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HEALTH EQUITY 2020

HEALTH EQUITY 2020 TOOLKIT APPENDIX 7

User Guide - Health Equity 2020 quantitative tool

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Copyright statement and disclaimer

The results of this quantitative estimation tool should be interpreted with care and interpreted regarding the simplifications, limitations and assumptions of the underlying model.

No rights can be obtained from the use of this tool.

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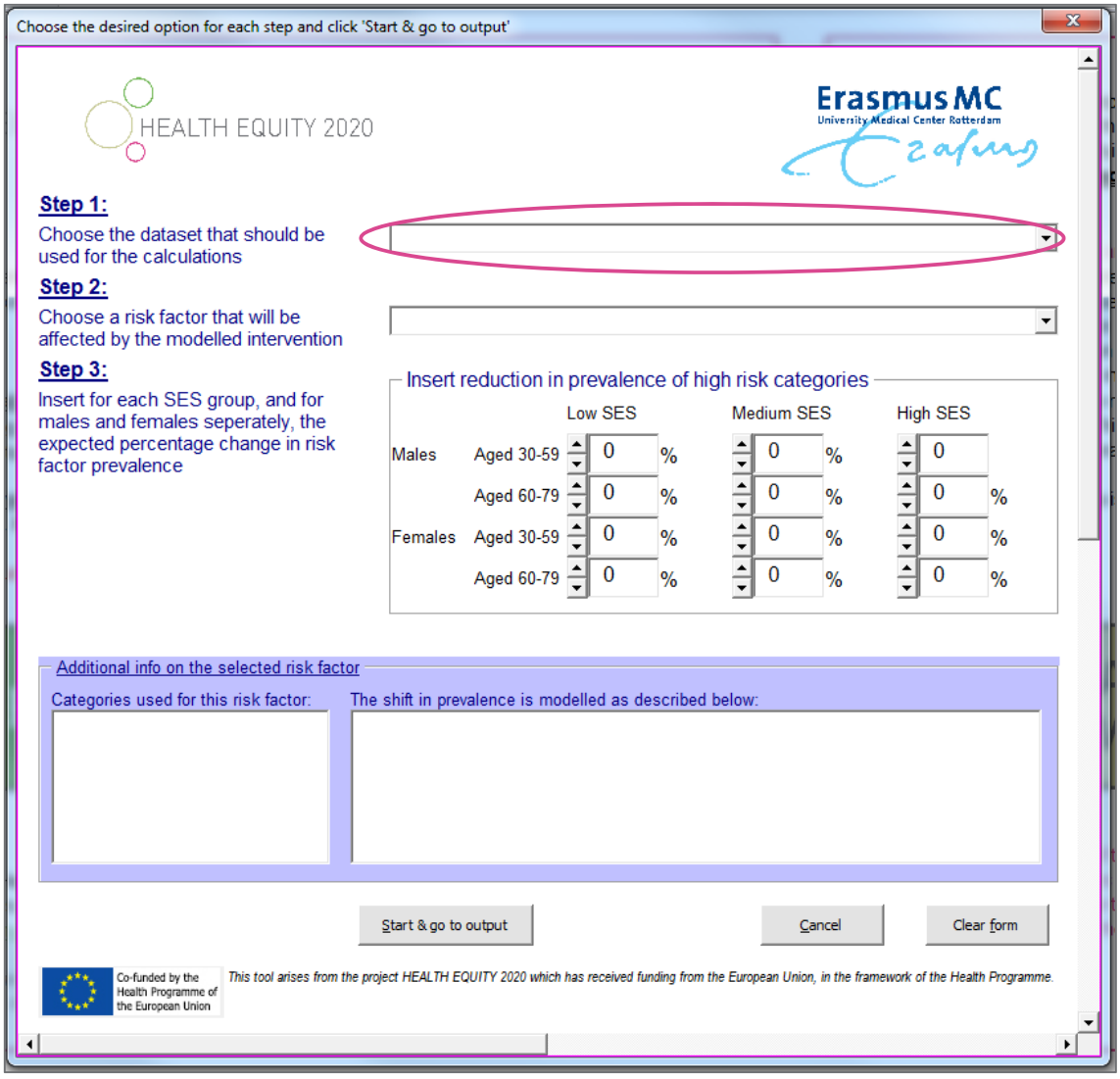
Quick start guide

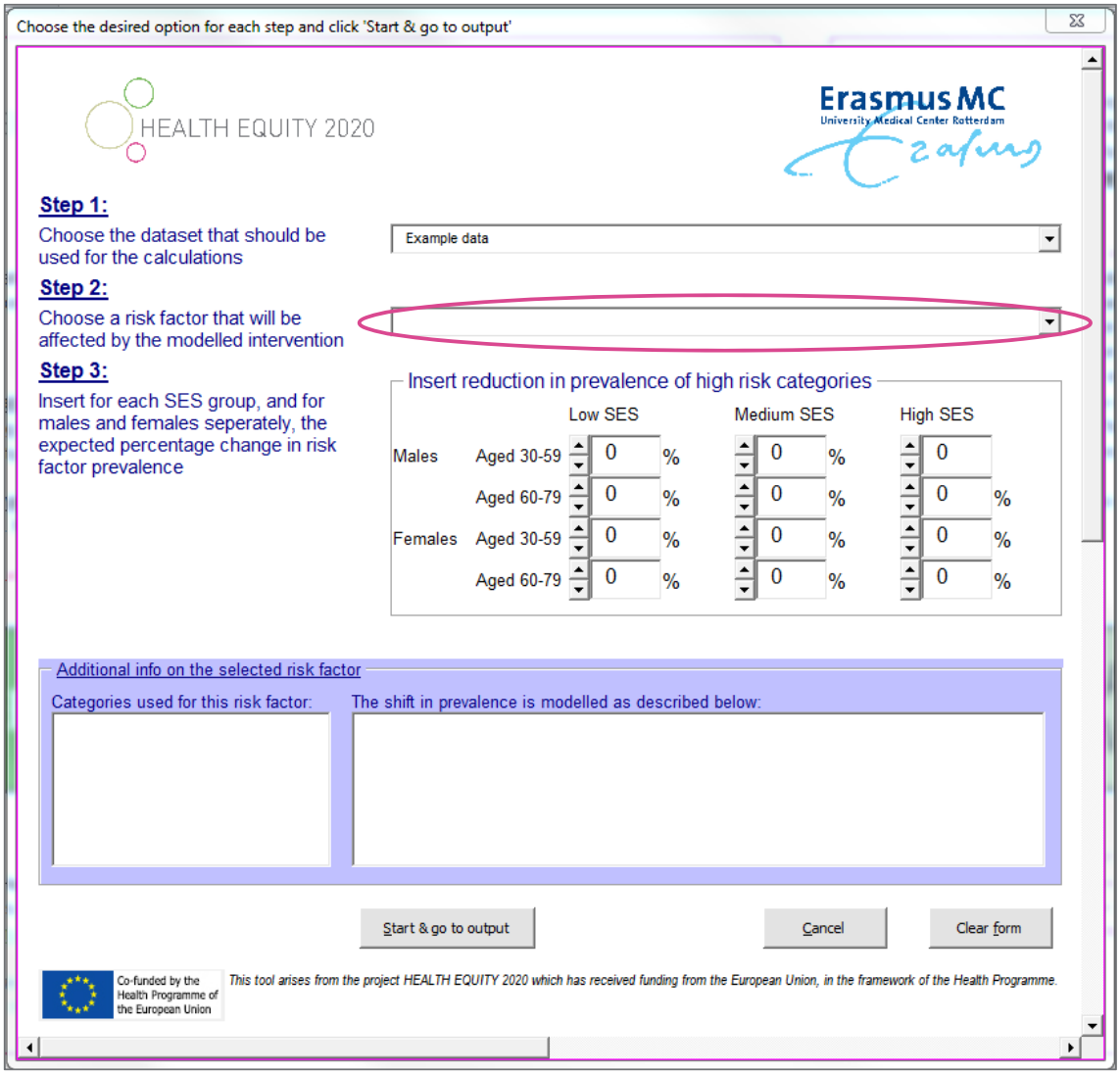
Open the excel file, read the cover page and click on START.

NOTE: if regional data are available, please read section 'Data Input' of the user guide.
NOTE: macro's need to be enabled. If macro's cannot be enabled or if the pink 'Start' button does not work, go directly to the tab 'Tool – input' to continue the use of the tool.

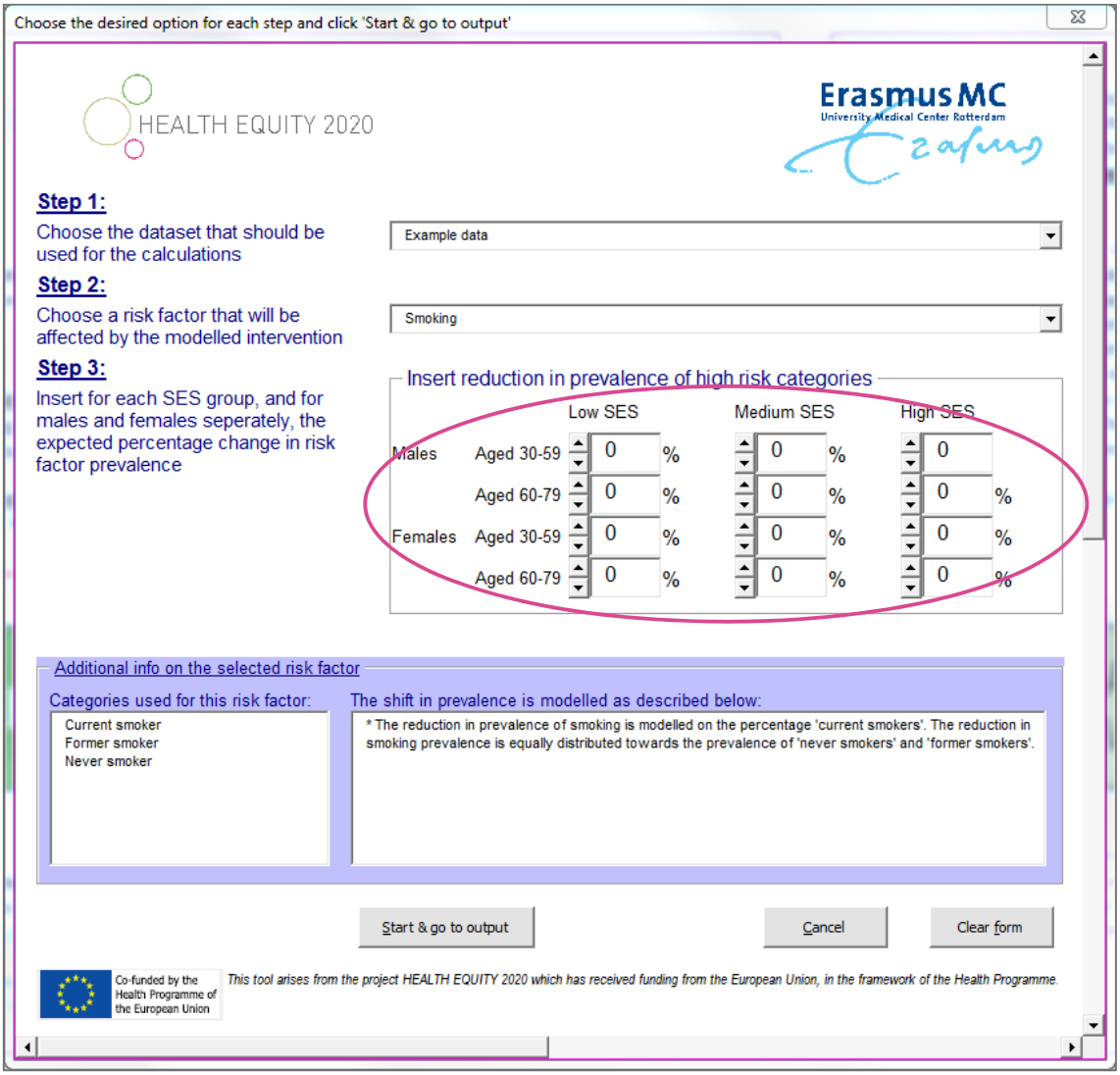
Step 1: select a dataset from the drop-down menu



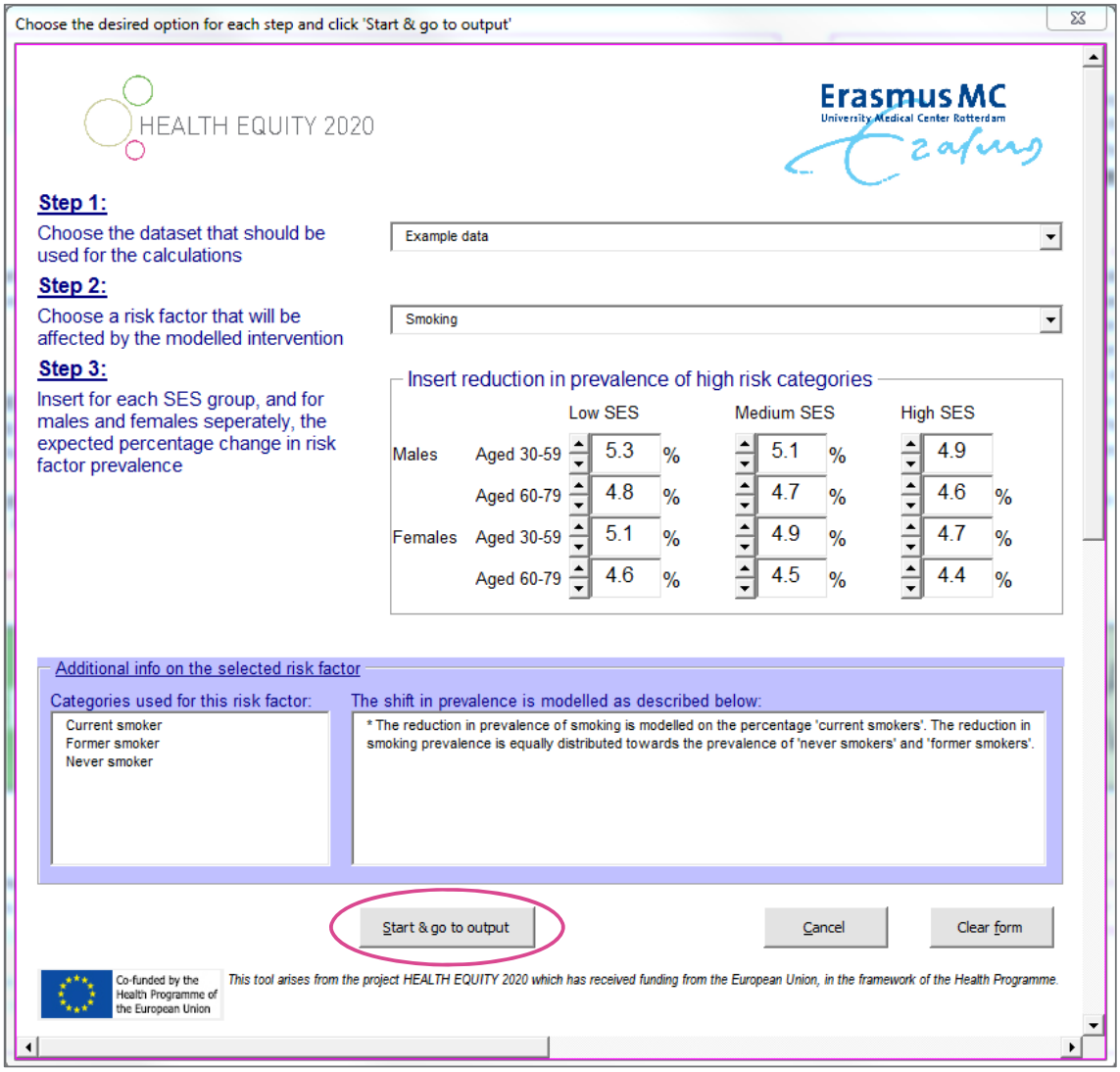
Step 2: select a risk factor from the drop-down menu



Step 3: shift in risk factor distribution



Start the simulation



Output:

MODEL OUTPUT

HEALTH EQUITY 2020

Legend output:

SES-Socioeconomic status
Current situation
Scenario situation
Difference between current and scenario situation

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Crafting

CLICK HERE

TO GO BACK TO THE INPUT SCREEN

START TOOL

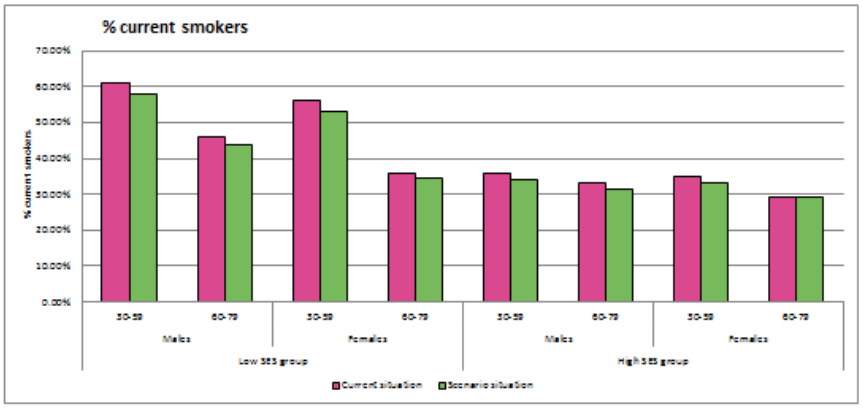
RISK FACTOR PREVALENCE

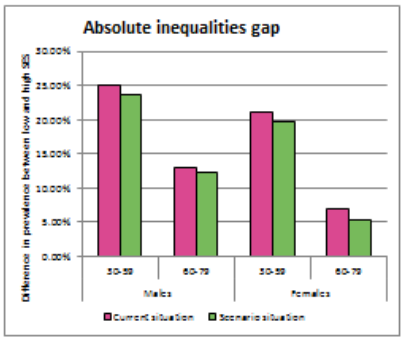
Smoking

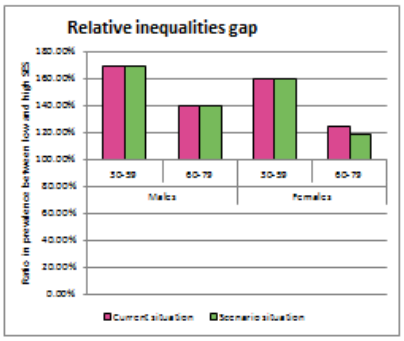
% current smokers

NOTE: only the prevalence of the highest risk category is presented here.

			situation (before shift in risk factor prevalence)	**situation** (after shift in risk factor prevalence)	**reduction** (due to shift in risk factor prevalence)
Low SES group	Males	30-59	61.00%	57.77%	-3.23%
		60-79	46.00%	43.79%	-2.21%
	Females	30-59	56.00%	53.14%	-2.86%
		60-79	36.00%	34.34%	-1.66%
High SES group	Males	30-59	36.00%	34.24%	-1.76%
		60-79	33.00%	31.48%	-1.52%
	Females	30-59	35.00%	33.36%	-1.65%
		60-79	29.00%	29.00%	0.00%
Absolute inequalities gap (in prevalence points [low-high])	Males	30-59	25.00%	23.53%	-1.47%
		60-79	13.00%	12.31%	-0.69%
	Females	30-59	21.00%	19.79%	-1.21%
		60-79	7.00%	5.34%	-1.66%
Relative inequalities gap (prevalence difference [low/high])	Males	30-59	169.44%	168.73%	-0.71%
		60-79	139.39%	139.10%	-0.29%
	Females	30-59	160.00%	159.33%	-0.67%
		60-79	124.14%	118.43%	-5.71%





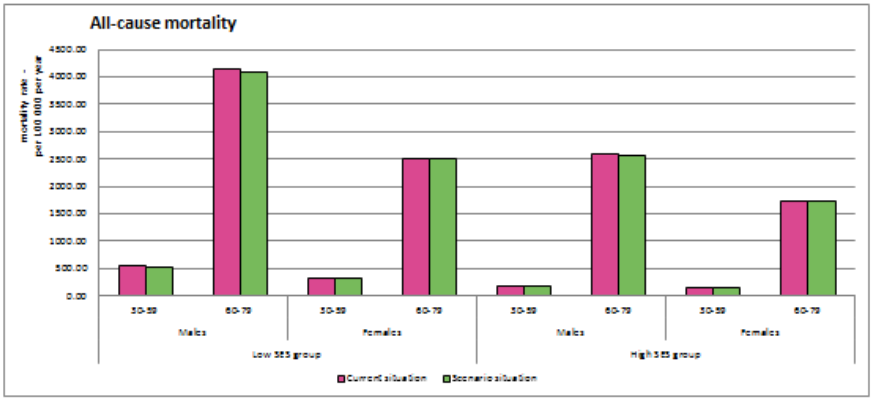


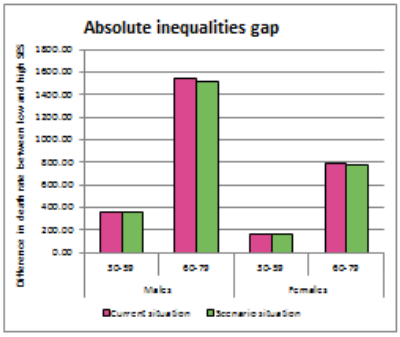
HEALTH INDICATORS

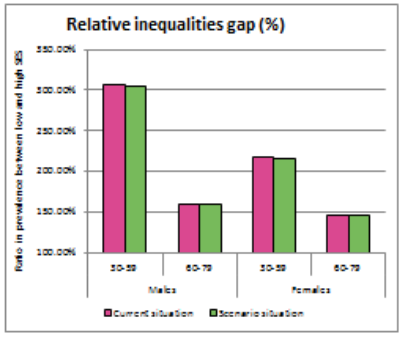
				Current situation (before shift in risk factor prevalence)	Scenario situation (after shift in risk factor prevalence)	excess premature (due to shift in risk factor prevalence)	
① **All-cause mortality** mortality rate - per 100 000 per year NOTE: for all sub-groups (combinations of age-group, gender and SES) the numbers presented are per 100 000 / year.	Low SES group	Males	30-59	541.00	531.93	9.07	
			60-79	4135.00	4084.94	50.06	
		Females	30-59	314.00	310.15	3.85	
			60-79	2513.00	2493.35	19.65	
	High SES group	Males	30-59	176.00	174.11	1.89	
			60-79	2596.00	2572.60	23.40	
		Females	30-59	145.00	143.87	1.13	
			60-79	1716.00	1716.00	0.00	
	① Absolute inequalities gap (absolute rate [low-high])	Males	30-59	365.00	357.82	-7.18	*
			60-79	1539.00	1512.34	-26.66	*
		Females	30-59	169.00	166.28	-2.72	*
			60-79	797.00	777.35	-19.65	*
	① Relative inequalities gap (% [percentage difference [low/high]])	Males	30-59	307.39%	305.51%	-1.88%	**
			60-79	159.28%	158.79%	-0.50%	**
		Females	30-59	216.55%	215.58%	-0.97%	**
			60-79	146.45%	145.30%	-1.14%	**
① **PIF** (potential impact fraction)	Low SES group	Males	30-59		1.68%		
			60-79		1.21%		
		Females	30-59		1.23%		
			60-79		0.78%		
	High SES group	Males	30-59		1.07%		
			60-79		0.90%		
		Females	30-59		0.78%		
			60-79		0.00%		

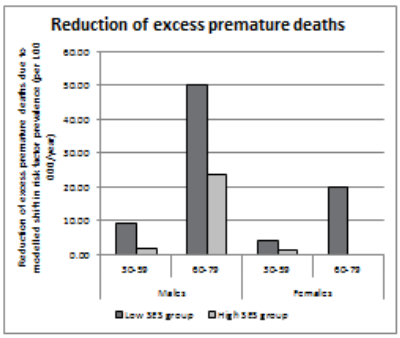
* reduction in the absolute inequality gap [new gap - old gap]

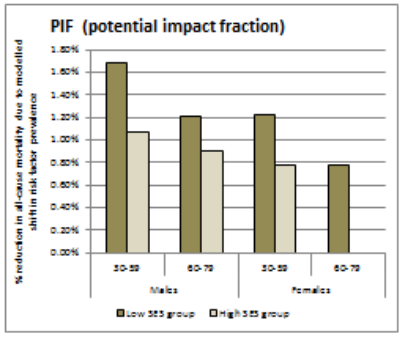
** reduction in the relative inequality gap [new gap - old gap] [in percentage points]











Introduction

The Health Equity 2020 project

Equity is about fairness and justice. Promoting equity is essential if human and social development is to be combined with economically productive societies. Reducing health disparities is important, and the upward trends for such differences call for further innovative, collaborative actions at all levels. The general objective of the Health Equity 2020 (HE2020) project is to assist Member States & regions to develop evidence-based regional action plans on reducing health inequalities, which also informs the use of European Structural and Investment Funds in the present and new programming period. By targeting policy-makers and practitioners who make and shape policies and implement actions, the project seeks to both (i) explore potential action areas & (ii) make the case (including economic evidence) for investments to reduce inequalities through regional actions within & beyond the health sector. The project uses different methods and means to achieve its objectives: (i) developing a toolkit and a portfolio of policy actions sensitive to differing needs in the regions (ii) supplement this toolkit by a practical knowledge database with good practice case examples, and (iii) organizing an Action Learning Workshop series & developing follow-up Action Learning Sets to increase knowledge & capacity of local stakeholders dealing with health inequalities.

The Health Equity 2020 Toolkit

An important product within Health Equity 2020 is a toolkit which provides a step-by-step approach towards developing these action plans. In the introduction, the main concepts, rationale and the general structure of the toolkit are presented. The toolkit consists of four phases that are important in developing evidence-based action plans; Phase 1 is the needs assessment, Phase 2 covers capacity assessment, Phase 3 assists in selecting entry points and Phase 4 describes the impact assessment (see Figure 1). The final goal of these phases is to draw up evidence based action plans that address socioeconomic health inequalities in the region.

In addition, the Action Database provides examples of action that could reduce socioeconomic inequalities in health. The Action Plans section provides examples of action plans developed by regions, and are included as a source of inspiration.

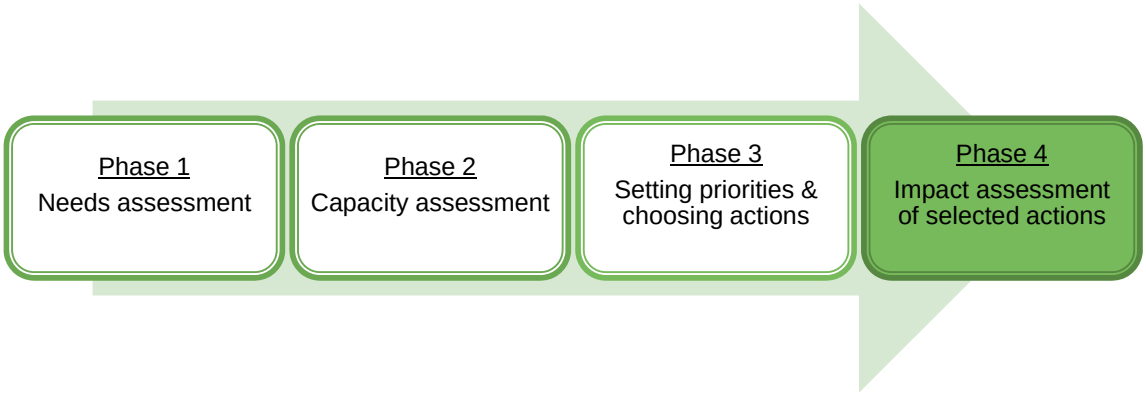


Figure 1: The process towards evidence-based action plans

The HE2020 quantitative tool

The HE2020 quantitative tool is one of the tools developed for ***Phase 4*** of the structured process followed within the toolkit: 'Impact assessment of selected actions'. The aim of the tool is to model the impact of policies or interventions that influence the prevalence or distribution of health behaviours on all-cause mortality and specifically on socioeconomic inequalities in all-cause mortality.

The HE2020 quantitative tool is designed to be a relatively simple, user-friendly quantitative modelling tool that is able to estimate the impact of policies and interventions on inequalities in mortality. In this tool, a change in risk factor prevalence (for example a decrease in smoking of 15%) can be modelled in order to obtain estimates of the impact on mortality and socioeconomic inequalities in mortality.

Data input

The first step in using the tool is to either select an existing dataset in the tool or to input own data that are relevant to the situation of the user.

Choosing an existing data set

The tool currently is equipped with three general datasets to choose from. The use of these datasets is recommended if there is no own data available. By using one of these three general datasets, the tool can still be used, even in absence of own data. However, the user should be aware that the results need to be interpreted with care and can only be used to estimate the potential order of magnitude of the effects and no significance should be given to the exact estimates. We recommend the use of own (local, regional or national) data when possible.

The datasets that are available in the tool are:

- Central-Eastern European region; the average of data from Estonia, Czech Republic and Hungary.
- North-Western European region: the average of data from Norway, Sweden, Finland, Denmark, England, Belgium and Switzerland.
- Southern European region: the average of data from Spain (represented by the Basque country, Barcelona and Madrid) and Italy (represented by the regions of Turin and Tuscany).

Entering own data

If own data are available for the specific country or region, this data can be entered into the tool so the tool can use this data for all calculations. The data needs to fulfil certain requirements to be able to be entered into the tool. The tool needs a certain minimum dataset to be able to function properly. In the following sections, the general data requirements are explained and this minimum dataset is described. More information on definitions and calculations can be found in the technical appendix.

General data requirements

Data is needed on all-cause mortality and risk factor prevalence. All this data should be stratified by gender, at least two socioeconomic groups (maximum of three), and two robust adult age categories (30-59 and 60-79).

Mortality data

The mortality in this tool refers to all-cause or total mortality within a population. The mortality should be age-standardized *within each age-category*. The sample data that is available within the tool uses annual mortality rates per 100,000.

NOTE: It is possible to use a different rate such as mortality per 10,000 but it is important to be consistent throughout your data.

Mortality rates are needed by:

- Age category (30-59 and 60-79)
- Gender (males and females)
- Socioeconomic group (two or three groups)

Possible sources to obtain mortality data from are national statistical offices and death registries (possibly linked to obtain information on socioeconomic status).

Table 1 shows an example of how the mortality data could look:

Table 1: Example of mortality data in the tool.

Mortality rate (per 100.000 person years)				
	Males		**Females**	
Education	**30-59**	**60-79**	**30-59**	**60-79**
Low	535	4028	309	2483
Middle	329	3586	190	1989
High	186	2642	138	1615

Risk factor prevalence

The risk factors that are included in this tool have strong evidence that they cause premature mortality. The risk factors that are now available in the tool are:

- Smoking
- Overweight and obesity
- Leisure time physical inactivity
- Alcohol consumption
- Diabetes Mellitus
- Inadequate fruit and vegetable consumption

The definitions of these risk factors and the used categories can be found in the technical appendix. Data about risk factor prevalence can often be obtained from health surveys.

All risk factor prevalence is needed by:

- Age category (30-59 and 60-79)
- Gender (males and females)
- Socioeconomic group (two or three groups)

Table 2 shows an example of how the risk factor prevalence data could look.

Table 2: Example of risk factor prevalence data in the tool.

Risk factor prevalence					
		Males		Females	
Education	**Smoking**	**30-59**	**60-79**	**30-59**	**60-79**
Low	Current	0.56	0.44	0.53	0.33
	Former	0.21	0.40	0.18	0.25
	Never	0.23	0.16	0.29	0.42
Middle	Current	0.46	0.37	0.44	0.30
	Former	0.24	0.47	0.20	0.29
	Never	0.30	0.16	0.35	0.41
High	Current	0.35	0.32	0.33	0.28
	Former	0.25	0.44	0.25	0.34
	Never	0.40	0.24	0.42	0.38

NOTE: The prevalence is presented as a percentage in the outcomes of the tool (e.g. 54%) but they should be entered in the tool as fractions (e.g. 0.54).

NOTE: The risk factors in the tool are all risk factors at the individual level and related to health-behaviours. It is known that other risk factors, such as environmental conditions, also influence socioeconomic health inequalities. However, at the time of the development of this tool, the lack of appropriate evidence available prevented us to include these risk factors. For decision making, it is important to also consider the risk factors outside the ones available in this tool.

Minimum dataset

The minimum dataset that is required to use the tool in its most limited form should contain information on all-cause mortality and at least one risk factor. The data should be for:

- Men *or* women
- Age group ±30-59 *or* ± 60-79
- At least 2 socioeconomic groups (maximum of three)

NOTE: The tool is relatively robust to the defined age-categories.

NOTE: The tool can be used to compare all kinds of socioeconomic groups such as low, medium and high educated (as in the sample data), low or high income, rural and urban, etcetera. The only requirement is that it is a logical assumption that the relative risks of the risk factors are the same for these different socioeconomic groups (e.g. smoking is just as harmful for low educated people as for high educated people). The relative risks that are included in the tool can be found in the technical appendix.

Modelling the risk factor changes

When the data is entered in the tool (or a predefined dataset will be used), the tool can be used to model the impact of changes in risk factor prevalence on mortality disparities. For example, if an intervention to increase physical activity in the population is expected to achieve a 10% increase in leisure time physical activity, with this tool, the impact of this change in risk factor prevalence on socioeconomic inequalities in all-cause mortality can be calculated.

Using the tool involves three main steps:

1. Selecting the dataset
2. Selecting the risk factor
3. Entering the shift in risk factor distribution

To start the tool, open the excel file and click on the pink START button.

NOTE: macro's need to be enabled. If macro's cannot be enabled or if the pink 'Start' button does not work, go directly to the tab 'Tool – input' to continue the use of the tool.

Step 1: Select dataset

The first step is to select the appropriate dataset. When own data is entered into the tool, the appropriate selection would be *"* Entered data (input own data – see tab 'data – help')"*. If no data is entered by the user, the user should select one of the predefined datasets (e.g. *"Southern European Region"*). This first step makes sure the tool will work with the appropriate dataset.

Step 2: Select risk factor

The second step is to select the risk factor that is supposed to be affected by the proposed intervention. When the aim is to calculate the impact of a smoking intervention, the user should select "*Smoking*". When the aim is to evaluate the potential effects of an intervention aimed at increased fruit and vegetable consumption, the user should select *"Fruit & vegetable consumption"*.

In the blue box on the input screen (beige box in the input screen without pop-up screen), information is given on the categories used in the tool for that particular risk factor (e.g. smokers, former smokers and never smokers).

Step 3: Enter shift in risk factor distribution

The third step is the most complex step. In this step, the user specifies the reduction in prevalence of the risk factor state with the highest risk that is expected. This prevalence reduction needs to be specified for all sub-groups you want to model: younger and older males and females of all included socioeconomic groups.

This third step requires the most preparation from the user. To specify this reduction in prevalence, it is necessary to have an idea of the amount of change that is expected to be accomplished by the proposed policy or intervention. This information may be obtained from previous research, reports or experiences from similar programs or from a pilot study. If no such information is available, the users have to make a balanced estimated based on the knowledge and experience they do have.

The percentage that needs to be entered is the percentage *change* in the at risk categories for the risk factor. For example, when current diabetes prevalence, in older men of low socioeconomic status, is 10%, and a certain intervention is expected to lower diabetes prevalence by 20% in this group, the new modelled prevalence would be 8% (20% of 10% = 2%, 10 - 2=8). The percentage of non-diabetics in this case would increase from 90% (100 - 10=90) to 92% (100 - 8=92).

In the blue box on the input screen (beige box in the input screen without pop-up), information is given on how the percentage change is modelled in the tool, i.e. how the change is distributed across the remaining risk factor categories. More information on how the changes in prevalence are handled for each of the risk factors can be found in the technical appendix.

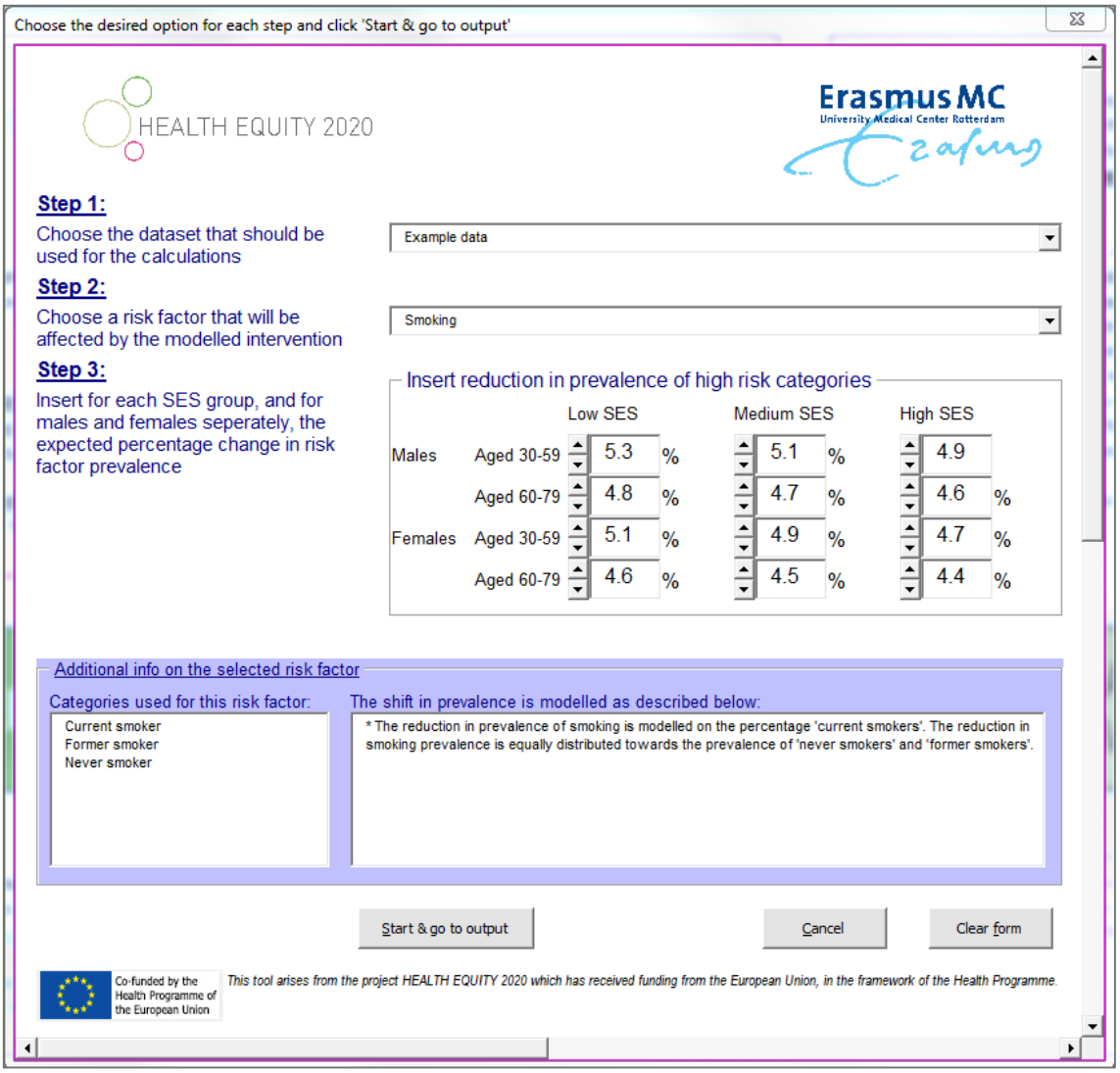


Figure 2: Screenshot of the input screen of the quantitative HE2020 tool.

Model output

When all steps in the input screen are fulfilled, the tool will calculate how the entered reductions in risk factor prevalence will influence socioeconomic inequalities in risk factor prevalence and all-cause mortality. All output is displayed in the 'Tool – output' tab. This tab can be accessed from the input screen by clicking 'Start & go to output'.

Risk factor prevalence

The top section of the output screen (figure 2) displays information on the risk factor prevalence. In the pink cells, the current risk factor prevalence is displayed. In the green cells, the modelled risk factor prevalence is displayed (after the entered reduction in risk factor prevalence). The grey cells display the difference between the current and the modelled situation.

In addition to the risk factor prevalence for the different socio-demographic groups (males, females, 30-59 year olds and 60-79 year olds, low and high socioeconomic position), the output screen also displays the absolute and relative inequalities in the current and in the modelled situation.

The *absolute inequalities* are calculated as the difference in percentage points between the low and the high socioeconomic groups (e.g. when the prevalence in the high socioeconomic group would be 30% and the prevalence in the low socioeconomic group would be 20%, the absolute inequalities would be 10% (30 - 20=10).

The *relative inequalities* are calculated as the ratio between the risk factor prevalence in the low socioeconomic group compared to the high socioeconomic group. The relative inequalities are also displayed as a percentage (e.g. when the prevalence in the high socioeconomic group would be 30% and the prevalence in the low socioeconomic group would be 20%, the ratio would be 1.5 (30 divided by 20=1.50) and the displayed relative inequalities would be 150%).

All of the output displayed in tables, is displayed in figures as well.

Figure 3: Screenshot of the output screen of the quantitative HE2020 tool – risk factor.

All-cause mortality

The bottom section of the output screen displays (figure 4) information regarding all-cause mortality. In the pink cells, the current mortality rate is displayed. In the green cells, the modelled mortality rate is displayed that is calculated by modelling the entered reduction in risk factor prevalence. The grey cells display the difference between the current and the modelled situation.

In addition to mortality rates in each of the different socio-demographic groups, the output screen also displays the absolute and relative inequalities in the current and in the modelled situation. Furthermore, information is displayed on the Potential Impact Fraction. Information on these different measures is in the next few paragraphs.

The *absolute inequalities* are calculated as the difference in the mortality rate between the low and the high socioeconomic groups (e.g. when the mortality rate in the high socioeconomic group would be 300 per 100,000 person years and the mortality rate in the low socioeconomic group would be 500 per 100,000 person years, the absolute inequalities would be 200 per 100,000 person years (500 - 300=200).

The *relative inequalities* are calculated as the ratio between the mortality rate in the low socioeconomic group compared to the high socioeconomic group. The relative inequalities are displayed as a percentage (e.g. when the mortality rate in the high socioeconomic group would be 300 per 100,000 person years and the mortality rate in the low socioeconomic group would be 500 per 100,000 person years, the ratio would be 1.6667 (500 divided by 300=1.67) and the displayed relative inequalities would be 166.67%).

The *Potential Impact Fraction (PIF)* is the fraction of all-cause mortality that would not have occurred when the exposure to a specific risk factor is decreased with a certain amount (the reduction in risk factor prevalence modelled by the user). So, a PIF of 5% means that 5% of all-cause mortality can be prevented if the modelled reduction in risk factor prevalence would be achieved. The PIF is also used as the main modelling method within the tool. More information on the modelling method can be found in the technical appendix.

All of the output displayed in tables, is displayed in figures as well.

Figure 4: Screenshot #2 of the output screen of the quantitative HE2020 tool - mortality.

Troubleshoot

Problem	Possible solution
Error message when I click on START	Macros are not enabled. Macros are needed to use the pop-up input screen that you access via the pink START button. Enable macros (see Microsoft help on how to enable macros in your Office package) or go directly to 'Tool – input' to use the tool without macro's.
When I enter a change in distribution directly into the input screen, the number that appears is incorrect (only when working in the pop-up screen via START)	You can enter values directly, or use the arrow buttons. Entering the values directly works in most cases. However, if you enter a whole number (e.g. 5 or 5.0), it will display 0.5. This has to do with the underlying programming. A work around is to work via the arrow buttons or to type in 5.1 and click once on the downwards arrow.
When I click back on START to do a new calculation, the input screen is empty again.	This is correct. The input screen will always clear when you click on START. If you want to keep your input (e.g. to only change some of the reductions in prevalence), we advise you to work directly via the 'Tool – input' screen and not via the pop-up START screen.
If you come across other problems that are not in the user guide or in the troubleshoot, please inform us.	

Warning: Never cut – paste into cells when you enter data. This will affect the underlying structure of the document and causes errors in the calculations of the tool. Only type in data or paste 'values' (Home → Paste → Paste values)

To paste values in MS Excel, use this icon:

Further information and contact information

For questions or more information on the methods used in this tool, contact the developers of the tool:

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The Netherlands
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Technical appendix

Aim

The aim of the HE2020 quantitative tool is to model the impact of policies or interventions that influence the prevalence or distribution of health behaviours on all-cause mortality and specifically on socioeconomic inequalities in all-cause mortality.

Method

The method used in the modelling tool is based on the Potential Impact Fraction (PIF). The method is a population based risk assessment method in which the unequal distribution of health risk behaviour is estimated for a simulated exposure. It is used to quantify the effects of risk factors and their interventions on population health.

Potential Impact Fraction

The Potential Impact Fraction (PIF) models the proportional change in mortality after a change in the exposure of a related (causal) risk factor.

$$PIF = \frac{\sum_{i=n}^{n} P_i RR_i - \sum_{i=n}^{n} P_i' RR_i}{\sum_{i=n}^{n} P_i RR_i}$$

n = number of exposure categories
P_i = proportion of population currently in the ith exposure category
P'_i = proportion of population in the ith exposure category in the modelled situation
RR_i = relative risk of mortality for the ith exposure category

$$PIF = \frac{(\text{Risk}_{\text{current situation}}) - (\text{Risk}_{\text{alternative situation}})}{(\text{Risk}_{\text{current situation}})}$$

$$PIF = \text{Risk reduction}_{\text{ due to change}}$$

Risk factors included in the tool

General information

The tool models a reduction in risk factor prevalence. This means that a 10% change would affect more people in a group with a high prevalence of a certain risk factor than in a group with a low prevalence of this risk factor. For example, if an intervention would reduce smoking with 10% and the intervention is equally effective in all socioeconomic groups, this would affect more people in the lower socioeconomic groups than in the high socioeconomic group, since more people smoke in this group. How the changes between the risk factor categories are modelled in the tool is described for each risk factor separately.

Smoking

Smoking was defined based on whether people where current, past or never smokers. The categories that are included in the tool, including their definitions, are:

- current smoker: those who currently smoke (both daily and occasional smokers)
- former smoker: those who smoked in the past but are not currently smoking
- never smoker: those who never smoked

Relative risks

Relative risk of all-cause mortality due to smoking were derived from the second Cancer Prevention Study (CPS-II) conducted by the American Cancer Society (ACS) among a cohort of 1 185 106 US American volunteers and with a follow-up of six years from 1982 to 1988 (Thun et al, 1997). The relative risks differ by gender and are presented in table 3.

Table 3: Relative risks of smoking on all-cause mortality.

	Men		Women	
	Aged 30-59	**Aged 60-79**	**Aged 30-59**	**Aged 60-79**
Current smoker	2.07	2.07	1.74	1.74
Former smoker	1.35	1.35	1.23	1.23
Never smoker	1.00	1.00	1.00	1.00

Modelled distribution shifts

The reduction in prevalence of 'smoking' is modelled in such a way that half of the reduction in smokers is shifted to the former-smokers category and half of the smokers transition towards the never-smoker category.

Suppose, a region has a current smoking prevalence of 50%. Of the non-smokers, 20% is former smoker and 30% is never-smoker. When a reduction in smoking of 10% is modelled, the prevalence of smoking becomes 45% (10% of 50% is 5 percentage points reduction, 50 – 5 = 45). Of this 5 percentage points reduction, 2.5 would move towards the former smoker category. The modelled prevalence of former smokers becomes 22.5% (20 + 2.5 = 22.5). The other half of the 5 percentage points would move towards the never smoker category. The modelled prevalence of never smokers would become 32.5% (30 + 2.5 = 32.5).

NOTE: The chosen shifts are based on an intervention that results in a hypothetical equal mix between smoking cessation (people will quit smoking due to the intervention) and smoking prevention (people will not start to smoke in the first place due to the intervention). In real life, interventions are probably focused towards either smoking cessation or smoking prevention. An intervention that primarily aims at smoking cessation would result in lower reductions in all-cause mortality since it is expected that the reduction is smokers is mirrored by an increase in former-smokers. Former smokers still have a higher mortality risk than never smokers. An intervention that primarily aims at smoking prevention would result in higher reductions in all-cause mortality since it is expected that the reduction is smokers is mirrored by an increase in never smokers.

Overweight and obesity

Overweight and obesity were defined based on the Body Mass Index (BMI). BMI is a measure of relative weight based on an individual's mass and height and is calculated with the formula below.

$$BMI = \frac{Weight\ (in\ kilogram)}{(height\ (in\ meters))2}$$

The internationally accepted cut-off values for adult BMI, as defined by the WHO (REF), were used to categorize the following three categories:

- obese: all with a BMI of 30 or higher (BMI >=30)
- overweight: all with a BMI of 25 or higher but below 30 (BMI 25 to <30)
- normal weight: all with a BMI below 25 (BMI <25)

Relative risks

Relative risk of all-cause mortality due to overweight and obesity were derived from Lhachimi (2011). The authors conducted a literature review and calculated relative risks for overweight and obese individuals by single age from 0 to 95 years. We computed average of these single age relative risks for the given age groups 30–59 and 60-79. The relative risks differ by gender and are presented in table 4.

Table 4: Relative risks of overweight and obesity on all-cause mortality.

	Men		Women	
	Aged 30-59	**Aged 60-79**	**Aged 30-59**	**Aged 60-79**
Obese	1.55	1.51	1.50	1.46
Overweight	1.20	1.19	1.15	1.14
Normal weight	1.00	1.00	1.00	1.00

Modelled distribution shifts

The reduction in prevalence of 'overweight and obesity' is modelled stepwise on the percentage 'obesity' and the percentage 'overweight'. The reduction in the prevalence of 'obesity' is distributed towards 'overweight'. The reduction in the prevalence of 'overweight' is distributed towards 'normal weight'.

Suppose, a region has a current prevalence of 30% obesity, 20% overweight and 50% normal weight. When a reduction of 10% is modelled, firstly obesity would be reduced by 10% and this reduction would move towards the overweight category. The new obesity prevalence (after modelling) becomes 27% (10% of 30% is 3 percentage points reduction, 30 – 3 = 27). These 3%, who were obese, will now be overweight. The original percentage of overweight is also reduced by 10% so it would be 18% (10% of 20% is 2 percentage points reduction, 20 – 2 = 18). However, the 3 percentage points that came from the obese category still have to be added. Therefore, the final prevalence of overweight after modelling would be 21% (18 + 3 = 21). The prevalence of normal weight would then be the rest of the population: 52% (100 – 27 – 21 = 52).

Leisure time physical activity

Leisure time physical activity includes all moderate or strenuous physical activity that is carried out during leisure time. It is categorized robustly into those who are active and those who are inactive:

- physically inactive: low-level activity dominated life style (sedentary)
- physically active: at least lightly active during leisure time

Relative risks

The relative risks of all-cause mortality due to physical inactivity were derived from a systematic review and meta-analysis of Nocon, Hiemann, and Müller-Riemenschneider et al. (2008). In this review, the relative risks compared the least active (reference group) with the most active. For the tool, we needed a relative risks that compared the most active (reference group) with the least active. The relative risks were therefore recalculated for the active as reference category. The relative risks differ by gender and are presented in table 5.

Table 5: Relative risks of physical inactivity on all-cause mortality.

	Men		Women	
	Aged 30-59	**Aged 60-79**	**Aged 30-59**	**Aged 60-79**
Inactive	1.28	1.28	1.54	1.54
Active	1.00	1.00	1.00	1.00

Modelled distribution shifts

The prevalence reduction in the high-risk category will directly influence the prevalence increase in the low-risk category.

Suppose, a region has a physical inactivity prevalence of 40% and the prevalence of physically activity is therefore 60%. When a reduction of 20% in inactivity prevalence is modelled, the new inactivity prevalence (after modelling) would become 32% (20% of 40% is 8% of the total population, 40 – 8 = 32). The physical activity prevalence would then become 68%.

Alcohol consumption

Alcohol consumption was defined as the average amount of pure alcohol consumed per day. In questionnaires, these amounts can be approximated by using information on the average number of standard glasses of alcohol consumed per day. Based on internationally widely accepted cut-off points, the following categories were used in the tool:

- very heavy drinker: consumes 60 or more grams of alcohol a day (>=60g/day)
- heavy drinker: consumes between 40 & 60 grams of alcohol a day (40 to <60g/day)
- moderate drinker: consumes between 20 & 40 grams of alcohol a day (20 to <40g/day)
- light drinker: consumes between 0.25 & 20 grams of alcohol a day (0.25 to <20g/day)
- abstainer: consumes less than 0.25 grams of alcohol a day (<0.25g/day)

The labels that were given to the different categories (e.g. light drinker) are mostly for ease of use of the tool and are somewhat arbitrary. We choose to keep the categories and accompanying labels the same for men and women. It should be acknowledged that for men, the boundaries of what is still considered healthy are wider than for women. In addition, there are indications that light drinking may be beneficial to a person's health. These differentiations are reflected in the used relative risks.

Relative risks

The relative risk of all-cause mortality due to alcohol consumption were derived from the DYNAMO-HIA study (final report, page 373-377) and were originally derived and adapted from the study by White et al (2002). The relative risks differ by age group and gender and are presented in table 6.

Table 6: Relative risks of alcohol consumption on all-cause mortality.

	Men		Women	
	Aged 30-59	**Aged 60-79**	**Aged 30-59**	**Aged 60-79**
Alcohol: >=60 g/day	1.40	1.12	1.52	1.39
Alcohol: 40 to <60 g/day	1.18	1.03	1.27	1.18
Alcohol: 20 to <40 g/day	1.07	0.97	1.13	1.07
Alcohol: 0.25 to <20 g/day	0.99	0.94	1.02	0.99
Alcohol: 0 to <0.25 g/day	1.00	1.00	1.00	1.00

Modelled distribution shifts

The reduction in prevalence of 'alcohol consumption' is modelled stepwise on the very heavy, the heavy and the moderate drinkers. The reduction in the prevalence of 'very heavy drinkers (>=60 g/day)' is distributed towards the category 'heavy drinkers (40 to <60 g/day)'. The reduction in the prevalence of 'heavy drinkers (40 to <60 g/day)' is distributed towards the category 'moderate drinkers (20 to <40 g/day)'. The reduction in the prevalence of 'moderate drinkers (20 to <40 g/day)' is distributed towards the category 'light drinkers (0.25 to <20 g/day)'. Since light drinking has no excess health risk, there is no reduction modelled in the prevalence of 'light drinkers (0.25 to <20 g/day)'. The category 'abstainers (0 to <0.25 g/day)' is kept constant.

Suppose, a region has a current prevalence of 5% very heavy drinkers, 10% heavy drinkers, 15% moderate drinkers, 60% light drinkers and 10% abstainers. When a reduction of 10% is modelled, firstly the very heavy drinkers would decrease by 10% and this reduction would move towards the heavy drinker category. The new very heavy drinker prevalence (after modelling) becomes 4.5% (10% of 5% is 0.5 percentage points reduction, 5 – 0.5 = 4.5). These 0.5% who were very heavy drinkers, will now be heavy drinkers. The original percentage of heavy drinkers is also reduced by 10% so it would be 9% (10% of 10% is 1 percentage points reduction, 10 – 1 = 9). These 1% who were heavy drinkers, will now be moderate drinkers. However, the 0.5 percentage points that came from the very heavy drinkers category still has to be added. Therefore, the final prevalence of heavy drinkers after modelling would be 9.5% (9 + 0.5 = 9.5). Etcetera.

Diabetes Mellitus

Diabetes Mellitus was defined as being diagnosed with Diabetes Mellitus:

- diabetes yes: those who are diagnosed with diabetes mellitus
- diabetes no: those who are not diagnosed with diabetes mellitus

Relative risks

The relative risks for diabetes mellitus were obtained from the Emerging Risk Factors Collaboration (2011). The relative risks differ by age group and gender and are presented in table 7.

Table 7: Relative risks of diabetes mellitus on all-cause mortality.

	Men		Women	
	Aged 30-59	**Aged 60-79**	**Aged 30-59**	**Aged 60-79**
Diabetes	2.32	1.60	2.32	2.32
No diabetes	1.00	1.00	1.00	1.00

Modelled distribution shifts

The prevalence reduction in the high-risk category will directly influence the prevalence increase in the low-risk category.

Suppose, a region has a diabetes prevalence of 30% and the prevalence of non-diabetes is therefore 70%. When a reduction of 10% in diabetes prevalence is modelled, the new diabetes prevalence (after modelling) would become 27% (10% of 30% is 3% of the total population, 30 – 3 = 27). The non-diabetes prevalence would then become 73%.

Fruit and vegetable consumption

Fruit and vegetable consumption was defined based on whether the respondent would consume fruits and vegetables on a (almost) daily basis or less:

- (almost) never consumption of fruits and vegetables: those who consume fruits and vegetables less than once a week (<1 times/week)
- at least once a week consumption of fruits and vegetables: those who consume fruits and vegetables between 1 and 3 times a week (1-3 times/week)
- (almost) daily consumption of fruits and vegetables: those who consume fruits and vegetables on 4 or more days a week (4-7 times/week)

Relative risks

The relative risks for fruit and vegetable consumptions were based on the calculation done within the EURO-GBD-SE project (final report, p319) that used cause-specific relative risks reported by Danaei et al (2009). The relative risks differ by age group and gender and are presented in table 8.

Table 8: Relative risks of insufficient fruit and vegetable consumption on all-cause mortality.

	Men		Women	
	Aged 30-59	**Aged 60-79**	**Aged 30-59**	**Aged 60-79**
(Almost) never consumption of fruits and vegetables	1.22	1.20	1.20	1.19
At least 1/week consumption of fruits and vegetables	1.14	1.14	1.13	1.12
(Almost) daily consumption of fruits and vegetables	1.00	1.00	1.00	1.00

Modelled distribution shifts

The reduction in prevalence of 'fruit & vegetable consumption' is modelled stepwise on the percentage '(almost) never consumption of fruits and vegetables' and the percentage 'at least once a week consumption of fruits and vegetables'. The reduction in the prevalence of the category '(almost) never consumption of fruits and vegetables' is distributed towards the category 'at least once a week consumption of fruits and vegetables'. The reduction in the prevalence of the category 'at least once a week consumption of fruits and vegetables' is distributed towards the category '(almost) daily consumption of fruits and vegetables'.

Suppose, a region has a current prevalence of 30% of '(almost) never consumption of fruits and vegetables', 20% 'at least once a week consumption of fruits and vegetables' and 50% '(almost) daily consumption of fruits and vegetables'. When a reduction of 10% is modelled, firstly the category '(almost) never consumption of fruits and vegetables' would be reduced

by 10% and this reduction would move towards the category 'at least once a week consumption of fruits and vegetables'. The new prevalence of '(almost) never consumption of fruits and vegetables' (after modelling) becomes 27% (10% of 30% is 3 percentage points reduction, 30 – 3 = 27). These 3%, who were in the category '(almost) never consumption of fruits and vegetables', will now be in the category 'at least once a week consumption of fruits and vegetables'. The original percentage of the category 'at least once a week consumption of fruits and vegetables' is also reduced by 10% so it would be 18% (10% of 20% is 2 percentage points reduction, 20 – 2 = 18). However, the 3 percentage points that came from the category '(almost) never consumption of fruits and vegetables' still has to be added. Therefore, the final prevalence of the category 'at least once a week consumption of fruits and vegetables' after modelling would be 21% (18 + 3 = 21). The prevalence of the category '(almost) daily consumption of fruits and vegetables' would then be the rest of the population: 52% (100 – 27 – 21 = 52).

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