World Health Organization

Technical briefing for Appendix 3 of the Global Action Plan for Non-Communicable Diseases

Interventions to promote healthy diet

List of interventions

Number	Intervention
H1	Reformulation policies for healthier food and beverage products (e.g. elimination of *trans*-fatty acids and/or reduction of saturated fats, free sugars and/or sodium)
H2	Front-of-pack labelling as part of comprehensive nutrition labelling policies for facilitating consumers' understanding and choice of food for healthy diets
H3	Public food procurement and service policies for healthy diets (e.g. to reduce the intake of free sugars, sodium, unhealthy fats, and to increase the consumption of legumes, wholegrains, fruits and vegetables)
H4	Behavioural change communication and mass media campaigns for healthy diets (e.g. to reduce the intake of energy, free sugars, sodium, unhealthy fats, and to increase the consumption of legumes, wholegrains, fruits and vegetables)
H5	Policies to protect children from the harmful impact of food marketing on diet
H6	Protection, promotion and support of optimal breastfeeding practices (*see page 7*)
H7	Taxation on sugar-sweetened beverages (SSB) as part of comprehensive fiscal policies to promote healthy diets (*see page 10*)

Identification of interventions (H1 to H5)

The interventions to promote healthy diets were included in the WHO Global Action Plan for the Prevention and Control of NCDs 2013-2020 [1], building on WHO global strategy on diet, physical activity and health [2], the WHO/UNICEF global strategy for infant and young child feeding [3], and the comprehensive implementation plan on maternal, infant and young child nutrition [4]. These interventions have been reiterated in the WHO Essential nutrition actions: mainstreaming nutrition through the life-course [5] and in the FAO/WHO Second International Conference on Nutrition Rome Declaration on Nutrition [6] and Framework for Action [7] which informs the United Nations Decade of Action on Nutrition 2016-2025 [8], the Commission on Ending Childhood Obesity [9], and recently reconfirmed following the 2021 United Nations Food Systems Summit [10] through the WHO priority actions to promote food systems for health[i]. These interventions are underpinned by WHO guidelines related to healthy diet,

[i] WHO. Food systems for health. https://www.who.int/initiatives/food-systems-for-health

including dietary goals for the prevention of obesity and diet-related noncommunicable diseases (NCDs), policy actions which have an impact on the food environment as well as infant feeding[ii].
Compared to the 2017 update, the following major changes were implemented to the healthy diet interventions:

- Impact pathways and effect sizes were updated for reformulation, nutrition labelling and public food procurement and service policies (interventions H1, H2 and H3). Revisions to impact pathways were done to consider additional potential harmful nutrients or unhealthy food, considering that WHO recommends countries take comprehensive and coherent policy actions to promote healthy diets and healthy food systems.
- The intervention on *trans*-fatty acid (TFA) elimination previously included in the 2017 update was integrated into the intervention on reformulation policies for healthier food and beverage products (intervention H1).
- Protection, promotion and support of optimal breastfeeding practices was added as an intervention with cost-effective analysis[iii]. Cost-effectiveness analysis was performed building on the existing breastfeeding promotion and counselling intervention in the OneHealth Tool where outcomes were added relating to reduced overweight, obesity and diet-related NCDs as result of improved breastfeeding practices.
- Policies to protect children from the harmful impact of food marketing was added as a new intervention with cost-effective analysis.
- The costing modules were updated to include key activities across the cycle of policy preparation, development, implementation and monitoring, enforcement and evaluation. In particular, the costs of monitoring and enforcement activities were considered, as this is often pointed out as a weak link in achieving policy compliance.

Methodological assumptions

- The impact of interventions H1-H6 was estimated with the OneHealth Tool [11].
- Country estimates for population level intakes in adults (interventions H1, H2, H4) were derived from the Global Burden of Disease 2019 (sodium, energy% from saturated and trans fat) [12] and the FAO food balance sheets (daily energy supply) [13].
- Country estimates for population level intakes in children and adolescents (interventions H3 and H5) were derived from the Global Dietary Database [14] (sugar-sweetened beverages (SSB), fruit and vegetables, energy% from saturated fat) for the age groups 6-9 and 10-14 years and the FAO food balance sheets (daily energy supply) [13].
- For each of the interventions, we provide additional clarifications in the annex (page 8) on the studies underlying the evidence mentioned in table 1.

[ii] WHO. Nutrition Guidance Expert Advisory Group (NUGAG). https://www.who.int/groups/nutrition-guidance-expert-advisory-group-(nugag)

[iii] The interventions was in the 2017 update without WHO-CHOICE analysis

Table 1: Impact sizes used in WHO-CHOICE analysis

	Population (P), effect size of interventions (E) and outcomes (O)	Comments on evidence and main changes to 2017 analysis
H1	**P:** Population >25 years of age of a country **E:** • Elimination (TFA) to CVD deaths/year = -14.2/100,000 population[1] • Reformulation (sodium) to salt intake = -0.57 g/day[2] • Salt intake to SPB = -5.56 mm Hg in SBP per -100 mmol/d, equivalent to -0.95 mm Hg in SBP per -1 g salt/d[3] • Reformulation (sugars) to body weight = -1.04 kg[4] **O:** Healthy Life Years (HLY) gained, and mortality averted.	Compared to the 2017 update, effect sizes were updated, expansion from reformulation to reduce sodium only to both sodium and sugars and to eliminate *trans*-fatty acids (TFA)[iv] [1] Based on a modelling study of the Danish TFA policy estimating a reduction of 14.2 CVD deaths/year per 100,000 population [15]. [2] Based on 12 studies in high income countries with baseline intakes ranging from 5.3g/day to 10.6g/day, follow-up period from 4 to 27 years (10 out of 12 studies evaluating changes over less than 10 years), and largely conducted in adults [16]. [3] Dose–response relationship established from 85 trials around the world, follow-up period ≥12 weeks [17]. [4] Results from 3 RTCs in adults, follow-up periods 8-10 weeks. Geographic location not reported [18].
H2	**P:** Population >25 years of age of a country **E:** • Nutrient declaration to energy% from TFA = -92.5%[1] • Energy% from TFA to total cholesterol = -0.045 mmol/L per % of energy from total TFA replaced by *cis*-PUFA[2] • FOPL to energy intake = -5.3%[3] • Energy intake to body weight = -0.95kg in body weight for each -100kJ/day (=24kcal/day) in energy intake (adults)[4] • FOPL to energy% from SFA = -6.8%[5]	Compared to 2017, additional nutrients than sodium were considered (TFA, SFA, dietary fibre, energy), and the intervention takes a more comprehensive approach to nutrition labelling including also nutrient declarations, which is a prerequisite for FOPL. Effect sizes were updated. [1] Reduction in energy% from TFA represent from 1992 to 2011, before and after mandatory inclusion of TFA on nutrient declarations, estimated from TFA content in breastmilk in women in Canada [19].

[iv] In the 2017 update TFA elimination was presented separately from reducing sodium in foods.

	• Energy% from SFA to total cholesterol = -0.064 mmol/L per 1% of energy from SFA replaced by cis-PUFA[6]
	• FOPL to sodium intake = -6.4%[7]
	• Sodium intake to SBP = -5.56 mm Hg in SBP per -100 mmol/d, equivalent to -1.04 mm Hg in SBP per -1 mg sodium/d[8]
	• FOPL to dietary fibre intake = -7.21%[9]
	• Dietary fibre intake[10]:
	  ○ Coronary heart disease: RR = 0.81 per 8 g/day
	  ○ Type 2 diabetes: RR = 0.85 per 8 g/day
	  ○ Colorectal cancer: RR = 0.92 per 8 g/day
	  ○ All-cause mortality: RR = 0.93 per 8 g/day
	
	O: Healthy Life Years (HLY) gained, and mortality averted.
		[2] Dose-response relationship between %energy from TFA and total cholesterol based on data in adult populations [20].
		[3] Reduction in purchases represent immediate or short-term effect of colour-coded and warning label interventions, and applied to dietary intakes [21].
		[4] Models weight change from change in energy intake in adults over a period of 3 years [22].
		[5] Reduction in purchases represent immediate or short-term effect of colour-coded and warning label interventions, and applied to dietary intakes. Change in SFA E% computed from change in SFA content (12.9%) relative to (non-significant) change in energy (6.5%) for the same comparison group, i.e. (12.9%-6.5%)/(1-6.5%) = 6.8%. [21].
		[6] Dose-response relationship between %energy from SFA and total cholesterol based on data in adult populations [23].
		[7] Reduction in purchases represents immediate or short-term effect of colour-coded and warning label interventions, and is applied to dietary intakes [21].
		[8] Dose–response relationship established from 85 trials involving >10,000 adults around the world [17].
		[9] Reduction in household purchases in a French population as result of summary indicator FOPL system [24].
		[10] Dose-response relationships between dietary fibre intake and various health outcomes in adult populations [25].

H3	**P:** School-age children and adolescents 5-19 years of age **E:** • School food policies to SSB intake = -0.18 SSB serving (12 oz, 355 ml)/day[1] • SSB intake to BMI = -0.06 BMI units per year per -1 SSB serving (12 oz, 355ml)/day[2] • School food policies to fruit intake = +0.76 fruit serving (80g)/day[3] • Fruit intake to[4]:	Compared to 2017, additional nutrients other than sodium and food products were considered (SFA, SSB, fruit). Effect sizes were updated. [1] Effect of competitive food/beverage standards in schools [26]. [2] Dose-response of SSB intake and BMI in children [27]. [3] Effect of school meal standards is used, despite higher than for direct provision (+0.28 servings of fruit and vegetable/

	○ Coronary heart disease: RR = 0.92 per 200 g/day ○ Stroke: RR = 0.84 per 200 g/day ○ Cardiovascular disease: RR = 0.92 per 200 g/day ○ Total cancer: RR = 0.97 per 200 g/day ○ All-cause mortality: RR = 0.90 per 200 g/day • School food policies to energy% from SFA = -0.93 % of energy/day[5] • Energy% from SFA to total cholesterol = -0.064 mmol/L per 1% of energy from SFA replaced by *cis*-PUFA[6] • School food policies to sodium intake = -170 mg/d[7] • Sodium intake to SBP = -0.8 mm Hg per -1 g sodium/day[8] **O:** Healthy Life Years (HLY) gained, and mortality averted.	day), as school meals standards are more common in LMIC [26]. [4] Dose-response relationship between fruit and vegetable intakes and various NCD related outcomes based on data mainly in adult populations, which are applied to children [28]. [5] Effect of school meal standards [26]. [6] Dose-response relationship between %energy from SFA and total cholesterol based on data in adult populations, which are applied to children [23]. [7] Effect of school meal standards [26]. [8] Dose-response relationship between sodium intake and blood pressure in children and adolescents [29].
H4	**P:** All population of a country **E:** • Behaviour change communication and mass media campaign for healthy diets to sodium intake = –486.19 mg/d, equivalent to an approximate 12% reduction below baseline urinary sodium levels[1] • Sodium intake to SBP = -5.56 mm Hg in SBP per -100 mmol/d, equivalent to -0.95 mm Hg in SBP per -1 g salt/d[2] • Behaviour change communication and mass media campaign for healthy diets to fruit and vegetable intake = +0.25 serving/day[3] • Fruit and vegetable intake to[4]: ○ Coronary heart disease: RR = 0.92 per 200 g/day ○ Stroke: RR = 0.84 per 200 g/day ○ Cardiovascular disease: RR = 0.92 per 200 g/day ○ Total cancer: RR = 0.97 per 200 g/day ○ All-cause mortality: RR = 0.90 per 200 g/day **O:** Healthy Life Years (HLY) gained, and mortality averted.	Compared to 2017, additional nutrients other than sodium and food products were considered (fruit and vegetables). Effect sizes were updated. [1] Effect of behaviour change interventions on sodium intake from 32 trials conducted in adults around the world [30]. [2] Dose–response relationship established from 85 trials involving >10,000 adults around the world [17]. [3] Effect of mass media campaigns on fruit and vegetable intake in adults [31] [4] Dose-response relationship between fruit and vegetable intakes and various NCD related outcomes based on data mainly in adult populations, which are applied to children [28].
H5	**P:** School-age children and adolescents 5-19 years of age **E:**	New CEA for the intervention compared to the 2017 update. [1] Inverse effect of TV advertising based on 11 studies from around the world [32].

	• Policies to protect children from TV advertising to energy intake = -60 kcal/day[1] • Energy intake to body weight = -1kg in body weight for each -(68 – 2.5*age) kcal/day in energy intake in boys aged 5-18 years, and -(62 – 2.2*age) kcal/day in energy intake in girls aged 5-18 years[2] **O:** Healthy Life Years (HLY) gained, and mortality averted.	[2] Models weight change from change in energy intake in children and adolescents [33]

Table 2: Costing assumptions used in WHO-CHOICE analysis

	Major costing assumptions
H1	Key categories of resources include: • Human resources (e.g. administrators, legal experts, food scientists, public health and relations officers largely at the national level, and food inspectors at the province level) • Training and meetings: training of food inspectors and for laboratories and industry; meetings with consumer organisations. • Public education campaigns including television and radio advertising. • Surveillance, monitoring and enforcement activities including: food product monitoring including laboratory analysis of the content of TFA, sodium and sugars every 3-5 years, food consumption/purchase surveys every 5-10 years and biomarkers surveys every 10 years. Parts of these costs are shared with intervention H2.
H2	Key categories of resources include: • Human resources (e.g. administrators, legal experts, food scientists, public health and relations officers largely at the national level, and food inspectors at the district level) • Training and meetings: training of food inspectors and for laboratories and industry; meetings with consumer organisations. • Surveillance, monitoring and enforcement activities including food product monitoring with spot check laboratory assessment, food consumption/purchase surveys every 5-10 years. Parts of these costs are shared with intervention H1.
H3	Key categories of resources include: • Human resources (e.g. administrators, legal experts, food scientists, public health and relations officers largely at the national and province level, and public food inspectors at the province and district level) • Training and meetings: training of public food inspectors and canteen staff in public institutions. Meetings with sectors providing public food and with user associations (e.g. parent-teacher associations) • Development of recipe books and procurement tools. Information leaflets for schools • Inspection in canteens and analysis of nutrient content in foods using menus, recipes and food composition tables organized every year, public food consumption survey in schools organized every 5 years.
H4	Key categories of resources include:

	• Human resources (e.g. administrators, public health and relations officers) • Training and meetings: review of enforcement plan, launch of public and retailer information campaign, briefings to stakeholders and the media. • Mass media campaign including television and radio advertising.
H5	Key categories of resources include: • Human resources (e.g. administrators, legal experts, food scientists, public health and relations officers largely at the national level, and food inspectors at the district level) • Training and meetings: training of food marketing inspectors and meetings with food industry and media outlets; meetings with consumer organisations. • Surveillance, monitoring and enforcement activities including food marketing monitoring in different channels every 3-5 years, food consumption/purchase surveys every 5-10 years.

Breastfeeding

Intervention

Number	Intervention
H6	Protection, promotion and support of optimal breastfeeding practices

Identification of intervention

The intervention is defined as the protection, promotion and support of optimal breastfeeding practices, i.e. early initiation of breastfeeding within 1 hour of birth with exclusive breastfeeding for the first 6 months of life and continued breastfeeding up to 2 years of age or beyond along with appropriate complementary feeding. Actions that help protect, promote and support breastfeeding are outlined in the WHO/UNICEF global strategy for infant and young child feeding [3] and include maternity protection in line with International Labour Organization's conventions; adoption of the International Code of Marketing of Breast-milk Substitutes and subsequent relevant World Health Assembly resolutions; implementation of the "Ten Steps to Successful Breastfeeding" specified in the Baby-Friendly Hospital Initiative; provision of supportive health services with infant and young child feeding counselling during all contacts with caregivers and young children, such as during antenatal and postnatal care, well-child and sick child visits, and immunization; and community support, including mother support groups and community-based health promotion and education activities.

Methodological assumptions

- In the OneHealth Tool, improvements in breastfeeding practices as result of breastfeeding promotion and counselling (odds of "age-appropriate breastfeeding") is estimated in the Lives Saved Tool module, which in turn estimates the effect on maternal and child health outcomes. As part of the 2022 update of Appendix 3, additional impact pathways for the longer term protective effects on obesity and diet-related NCDs in the breastfed child and the breastfeeding mother from improved breastfeeding practices are being linked to this same intervention based on systematic reviews that have quantified the effects. While the impact of the intervention is restricted to that of breastfeeding counselling and promotion to mothers in the health facilities, the costing module includes activities such as e.g. a national breastfeeding coordinator and legal experts and monitoring and enforcement mechanisms to support regulatory actions to protect, promote and support breastfeeding to ensure a comprehensive programme in countries.
- Country estimates for exclusive, pre-dominant and partial breastfeeding practices for different age groups are included in the OneHealth Tool [11].

Table 1: Impact sizes used in WHO-CHOICE analysis

Number	Population (P), effect size of interventions (E) and outcomes (O)	Comments on evidence and main changes to 2017 analysis
H6	**P:** Breastfed children and lactating mothers **E on breastfed children:** • Any breastfeeding to overweight/obesity: OR = 0.74[1] • Exclusive breastfeeding to overweight/obesity: OR = 0.79[2] • Any breastfeeding to SBP: Mean difference = -0.80[3] • Any breastfeeding to Type 2 diabetes: OR = 0.67[4] **E on lactating mothers:** • Any breastfeeding to maternal type 2 diabetes: RR = 0.68[5] • Breastfeeding >12 months to breast cancer: OR = 0.74[6] • Breastfeeding >12 months to ovarian carcinoma: • OR = 0.63[7] **O:** Healthy Life Years (HLY) gained, and mortality averted.	New intervention [1] Horta et al 2015: based on 113 estimates in both high income and low and middle income countries [34]. [2] Horta et al 2015 based on 24 estimates [34]. [3] Horta et al 2015 based on 43 estimates [34]. [4] Horta et al 2019 [35]. [5] Aune et al 2013 based on 6 studies [36]. [6] Chowdhury et al 2015 based on 50 estimates [37]. [7] Chowdhury et al 2015 based on 29 estimates [37].

OR = odds ratio; RR = relative risk

Table 2: Costing assumptions used in WHO-CHOICE analysis

	Major costing assumptions
H6	Key categories of resources include: • In health facilities assumed nurses and midwives to provide a total of 70 minutes breastfeeding counselling (across 6 different routine visits) to all pregnant women and mothers in the ante, peri and postnatal periods. • Other human resources at national and province level (e.g. administrators, breastfeeding coordinator, legal experts, nutritionists, lactation management specialists, trainers for health workers on breastfeeding counselling) to form a team that will support the development, implementation and monitoring of effective supportive policies, as well as mechanisms for preventing and managing potential conflict of interest.

	• Training and meetings: regular 5 days training courses for health workers on breastfeeding counselling at provincial and district level, meetings with civil society interests' groups to support government-led action and monitoring while preventing and managing potential conflict of interest. • Media coverage of national breastfeeding week one time per year • Government-led monitoring and enforcement of infant food marketing practices on a regular basis with surveys every 3-5 years. Infant feeding practices survey (e.g. DHS, MICS) among mothers of infants and young children organized every 5 years.

Sugar-sweetened beverage (SSB) taxation

Intervention

Number	Intervention
H7	Taxation on sugar-sweetened beverages (SSBs) as part of comprehensive fiscal policies to promote healthy diets

Identification of interventions

Similar to intervention H1 to H5, implementing a tax on sugar-sweetened beverages (SSBs) is proposed as a policy option to support a reduction in the intake of free sugars as part of a comprehensive approach to addressing the prevention of obesity and dental caries, in addition to other general recommendations on the use of fiscal policies (such as taxation and subsidies) being an important policy measure to promote healthy diet and reduce the health burden of associated conditions as outlined in the WHO Global NCD Action Plan [1], building on the WHO global strategy on diet, physical activity and health [2], the WHO/UNICEF global strategy for infant and young child feeding [3], the comprehensive implementation plan on maternal, infant and young child nutrition [4] and the Commission on Ending Childhood Obesity [9]. The intervention is underpinned by WHO guidelines related to healthy diet, including dietary goals for the prevention of obesity and diet-related noncommunicable diseases (NCDs), policy actions which have an impact on the food environment[v].

Methodological assumptions

- Sugar-sweetened beverage (SSB) sales data and estimates were obtained from Euromonitor [45], and used as a direct proxy for consumption. The following are categories of SSBs included in this analysis: carbonated or non-carbonated soft drinks, fruit/vegetable juices and drinks, liquid and powder concentrates[vi], flavoured water, energy and sports drinks, ready-to-drink tea, ready-to-drink coffee, and flavoured milk drinks.
- Erring towards a more conservative estimate of impact for the intervention, low calorie / low sugar product categories were not included as these contained a variable mix of products with or without added sugars, and/or artificial sweeteners. SSB consumption volume was then converted into the number of daily servings per capita, assuming a serving size of 355 ml.
- In the absence of robust global data on the differential consumption pattern of SSBs by BMI status and age, within and between countries, SSB consumption levels were assumed to be the same across all population groups within a given country.
- The model simulates a tax policy that causes the retail price of SSBs to increase by 20%, similar to the previous update. The impact of this price increase on consumption is captured by a measure

[v] WHO. Nutrition Guidance Expert Advisory Group (NUGAG). https://www.who.int/groups/nutrition-guidance-expert-advisory-group-(nugag)

[vi] Powder concentrate sales figures reported in tonnes. To translate this amount into liters, a conversion factor of 100 grams of powder per liter of SSB made was used.

called the price elasticity of demand. Several studies on the price elasticity of demand for SSBs show a range of around -0.8 to -1.59, in different settings [46-61]. Using -0.8 as the price elasticity of demand value, this can be interpreted as follows: for a 20% increase in SSB prices, a 16% reduction in consumption is expected.

- The most recent systematic review and meta-analysis on outcomes following SSB taxation found no evidence of substitution to untaxed beverages [61]. With this, and given the use of the more conservative price elasticity of demand value for this model, no adjustment factor for substitution was utilized.
- The impact of reduced SSB consumption on bodyweight for adults was converted to the average body mass index (BMI) reduction for the adult population using baseline height and weight figures sourced from the NCD Risk Factor Collaboration (NCD RisC) estimates [62]. Since the effect size used for children is already in BMI units, this was directly applied for these groups. The new mean BMI values for each population group (by age and sex) were then calculated by subtracting the impact of the SSB tax from baseline BMI data [62,63].
- A log-normal distribution was used to estimate the share of the population under each BMI classification at baseline. The resulting figures were then used in weighting the all-cause mortality hazard ratios of each BMI group taken from the Global BMI Mortality Collaboration study [64], which generated a composite index for the entire population group.
- The same process of estimating the population under each BMI classification was done for the post-SSB tax scenario, using the new mean BMI values after the effect sizes have been applied. The potential shift from normal weight to underweight was discounted assuming normal weight individuals will compensate with other caloric sources.
- The composite indices for a business-as-usual scenario versus a post-tax scenario were then compared for each population group. The corresponding adjustment factor to mortality represented the impact of SSB taxation and was applied for each year of the simulation. The number of lives saved was then adjusted with the prevailing disability weights for each population group to arrive at the desired outcome of healthy life years gained.
- The impact from avoiding dental caries has also been added to the model. Published effect sizes [65,66] were adjusted to fit serving size assumptions[vii], intake, and the analysis period.
- Other impact pathways, such as the impact of reducing SSB consumption on diabetes prevalence, are being validated.

[vii] Sugar content from SSBs consumed was estimated using the following conversion factor: 32.93 grams for each 300ml.

Table 1: Impact sizes used in WHO-CHOICE analysis

Number	Population (P), effect size of interventions (E) and outcomes (O)	Comments on evidence and main changes to 2017 analysis
H7	**P:** Policy/legislative intervention covering the entire population **E:** Price elasticity of demand for SSBs: -0.8 [46-61] • Bodyweight (adults): 0.12 kg added per year for each additional 355ml daily serving of SSB consumed [27] • BMI (children): 0.05 BMI units added per year for each additional 355ml daily serving of SSB consumed [27] • Risk of dental caries (adults): IRR 1.31 for each additional daily serving of SSB consumed over a 4-year period [65] • Risk of dental caries (children up to 15 years): 1% increase in the probability of developing caries for each additional 5g of daily sugars intake over a 3-year period [66] **O:** Healthy Life Years (HLY) gained, and mortality averted.	Given the range of price elasticity of demand estimates for SSBs, the lower-bound elasticity value was used (-0.8) for this exercise, leaning towards a more conservative impact estimate. The reference study for effect sizes on weight and BMI was changed, as impact expressed on a yearly basis for both adults and children provided a better fit with the model. The impact on oral health has been added.

Table 2: Costing assumptions used in WHO-CHOICE analysis

	Major costing assumptions
H7	• Assumptions on human resource requirements for taxation interventions have been previously published in detail [67]. SSB taxation is considered as a legislative or policy intervention comparable to tobacco and alcohol taxation, and thus similar assumptions on human resources and other needs to implement the intervention were made. The major components in the costing include the development and passing of legislation, programme implementation, enforcement, as well as monitoring and evaluation.

Annex to healthy diet technical brief

Intervention	Comments
H1: Reformulation policies for healthier food and beverage products	• Reformulation of food and beverage products to eliminate TFA and reduce the content of saturated fatty acids (SFA), sugars and/or salt in food and beverage products is an important "upstream" action to reduce the availability of potentially harmful nutrients in the food supply [70-72]. Reformulation may result from policies setting mandatory limits or voluntary targets for nutrient content in food and beverage products, or it may happen in the absence of a specific reformulation policy, as result of industry response to e.g. a FOPL or food or beverage tax policy. • Regarding policies to eliminate TFA in food products, Restrepo et al 2016 estimated the impact of the TFA policy in Denmark and found that mortality attributable to cardiovascular disease (CVD) decreased on average 14.2 deaths per 100,000 people per year. Additional supportive evidence from the PHO ban in food service establishments in New York found a 4.5% reduction in CVD mortality rates, or 13 fewer CVD deaths per 100,000 persons per year [15,38]. • Regarding reformulation policies to reduce the content of sodium, Gressier et al 2020 conducted a systematic review and meta-analysis of empirical evidence related to food reformulation, largely in adult populations in high income countries. A significant decrease in salt intake was found in 12 out of the 20 studies on salt reformulation [16]. • Regarding reformulation policies to reduce the content of sugar, Hashem et al 2019 conducted a systematic review and meta-analysis of 16 studies to determine the effect of product reformulation measures on sugar intake and health outcomes. A significant decrease was found in body weight when pooling the results of three RCTs [18].
H2: Front-of-pack labelling as part of comprehensive nutrition labelling policies	• Interpretive front-of-pack labelling (FOPL) as part of comprehensive nutrition labelling policies including mandatory nutrient declaration in line with Codex guidelines is an important tool to promote healthy diets [73-77]. The impact pathways of nutrition labelling policies are two-fold: 1) increased consumer understanding on nutrient contents in food products leading to improved purchasing behaviour, and 2) increased reformulation of food products to reduce the content of sugars, sodium and/or unhealthy fats. Both pathways lead to improved dietary practice resulting in reductions in NCD risk related outcomes, however studies evaluating the impact of nutrition labelling policies on dietary intake, nutrition status or NCD risk related outcomes in real world settings are scarce. The effect of nutrient declarations is based on before and after cross sectional studies estimating intake from biomarkers. Regarding front-of-pack labelling, most studies are conducted in laboratory settings and/or evaluate effect on purchases, and many are limited to single foods or beverages. The assumptions below are based on real world studies of interpretive FOPL where available, transposing impact on purchases to intakes as necessary. • Regarding nutrient declarations, Ratnayake et al. 2014 and Friesen and Innis 2006 found consistent large decrease in TFA intake estimated from measuring trans fat levels in breast milk in women before and after the introduction of

	trans fatty acid labelling on nutrient declarations in Canada in 2003, which became mandatory in December 2005 [19,39]. • Regarding FOPL, Song et al. 2021 did a systematic review and meta-analysis of 156 studies conducted in Europe and Latin and North America assessing four types of interpretative FOPLs (traffic light labelling system (TLS), Nutri-Score (NS), nutrient warning (NW), and health warning (HW)). Eight of the studies were real world studies of the effect of FOPL on multiple food and beverage categories. The authors found significant decreases in energy, saturated fat and sodium in purchases for different FOPL systems. In the table of effect sizes below, the percentage change in purchases is applied to dietary intake, which is not uncommon in modelling studies. For each effect size, the most conservative significant total change in nutrient content of purchases for any FOPL system is cited, with preference given to real world studies on effect of FOPL on multiple food and beverage categories [21]. • In addition, various modelling studies have estimated the impact of FOPL on dietary intake and subsequently on health outcomes in specific populations, by transposing observed changes in nutrient content of food purchases in experimental studies to changes in dietary intakes as observed in food consumption surveys (e.g. Egnell et al 2019 [24]). In the cost effect analysis, the most conservative significant modelled effect size for change in estimated dietary intake is provided for nutrients that are not covered by the systematic review cited above.
H3: Public food procurement and service policies for healthy diets	• Public food procurement and service policies are important tools to ensure healthy food is served and sold in public settings [78, 79]. This includes procurement, service and sale of foods and beverages low in sodium, sugars, and unhealthy fats, as well as that of fruits and vegetables, whole grains, pulses and nuts, and the use of iodised salt. It also includes the restriction of unhealthy foods and beverages, such as sugar-sweetened beverages (SSBs) and unhealthy snacks. • Most of the evidence available for this policy is for the school setting and many of the health problems encountered in adulthood stem from experiences early in life. The major non-communicable diseases including, cardiovascular diseases are often associated with older age groups, but the evidence suggests that they affect people of all ages. • In a systematic review and meta-analysis, Micha et al 2018 quantified the impact of school food environment policies (direct provision, competitive food and beverage standards, and school meal standards) on dietary habits, adiposity, and metabolic risk in children based on 91 interventions, largely conducted in Western high-income countries. Significant impact of school food policies was found on the consumption of fruits and/or vegetables, SSBs, unhealthy snacks, total fat and SFA [25].
H4: Behaviour change communication and mass media campaign for healthy diets	• The evidence for behaviour change communication and mass media campaign for healthy diets is based on those to reduce sodium intake and to increase the consumption of fruits and vegetables, both being commonly implemented in countries. • For sodium, a systematic review and meta-analysis [40] of behavior change interventions in adults found that these interventions resulted in significant improvements in salt consumption behavior (eg, decrease in purchase of salty foods; increase in use of salt substitutes), leading to reductions in sodium intake as measured by urinary sodium in 32 trials (N = 7840 participants;

	mean difference, –486.19 mg/d [95%CI, –669.44 to –302.95]; P < 0.001; I2 = 92%), equivalent to an approximate 12% reduction below baseline urinary sodium levels. • For fruits and vegetables, a systematic review and meta-analysis [31] of five randomized and nonrandomized interventions from the USA, New Zealand, and Australia, implementation of mass media campaigns was associated with 0.25 serving/day increased consumption of fruits and vegetables (95 % CI = 0.15–0.35). This review has also been cited as the only one with pooled results in a more recent umbrella review [e.g. 41].
H5: Policies to protect children from the harmful impact of food marketing	• Protecting children from the harmful impact of food marketing is important to reduce their preference and demand for and consumption of unhealthy food high in fats, sugars and salt [80-85]. In 2010, the World Health Assembly adopted the WHO set of recommendations on the marketing of foods and non-alcoholic beverages to children[viii] and previous versions of the Appendix 3 have highlighted this intervention, including the set-up of effective monitoring mechanisms, as an important policy action for healthy diets. • The evidence for policies to reduce the power of and children's exposure to food and non-alcoholic beverage marketing is scarce [42], however there is evidence confirming that such marketing practices are abundant and that they are for unhealthy food high in fats, sugars and salt [43]. Evidence on the impact of marketing on children is unequivocal and has recently been updated in a new systematic review [44]. Therefore, the assumption is made that by adopting and implementing such policies, a reverse impact of equivalent magnitude is likely. • In a systematic review and meta-analysis, Russel et al 2018 [32] quantified the impact of food marketing via TV ads and through advergames to children. In the meta-analysis, they revealed that children exposed to food advertising on TV (11 studies) and advergames (five studies) respectively consumed an average 60.0 kcal (95% confidence interval [CI], 3.1-116.9) and 53.2 kcal (95% CI, 31.5-74.9) more than children exposed to non-food advertising.
H6: Protection, promotion and support of optimal breastfeeding practices	• The protection, promotion and support of optimal breastfeeding practices, i.e. early initiation of breastfeeding within 1 hour of birth with exclusive breastfeeding for the first 6 months of life and continued breastfeeding up to 2 years of age or beyond along with appropriate complementary feeding, is important to ensure child health and survival, protect against childhood illnesses, promote healthy growth and prevent overweight, obesity and diet-related NCDs in both the child and the mother [86-89]. • Regarding protective effects for the infant, Horta et al. 2015 conducted a systematic review of long-term consequences of breastfeeding on cholesterol, obesity, systolic blood pressure and type 2 diabetes, updating systematic reviews and meta-analyses carried out in 2006 and 2011 commissioned by WHO. Breastfed subjects were less likely to be classified as obese/overweight (with a slightly stronger association among studies that reported on exclusive breastfeeding), were less likely to have type 2 diabetes, and had lower SBP. In 2019, Horta et al updated the effect size for type 2 diabetes adding three more studies to the 2015 review [34,35]. • Regarding protective effects for the mother, Chowdhury et al 2015 conducted a systematic review and meta-analysis to evaluate the effect of breastfeeding

[viii] https://www.who.int/publications/i/item/9789241500210

	of mothers and quantified protective effects on breast carcinoma, ovarian carcinoma, and type 2 diabetes mellitus. A majority of studies had been conducted in high income countries. For type 2 diabetes, they reported the findings of Aune et al 2013 who had conducted a systematic review and dose-response meta-analysis of breastfeeding and maternal risk of type 2 diabetes [37].
H7: Taxation on sugar-sweetened beverages (SSB) as part of comprehensive fiscal policies to promote healthy diets	• SSB consumption data from other databases were also considered, however the decision to use Euromonitor data for this analysis was made given the availability of estimates for all countries, as well as consistency with the previous update. • A number of studies have investigated different models of predicting population distribution according to BMI [68,69]. While a log-normal distribution provides a closer approximation of BMI compared to a normal distribution, these models may provide an even better fit and possibly improve the analysis if utilized.

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