8	7.0	2.5
8	M35-39	2423.4	241.6	46.1	32.2	199.6	43.0	16.9	19.7	5.9	7.0	2.5
9	M40-44	2379.7	244.0	46.7	29.6	203.8	43.6	15.9	19.8	5.9	7.0	2.5
10	M45-49	2330.5	247.7	47.6	27.3	207.6	44.2	14.9	19.9	5.9	7.0	2.5
11	M50-54	2257.7	249.4	46.4	24.5	212.5	45.0	13.8	19.9	5.9	7.0	2.5
12	M55-59	2185.0	251.3	48.0	22.3	216.9	45.6	12.9	19.9	5.9	7.0	2.4
13	M60-64	2114.3	254.8	47.9	19.4	221.0	46.2	12.1	19.9	5.9	7.0	2.4
14	M65-69	2026.5	256.5	47.7	17.3	226.0	46.9	11.1	19.8	5.9	7.0	2.4
15	M70-74	1952.2	258.2	47.4	15.9	230.1	47.5	10.4	19.7	5.9	7.0	2.4
16	M75-79	1859.2	258.9	46.6	15.2	235.3	48.2	9.6	19.6	5.9	7.0	2.2
17	M80-84	1774.5	264.1	50.4	14.2	240.0	48.8	8.8	19.4	5.8	7.0	2.1
18	M85+	1774.5	264.1	50.4	14.2	240.0	48.8	8.8	19.4	5.8	7.0	2.1
19												
20	F15-19	1803.2	193.0	36.3	45.3	162.9	35.1	26.1	15.5	4.5	7.0	1.8
21	F20-24	1773.8	200.4	37.2	43.4	166.8	35.7	24.5	15.7	4.5	7.0	1.8
22	F25-29	1740.5	206.4	37.7	39.3	170.8	36.2	22.9	15.8	4.6	7.0	1.8
23	F30-34	1704.5	212.7	38.7	33.5	175.1	36.9	21.4	15.9	4.6	7.0	1.8
24	F35-39	1673.5	217.6	39.5	29.4	178.8	37.4	20.1	16.0	4.6	7.0	1.8
25	F40-44	1642.7	221.3	39.3	26.3	182.6	37.9	18.8	16.1	4.6	7.0	1.8
26	F45-49	1612.0	224.0	40.4	23.4	186.5	38.4	17.6	16.1	4.6	7.0	1.7
27	F50-54	1585.7	227.0	40.5	21.6	189.9	38.9	16.6	16.2	4.6	7.0	1.7
28	F55-59	1557.7	229.4	40.1	18.5	193.7	39.4	15.5	16.4	4.7	7.0	1.7
29	F60-64	1534.3	229.6	39.8	16.9	196.9	39.8	14.6	16.5	4.7	7.0	1.7
30	F65-69	1509.1	231.4	41.3	15.3	200.5	40.3	13.7	16.6	4.7	7.0	1.7
31	F70-74	1489.0	230.3	41.3	14.5	203.5	40.7	13.0	16.8	4.7	7.0	1.6
32	F75-79	1468.8	229.8	41.4	13.5	206.5	41.1	12.3	16.9	4.7	7.0	1.7
33	F80-84	1447.2	229.4	41.9	13.3	209.8	41.5	11.6	17.2	4.8	7.0	1.6
34	F85+	1447.2	229.4	41.9	13.3	209.8	41.5	11.6	17.2	4.8	7.0	1.6

	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
2	**Counterfactual**											
3		Mean Total Energy Intake (kcal/day)	Mean Fruit (g/d) Consumers	SD Fruit (g/d) Consumers	% consuming <1 fruit portion daily	Mean Veg (g/d) Consumers	SD FVeg (g/d) Consumers	% consuming <1 veg portion daily	Mean Fibre (g/d)	SD Fibre (g/d)	Mean Salt (g/d)	SD Salt (g/d)
4	M15-19	2325.0	222.6	43.2	43.5	182.5	40.3	21.9	18.3	5.6	6.5	2.
5	M20-24	2400.0	229.4	44.1	43.0	186.4	41.0	20.6	18.8	5.6	6.5	2.
6	M25-29	2431.2	234.1	45.2	39.4	190.7	41.6	19.4	19.2	5.8	6.5	2.
7	M30-34	2430.3	237.0	46.5	36.7	194.6	42.2	18.2	19.4	5.8	6.5	2.
8	M35-39	2400.8	241.6	46.1	32.2	199.6	43.0	16.9	19.7	5.9	6.5	2.
9	M40-44	2359.7	244.0	46.7	29.6	203.8	43.6	15.9	19.8	5.9	6.5	2.
10	M45-49	2313.0	247.7	47.6	27.3	207.6	44.2	14.9	19.9	5.9	6.5	2.
11	M50-54	2243.4	249.4	46.4	24.5	212.5	45.0	13.8	19.9	5.9	6.5	2.
12	M55-59	2173.7	251.3	48.0	22.3	216.9	45.6	12.9	19.9	5.9	6.5	2.
13	M60-64	2105.7	254.8	47.9	19.4	221.0	46.2	12.1	19.9	5.9	6.5	2.
14	M65-69	2020.9	256.5	47.7	17.3	226.0	46.9	11.1	19.8	5.9	6.5	2.
15	M70-74	1949.1	258.2	47.4	15.9	230.1	47.5	10.4	19.7	5.9	6.5	2.
16	M75-79	1859.1	258.9	46.6	15.2	235.3	48.2	9.6	19.6	5.9	6.5	2.
17	M80-84	1777.0	264.1	50.4	14.2	240.0	48.8	8.8	19.4	5.8	6.5	2.
18	M85+	1777.0	264.1	50.4	14.2	240.0	48.8	8.8	19.4	5.8	6.5	2.
19												
20	F15-19	1783.6	193.0	36.3	45.3	162.9	35.1	26.1	15.5	4.5	6.5	1.
21	F20-24	1756.1	200.4	37.2	43.4	166.8	35.7	24.5	15.7	4.5	6.5	1.
22	F25-29	1724.5	206.4	37.7	39.3	170.8	36.2	22.9	15.8	4.6	6.5	1.
23	F30-34	1690.1	212.7	38.7	33.5	175.1	36.9	21.4	15.9	4.6	6.5	1.
24	F35-39	1660.4	217.6	39.5	29.4	178.8	37.4	20.1	16.0	4.6	6.5	1.
25	F40-44	1630.9	221.3	39.3	26.3	182.6	37.9	18.8	16.1	4.6	6.5	1.
26	F45-49	1601.4	224.0	40.4	23.4	186.5	38.4	17.6	16.1	4.6	6.5	1.
27	F50-54	1576.1	227.0	40.5	21.6	189.9	38.9	16.6	16.2	4.6	6.5	1.
28	F55-59	1549.1	229.4	40.1	18.5	193.7	39.4	15.5	16.4	4.7	6.5	1.
29	F60-64	1526.5	229.6	39.8	16.9	196.9	39.8	14.6	16.5	4.7	6.5	1.
30	F65-69	1502.2	231.4	41.3	15.3	200.5	40.3	13.7	16.6	4.7	6.5	1.
31	F70-74	1482.8	230.3	41.3	14.5	203.5	40.7	13.0	16.8	4.7	6.5	1.
32	F75-79	1462.8	229.8	41.4	13.5	206.5	41.1	12.3	16.9	4.7	6.5	1.
33	F80-84	1442.4	229.4	41.9	13.3	209.8	41.5	11.6	17.2	4.8	6.5	1.
34	F85+	1442.4	229.4	41.9	13.3	209.8	41.5	11.6	17.2	4.8	6.5	1.

Fig. 11. Reducing salt intake by 0.5 g/day for the entire population

You can also set up counterfactual scenarios where the change in risk factors is different for different age groups and sexes. Fig. 12 shows a counterfactual scenario where physical activity rates have increased only for 20–29-year-olds, with a larger increase seen in females.

3.2 COUNTERFACTUAL SD VALUES

In most cases, it is appropriate to assume that everyone in the population changes their behaviour by the same degree, and therefore the SD should remain the same in the baseline and counterfactual scenarios for each risk factor. Of course, if you have sufficient data to parameterize the counterfactual distribution, then you can use these new SD values for the green counterfactual table.

3.3 DISABLE OBESITY AND MONTE CARLO ANALYSIS

The model is very sensitive to obesity and the number of calories consumed and expended. This means that small changes to BMI and energy balance can have a large impact on the final results. Our current understanding of how single policies impact overall behaviour is limited. For instance, reduced saturated fat intake may not necessarily reduce total calories if consumers make up the shortfall by eating more of other food types.

If you are completely confident that you can account for any compensatory behaviours, then type "No" into the "Disable obesity" box in row 74. Be aware that this risks overestimating the number of deaths averted. For this reason, we generally recommend typing "Yes" – this should be the default.

We will return to Monte Carlo (MC) analysis once we have finished entry of input data (see Section 5.2 below). MC analysis is a statistical means of compiling uncertainty around the deterministic final point estimate of deaths averted in situations where more than one risk factor has been changed. For now, ensure that "No" is typed in cell AD4.

H	I	J
Mean ht (m)	Mean BMI	SD BMI
1.74	22.44	4.29
1.77	23.51	3.23
1.76	24.22	3.65
1.75	26.67	3.90
1.75		
1.73		
1.73		
1.69		
1.69		
1.68		
1.67		
1.66		
1.66		
1.64		
1.64		
1.61		
1.62		
1.61		
1.61		
1.61		
1.59		
1.59		
1.57		
1.56		
1.55		
1.55		
1.53	30.30	4.54
1.52		
1.52	25.46	5.56
1.52	25.46	5.56

Disable obesity?
No

Physical Activity (hrs/week) and Energy Balance	Mean METhrs/wk in active pop	SD METhrs/wk in active pop	% sedentary	MET value for non-MVPA time	MET value for MVPA time
M15-19	30.00	4.18	22.81	1.00	5.70
M20-24	50.00	4.73	34.48	1.00	5.19
M25-29	50.00	5.13	19.39	1.00	5.28
M30-34:	30.00	5.93	26.58	1.00	5.43
M35-39	30.00	6.39	41.22	1.00	4.92
M40-44	30.00	5.77	44.90	1.00	4.85
M45-49	30.00	5.10	54.35	1.00	4.47
M50-54	30.00	6.05	44.79	1.00	4.51
M55-59	30.00	4.95	40.16	1.00	4.36
M60-64	30.00	5.07	44.11	1.00	4.18
M65-69	30.00	3.98	45.84	1.00	4.20
M70-74	30.00	3.71	46.35	1.00	4.09
M75-79	30.00	3.87	45.98	1.00	4.05
M80-84	30.00	3.07	56.10	1.00	4.00
M85+	30.00	3.07	56.10	1.00	4.00
F15-19	30.00	3.12	39.14	1.00	5.04
F20-24	55.00	3.82	51.61	1.00	4.42
F25-29	55.00	4.38	39.82	1.00	4.67
F30-34	30.00	4.24	50.37	1.00	4.39
F35-39	30.00	4.61	40.98	1.00	4.40
F40-44	30.00	4.12	47.07	1.00	4.09
F45-49	30.00	4.21	47.30	1.00	4.09
F50-54	30.00	4.54	43.64	1.00	4.00
F55-59	30.00	4.23	39.14	1.00	3.93
F60-64	30.00	4.81	33.80	1.00	4.04
F65-69	30.00	3.82	51.85	1.00	4.02
F70-74	30.00	3.37	32.11	1.00	3.95
F75-79	30.00	2.81	62.66	1.00	3.84
F80-84	30.00	2.91	53.26	1.00	3.60
F85+	30.00	2.91	53.26	1.00	3.60

Fig. 12. A counterfactual scenario where changes vary between males and females and affect only one age group

4 Entering population and mortality data

Yes		
Population:		
	Male	Female
15-19	285539	273725
20-24	274167	267677
25-29	277458	277226
30-34	305934	321499.5
35-39	358175	388286.5
40-44	387083.5	422322
45-49	361957.5	394938
50-54	359277.5	397944
55-59	335611	373651
60-64	304205.5	348418.5
65-69	275790	324480.5
70-74	221160.5	283280.5
75-79	180312.5	250021
80-84	132988.5	211199.5
85+	89118.5	190,381

Mortality:

	I60-I69: Cerebrovascular diseases	I20-I25: Ischaemic heart diseases	C00-C1[illegible] Lip, [illegible] cavity and pharynx	[illegible]: Oesophagus	C16: Stomach	C34: Bronchus and lung	C25: Pancreas	C18-20: Colorectum	C5[illegible] Breast	[illegible]4.1: Endometrium	C2[illegible] Gallbla[illegible]der	C64: Kidney	[illegible] Hypertensive disease	E11,E14: Diabetes	[illegible] Bladder cancer	[illegible] Liver cancer	C53: Cervix cancer	J40-J44: Chronic obstructive pulmonary disease	K70, K74: Liver disease	I50: Heart failure
M15-19	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
M20-24	4	2	0	0	0	0	0	0	0	[illegible]	0	0	0	[illegible]	0	1	0	0	0	0
M25-29	1	3	1	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0	0
M30-34	3	12	0	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3	0	0	3	0
M35-39	11	27	4	[illegible]	[illegible]	8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	0	2	15	1
M40-44	31	58	20	4	16	34	10	12	1	0	[illegible]	2	0	5	2	8	0	5	49	4
M45-49	44	103	48	23	26	66	19	47	0	0	1	4	3	11	4	17	0	4	76	6
M50-54	80	192	100	40	80	168	35	69	0	0	2	8	6	25	14	56	0	24	122	17
M55-59	130	283	131	64	89	335	68	123	1	0	1	17	13	45	28	98	0	31	125	15
M60-64	194	336	119	79	141	407	91	186	3	0	2	29	18	80	52	106	0	78	129	41
M65-69	312	409	99	69	142	526	111	247	1	0	7	32	34	163	89	127	0	111	124	68
M70-74	477	468	54	59	186	500	141	283	3	0	7	39	58	223	103	116	0	151	116	114
M75-79	800	598	50	53	214	513	152	381	6	0	6	51	104	308	115	129	0	269	79	206
M80-84	1181	671	35	35	219	317	134	408	5	0	9	48	186	439	150	103	0	421	42	412
M85+	1820	1014	36	26	194	255	97	442	4	0	5	42	415	551	161	80	0	664	27	943
Total	5088	4178	697	454	1316	3134	860	2213	24	0	40	275	838	1851	720	845	0	1760	907	1827
F15-19	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F20-24	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
F25-29	1	1	0	0	0	0	0	0	2	0	0	0	1	1	0	1	2	1	0	0
F30-34	4	3	0	0	2	1	0	6	7	1	0	0	0	0	0	0	2	0	0	0
F35-39	8	2	1	0	7	2	3	7	36	1	0	0	0	2	0	1	5	0	1	0
F40-44	19	17	0	0	10	25	5	21	71	0	1	2	2	0	2	3	11	3	16	2
F45-49	33	18	5	0	23	29	9	27	88	0	0	3	1	9	1	5	18	4	21	0
F50-54	30	35	9	4	38	62	17	53	121	3	0	1	3	15	5	9	17	3	35	3
F55-59	62	59	3	8	47	89	34	77	134	14	6	5	6	19	1	17	17	11	37	12
F60-64	102	78	14	7	65	103	56	102	149	17	4	10	10	59	11	20	16	19	32	18
F65-69	175	123	16	3	72	119	60	133	183	28	10	13	25	94	10	34	20	29	23	33
F70-74	363	219	11	4	85	126	84	165	175	41	11	16	70	192	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	86
F75-79	719	375	17	9	129	124	105	230	210	44	12	21	124	329	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	238
F80-84	1370	602	20	13	170	119	131	305	207	43	15	29	268	594	51	66	20	234	19	542
F85+	3757	1655	56	21	233	143	174	519	391	34	14	46	1,082	1,115	111	66	26	600	14	2,293
Total	6644	3188	152	69	881	942	678	1645	1774	226	73	146	1592	2429	241	326	194	1029	261	3227

Fig. 13. The Population & Mortality sheet

4.1 POPULATION DATA

Once you have completed entering baseline and counterfactual values for your risk factor(s) of interest, select the next Excel sheet, entitled **Population & Mortality**.

Cell A1 tells you whether MC analysis is on or off.

The first table, starting at row 3, requires data on the age and sex distribution of your population. The example data has 1000 males and females in each age band. Using a population survey from the same year as the risk factor data, enter the total number of males and females in each age band, replacing the example data in the blue and pink cells. If you do not have 5-year bandings, then put the same number in each row within the banding that you have available.

A recommended source for population data is the United Nations Department of Economic and Social Affairs (DESA)'s World Population Prospects.

	A	B	C
1	Yes		
2	**Population:**		
3		Male	Female
4	**15-19**	285539	273725
5	**20-24**	274167	267677
6	**25-29**	277458	277226
7	**30-34**	305934	321499.5
8	**35-39**	358175	388286.5
9	**40-44**	387083.5	422322
10	**45-49**	361957.5	394938
11	**50-54**	359277.5	397944
12	**55-59**	335611	373651
13	**60-64**	304205.5	348418.5
14	**65-69**	275790	324480.5
15	**70-74**	221160.5	283280.5
16	**75-79**	180312.5	250021
17	**80-84**	132988.5	211199.5
18	**85+**	89118.5	190,381

Fig. 13.a The Population section from the Population & Mortality sheet

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
20	**Mortality:**																									
21		I60-I69: Cerebrovascular diseases	I20-I25: Ischaemic heart diseases	C00-C14: Lip, oral cavity and pharynx	C15: Oesophagus	C16: Stomach	C34: Bronchus and lung	C25: Pancreas	C18-20: Colorectum	C50: Breast	C54.1: Endometrium	C23: Gallbladder	C64: Kidney	I10-I15: Hypertensive disease	E11,E14: Diabetes	C67: Bladder cancer	C22: Liver cancer	C53: Cervix cancer	J40-J44: Chronic obstructive pulmonary disease	K70, K74: Liver disease	I50: Heart failure	I71: Aortic aneurysm	I26: Pulmonary embolism	I05-09: Rheumatic heart disease	N18: Chronic renal failure	**Total**
22	M15-19	0	2																							2
23	M20-24	4	2																							6
24	M25-29	1	3																							4
25	M30-34	3	12																							15
26	M35-39	11	27																							38
27	M40-44	31	58																							89
28	M45-49	44	103																							147
29	M50-54	80	192																							272
30	M55-59	130	283																							413
31	M60-64	194	336																							530
32	M65-69	312	409																							721
33	M70-74	477	468																							945
34	M75-79	800	598																							1,398
35	M80-84	1181	671																							1,852
36	M85+	1820	1014																							2,834
37	**Total**	5088	4178																							9,266

Fig. 13.b The Mortality section from the Population & Mortality sheet

World Population Prospects: population data [online portal with downloadable Excel files]
United Nations Department of Economic and Social Affairs (DSA), Population Division
https://population.un.org/wpp/Download/Standard/Population

30-34	
35-39	
40-44	
45-49	
50-54	
55-59	
60-64	
65-69	
70-74	
75-79	
80-84	
85+	

4.2 MORTALITY DATA

The columns of the mortality table list various NCDs, along with ICD-10 codes (Fig. 13, 14). The rows are split into male (blue) and female (pink) and 5-year age bands. Example data have been entered to show 1 death for each NCD for each age group. There is currently an error in the coding which means that the totals do not automatically sum (rows 37 and 54). This glitch does not affect PRIME in any way, so you do not need to correct it.

Using national mortality data giving cause of death by age and sex, enter in each cell the total number of deaths from each condition. Use data from the same year as the risk factor and population data.

PRIME is most accurate with 5-year age bandings; however, these are not always available. If this is the case, you will have to divide the deaths between the year age categories as you see fit. For example, in Fig. 14 there were 119 000 deaths from ischaemic heart disease for males aged 15–49 years. In this instance, we have divided the total number of deaths evenly between the 5-year age bandings. The 225 000 deaths in males aged 50–74 years have also been divided up equally, as have the 60 000 deaths in males older than 75 years.

Note that, while this is the simplest approach, the assumption is almost certainly incorrect: it is very likely that there are more deaths in the 45–49 year age group than in the 15–19 year age group. If you cannot obtain 5-year age-banded mortality data, we suggest that you seek advice from an epidemiologist on how to distribute the deaths most appropriately between the age categories.

Complete the table as fully as possible.

Mortality:

	I60-I69: Cerebrovascular diseases	I20-I25: Ischaemic heart diseases	C00-C14: Lip, oral cavity and pharynx	C15: Oesophagus	C23: Gallbladder	C64: Kidney	I10-I15: Hypertensive disease	E11,E14: Diabetes	C67: Bladder cancer
M15-19	0	2							
M20-24	4	2							
M25-29	1	3							
M30-34	3	12							
M35-39	11	27							
M40-44	31	58							
M45-49	44	103							
M50-54	80	192							
M55-59	130	283							
M60-64	194	336							
M65-69	312	409							
M70-74	477	468							
M75-79	800	598							
M80-84	1181	671							
M85+	1820	1014							
Total	5088	4178							
F15-19									
F20-24									
F25-29									
F30-34									
F35-39									
F40-44									
F45-49									
F50-54									
F55-59									

Fig. 14. Entering mortality data on cerebrovascular and ischaemic heart disease for males

Data on cause of death can be found at the following sources:

- UNdata – deaths by cause of death, age and sex;
- WHO Global Health Estimates – deaths by cause, age, sex, by country and by region, 2000–2016 (the spreadsheet, including GHE codes, is available here);
- WHO Global Health Estimates comprehensive dataset is available here;
- Institute for Health Metrics and Evaluation (IHME) data are available here.

Your data source may not map causes of death to ICD-10 codes. Try to use definitions that are as similar as possible to those in ICD-10. You can search the online ICD-10 to check definitions. This link takes you to "I60–I69: Cerebrovascular diseases", which is the first set of conditions in the mortality table (column B). You can search for other codes (e.g. "I20" for ischaemic heart disease) in the search bar at the top left of the webpage, as shown in Fig. 15.

There is no easy way of dealing with a situation where your data source is not very granular – for instance, if it provides data only for upper gastrointestinal cancers, not for oesophagus, stomach, gallbladder, etc. separately. We suggest speaking with an epidemiologist about the best way to split the deaths into the relevant categories.

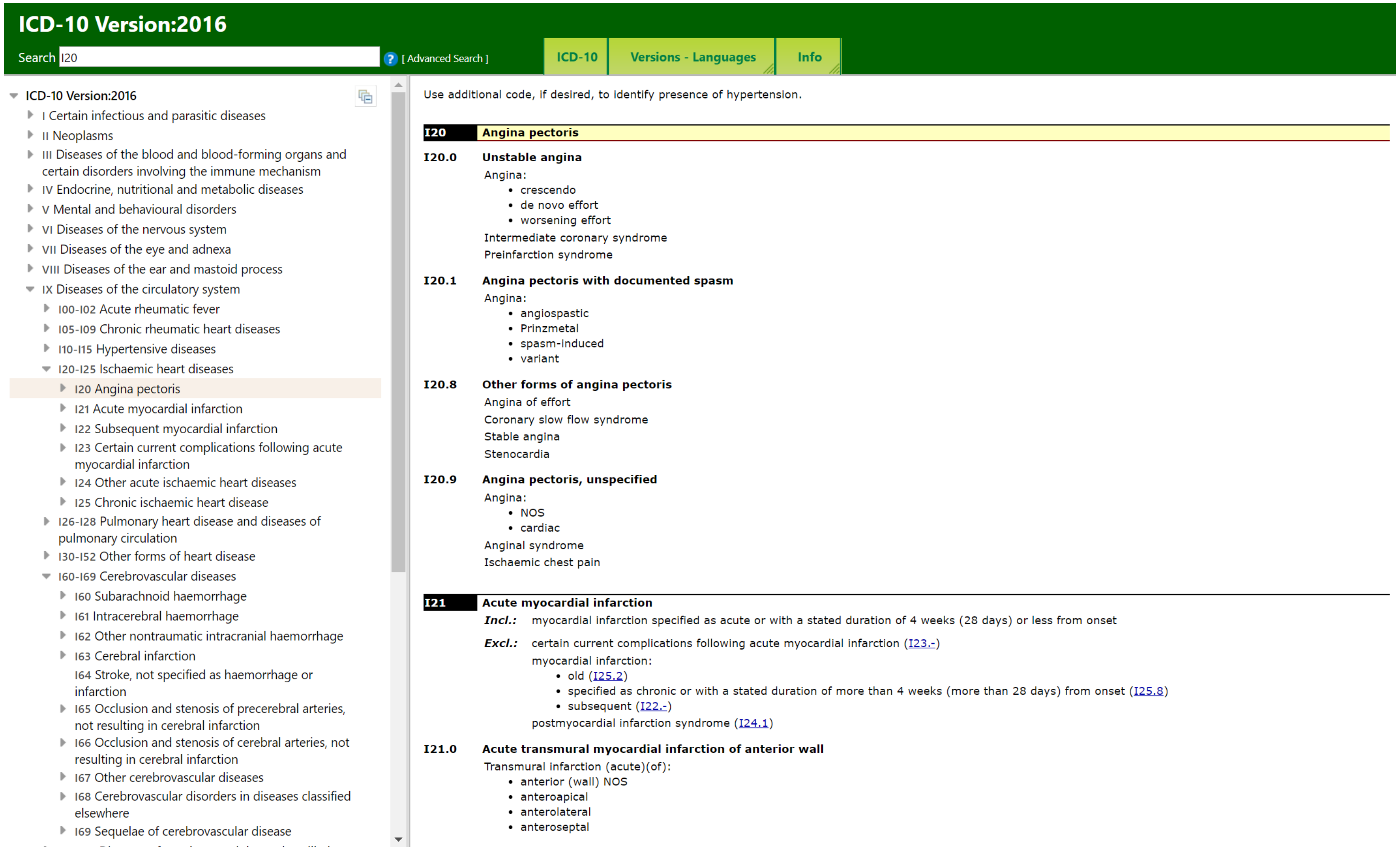
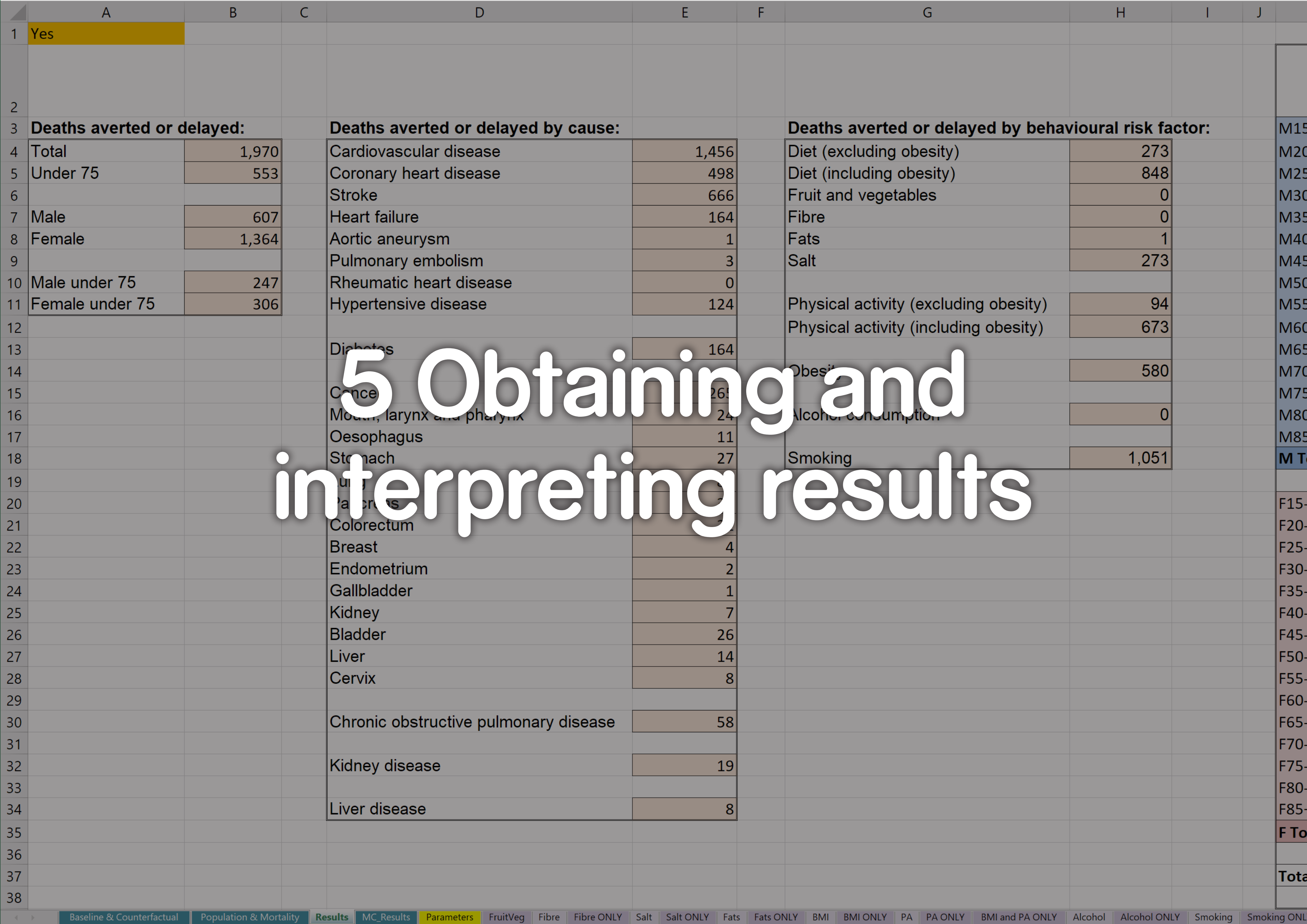


Fig. 15. Searching for ICD-10 disease definitions

5 Obtaining and interpreting results



Yes

Deaths averted or delayed:	
Total	1,970
Under 75	553
Male	607
Female	1,364
Male under 75	247
Female under 75	306

Deaths averted or delayed by cause:	
Cardiovascular disease	1,456
Coronary heart disease	498
Stroke	666
Heart failure	164
Aortic aneurysm	1
Pulmonary embolism	3
Rheumatic heart disease	0
Hypertensive disease	124
Diabetes	164
Cancer	265
Mouth, larynx and pharynx	24
Oesophagus	11
Stomach	27
Lung	[illegible]
Pancreas	[illegible]
Colorectum	[illegible]
Breast	4
Endometrium	2
Gallbladder	1
Kidney	7
Bladder	26
Liver	14
Cervix	8
Chronic obstructive pulmonary disease	58
Kidney disease	19
Liver disease	8

Deaths averted or delayed by behavioural risk factor:	
Diet (excluding obesity)	273
Diet (including obesity)	848
Fruit and vegetables	0
Fibre	0
Fats	1
Salt	273
Physical activity (excluding obesity)	94
Physical activity (including obesity)	673
Obesity	580
Alcohol consumption	0
Smoking	1,051

After you have finished inputting national data from the same year on baseline risk factor distribution, counterfactual scenario, population structure and mortality rates, PRIME instantaneously calculates the estimated averted deaths.

Select the third Excel sheet entitled **Results**.

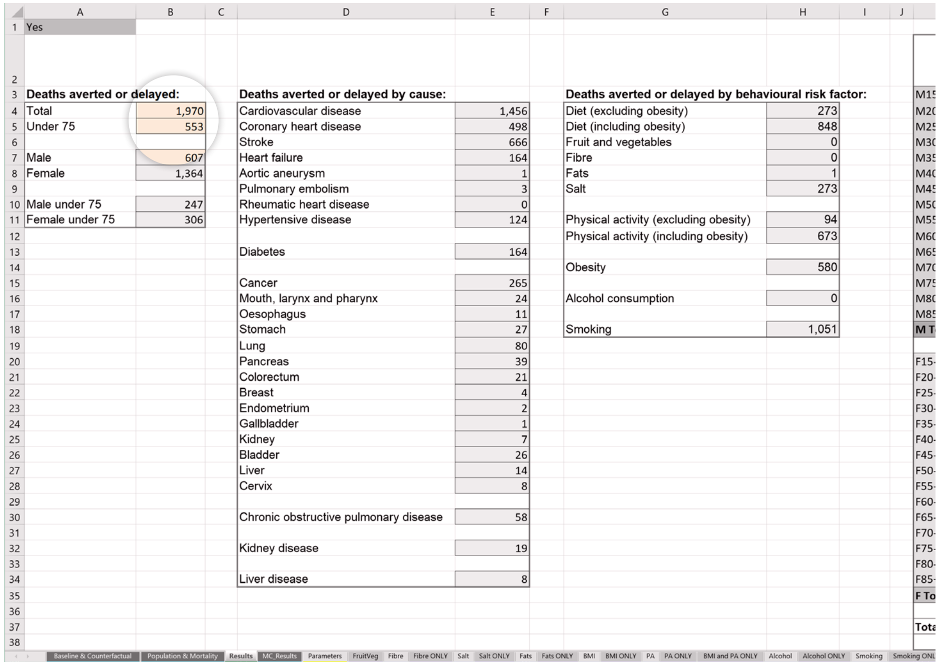
On this sheet a number of tables break down exactly where any averted deaths have come from, as a result of the relative weighting of different risk factors.

The main result is displayed in cell B4. The rows beneath show how many of the averted deaths occurred in those aged under 75 years (B5), in males (B7) and females (B8), and in males and females aged under 75 years (B10 and B11).

The cells in column E show how many of the averted deaths occurred in each disease category. The cells in column H show which behavioural risk factor changes were responsible for the averted deaths.

The example data in Fig. 16 show no averted deaths because the values for the baseline and counterfactual scenarios are identical to start with. Once the counterfactual values differ, the results tables will start to populate automatically.

The larger table starting at column K breaks down exactly how many deaths were averted for each condition for each age group and sex. The orange columns (L, N, P, R, etc.) show the baseline deaths for each group (values that you entered on the second sheet); the green columns (M, O, Q, S, etc.) show the number of deaths that PRIME has calculated for the counterfactual scenario.



Deaths averted or delayed:	
Total	1,970
Under 75	553
Male	607
Female	1,364
Male under 75	247
Female under 75	306

Deaths averted or delayed by cause:	
Cardiovascular disease	1,456
Coronary heart disease	498
Stroke	666
Heart failure	164
Aortic aneurysm	1
Pulmonary embolism	3
Rheumatic heart disease	0
Hypertensive disease	124
Diabetes	164
Cancer	265
Mouth, larynx and pharynx	24
Oesophagus	11
Stomach	27
Lung	80
Pancreas	39
Colorectum	21
Breast	4
Endometrium	2
Gallbladder	1
Kidney	7
Bladder	26
Liver	14
Cervix	8
Chronic obstructive pulmonary disease	58
Kidney disease	19
Liver disease	8

Deaths averted or delayed by behavioural risk factor:	
Diet (excluding obesity)	273
Diet (including obesity)	848
Fruit and vegetables	0
Fibre	0
Fats	1
Salt	273
Physical activity (excluding obesity)	94
Physical activity (including obesity)	673
Obesity	580
Alcohol consumption	0
Smoking	1,051

Fig. 16. The Results sheet

5.1 WHAT DOES "DEATHS AVERTED OR DELAYED" MEAN?

PRIME does not take what is known about deaths in the year you chose and then work out how many lives would be saved in the following year, given the counterfactual changes in risk factors. Instead, it answers the question, "How many deaths would have occurred in the baseline year if the distribution of risk factors had been different?"

For example, let's say you are using 2015 data on salt intake, which was 4 g per person. In the counterfactual scenario, you set consumption at 2 g per person. PRIME tells you how many deaths would have occurred in 2015 if consumption had been at 2 g per person instead of 4 g.

The final result is "x fewer deaths". However, these individuals will eventually die of something, and they may still die from the same cause but at a later date. That's why PRIME gives the number of deaths averted or delayed – because we don't know what will happen in the future.

5.2 MONTE CARLO ANALYSIS

Running a Monte Carlo (MC) analysis is a means of establishing realistic confidence intervals around the final number of deaths averted.

When changing a risk factor, PRIME uses relative risk figures from meta-analyses to work out the expected change in deaths. If you are interested, the values used can be seen in the yellow columns on the **Parameters** page, along with the upper and lower confidence limits. If you are changing more than one risk factor, it is mathematically inappropriate to simply add or multiply the confidence limits. An MC analysis chooses a random point estimate from within the known CI for each risk factor and runs the model multiple times (you have the option of running the model 5000, 10 000 or 100 000 times). This effectively compiles uncertainty around the deterministic result. PRIME observes the outcomes and provides CI values (on the MC_Results sheet in cells B4 and D4). The more times the MC analysis is run, the more accurate the CIs; however, 5000 should be sufficient.

To run the MC analysis, first ensure that "Yes" is typed into cell AD4 on the first sheet (Baseline and Counterfactual). Then simply click the relevant button in column K on the MC_Analysis sheet and wait for the analysis to finish running. You can press the escape key to stop the analysis at any time. Please note that the MC analysis uses your computer's copy and paste function, and while it is running, you will not be able to use this feature in any other document.

In Fig. 17 the 5000 option located in the middle of the sheet is highlighted blue. The final results (the 2.5th and 97.5th centiles) are displayed at the top left of the screen in cells B4 and D4 and highlighted as well in Fig. 17. Once you have run your MC analysis, go back to the first sheet and reset cell AD4 by entering "No" (if you don't reset this cell, then PRIME continues to use randomly selected risk ratios to populate the results page, rather than using the best estimate scenario).

You should check that the point estimate in cell C4 is roughly similar to the results you obtain in the Results sheet (B4). However, the most accurate result is the one in the Results sheet. Use the upper and lower CIs from cells B4 and D4 on the MC_Analysis sheet to compute your final CI.

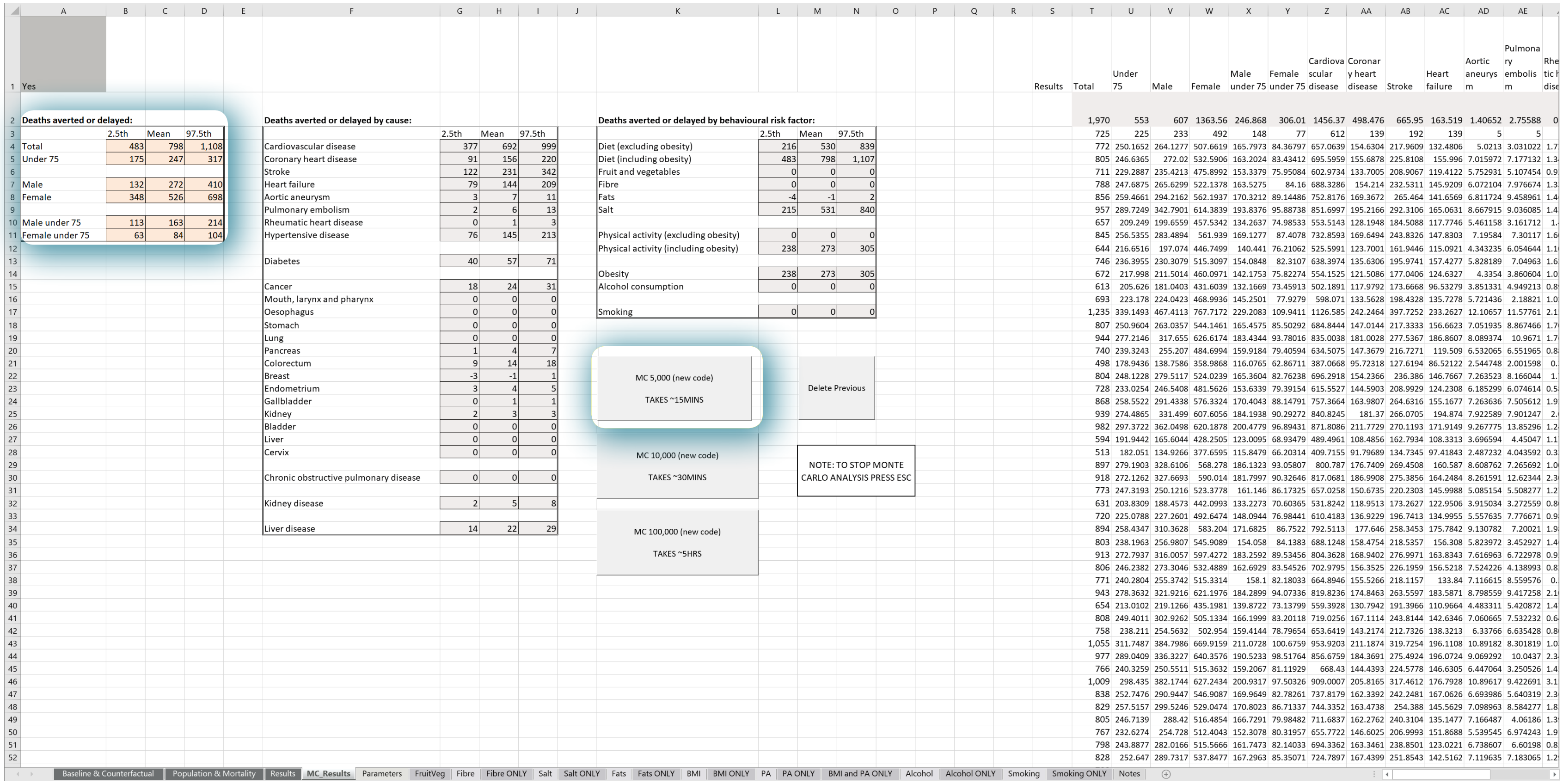


Fig. 17. Running a Monte Carlo analysis 5000 times

5.3 COMMUNICATING THE RESULTS

The best way to communicate results is probably to talk about how many fewer deaths would have been seen in the year of interest if the counterfactual scenario had been real.

For instance:

> *"If salt consumption had been 2 g lower per person, there would have been 100 000 fewer deaths in 2015."*
>
> *"If everyone had met the national recommendations for physical activity in 2015, then 100 000 lives would have been saved."*
>
> *"If everyone met the national nutrition guidelines, then 50 000 deaths could be averted, with 70% of the averted deaths due to increasing fibre intake."*
>
> *"Our modelling suggests that halving the number of male smokers would save 5000 lives."*

The WHO Regional Office for Europe

The World Health Organization (WHO) is a specialized agency of the United Nations created in 1948 with the primary responsibility for international health matters and publichealth. The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health conditions of the countries it serves.

Member States

Albania
Armenia
Azerbaijan
Belgium
Bulgaria
Cyprus
Denmark
Finland
Georgia
Greece
Iceland
Israel
Kazakhstan
Latvia
Luxembourg
Monaco
Netherlands
Norway
Portugal
Romania
San Marino
Slovakia
Spain
Switzerland
Turkey
Ukraine
Uzbekistan
Andorra
Austria
Belarus
Bosnia and Herzegovina
Croatia
Czech Republic
Estonia
France
Germany
Hungary
Ireland
Italy
Kyrgyzstan
Lithuania
Malta
Montenegro
North Macedonia
Poland
Republic of Moldova
Russian Federation
Serbia
Slovenia
Sweden
Tajikistan
Turkmenistan
United Kingdom

World Health Organization
Regional Office for Europe
UN City, Marmorvej 51, DK-2100 Copenhagen Ø, Denmark
Tel.: +45 45 33 70 00 | Fax: +45 45 33 70 01
E-mail: eurocontact@who.int
Website: www.euro.who.int