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Equity and Inclusion
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Taxation of foods high in saturated fats, sodium, and sugars in India

Estimation of a demand model and proposed study design for modelling the impact on health and distributional equity

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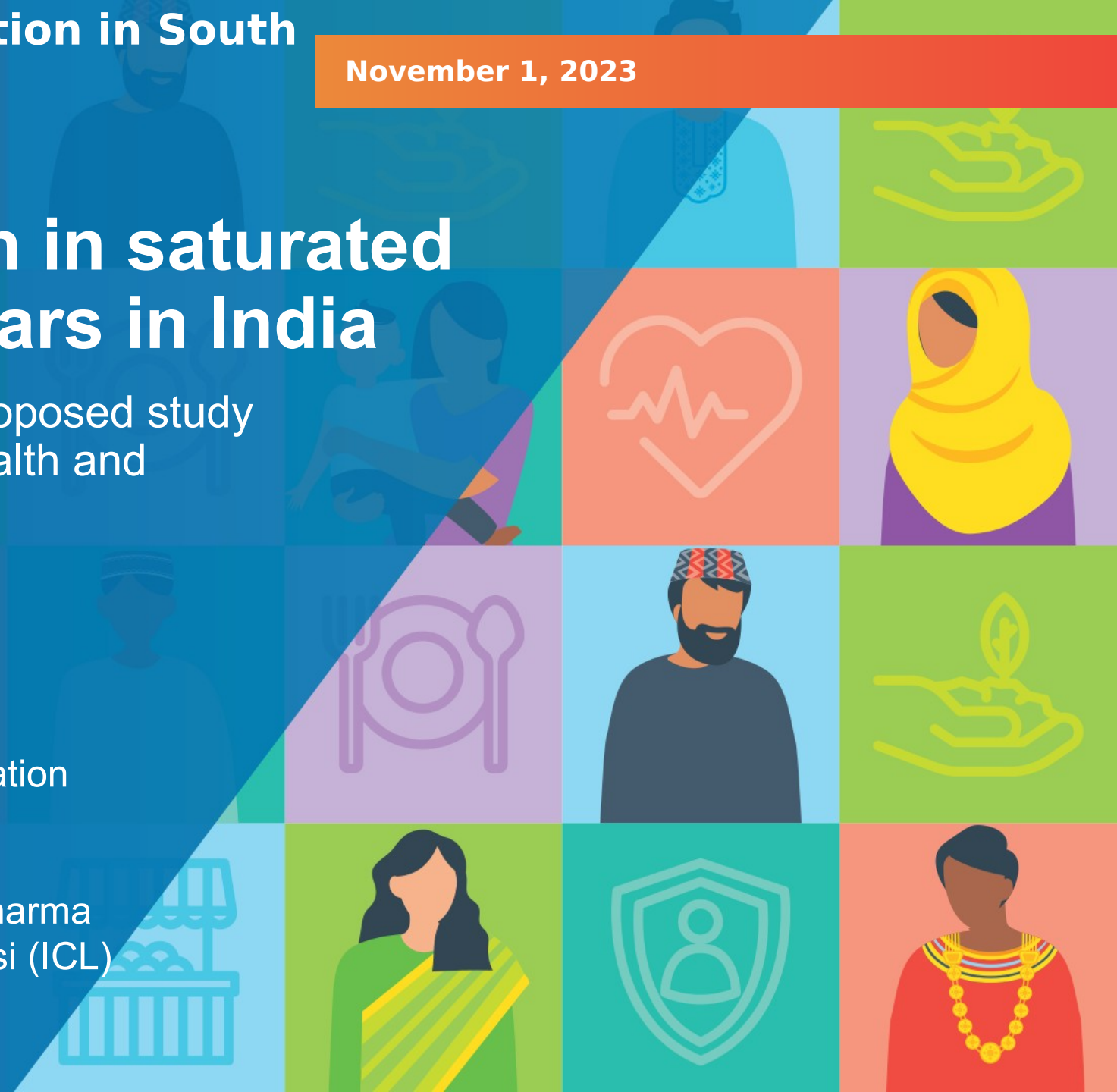


Rationale

- India faces a **triple dietary burden** (Meenakshi, 2016): undernutrition, micronutrient deficiency, and overweight and obesity
- **Overweight in adults is increasing**: approx. 5% in 1975 to 20% in 2016 (WHO, 2017)
- **Obesity is increasing**:
  - Children under 5 yo: 3.4% (Saha et al, 2022)
  - Adults: 3.9% (WHO, 2017) expected to reach 9.5% for men and 13.9% for women by 2040 (Luhar et al, 2020)
- **Ultra-processed foods* sales value has increased** by 13.4% annually during 2011-2021 (WHO India, 2023)
- 2/3 of rural poor could not afford a recommended healthy diet in 2011 (Raghunathan et al, 2021)

** Based on 5 main UPF categories: chocolate and confectionery; salty snacks; sweetened beverages; ready-made and convenience food; and breakfast cereals*

- Health taxes and particularly **taxation of foods high in fat, sugar and sodium (HFSS)** can help:
  - **Correcting for negative externalities** (e.g., government healthcare expenditure to treat diseases)
  - **Addressing internalities** (i.e, “encouraging people to avoid acting against their own self-interest” (Adam et al, 2011))
- A solution: applying **differentiated tax rates based on the nutrient composition of foods**, with highest rates applied to HFSS foods and a discounted/zero rate to non-HFSS foods or healthier foods
- **Main goals** of HFSS food taxation:
  - Disincentivizing the consumption of HFSS foods
  - Incentivizing the consumption of non-HFSS foods
  - Incentivizing nutrient reformulation of HFSS foods by the industry

Objective and contributions

- **Inform policymaking** on the distributional impact of taxing HFSS foods in India on:
  - Health outcomes
  - Healthcare expenditure
  - Household expenditure
  - Government fiscal revenue
- **Inform on the suitability of various definitions of HFSS food for fiscal policy design**, including the draft Food Safety and Standards Authority of India (FSSAI) definition
- Provide **updated baseline nutrient estimates** for Indians across income groups and sectors
- Provide **updated price elasticity of demand estimates for unhealthy and healthier foods** for Indians across income groups and sectors
- **Propose an adaptable method** for estimating the distributional impact of HFSS food taxes and other food pricing policies for **replication in other low- and middle-income countries**

Outline

1. Estimation of a demand model
2. Estimation of baseline intake
3. Proposed methods for modelling the impact on health and distributional equity

1. Estimation of a demand model

1. Data and methods

- **NSS 68th - Household Consumer Expenditure survey**, 2011-2012 (≥ 101,000 HH, 30-day recall period)
- Exploring **own- and cross-price effects** between aggregated food groups and healthier and less healthy foods
- Beverages: not able to disaggregate by sugar-sweetened beverages (SSBs) vs. non-SSBs due to low demand for SSBs (only 13% of HH with non-zero purchases)
  => use of Rijo et al (2022) estimates
- **Linear Approximation of Almost Ideal Demand System (LA-AIDS)** (Deaton and Muellbauer, 1980):

includes: survey quarter, HH size, HH head age, gender, and education

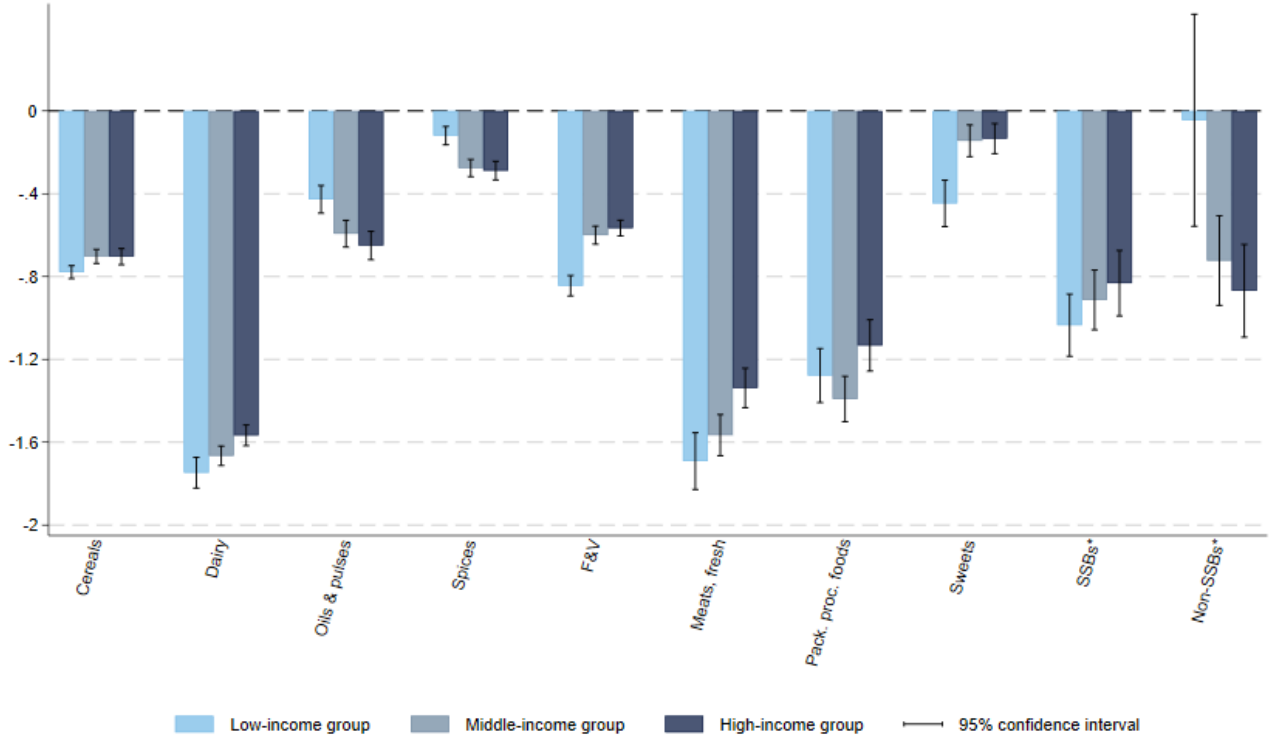
- Identifying restrictions derived from microeconomic demand theory (Deaton and Muellbauer, 1980)
- Estimating **quality-adjusted prices** using Capacci and Mazzochi (2011)'s demeaning method
- Using **Inverse Mills Ratios** to account for censoring (Heien and Roheim Wessells, 1990)
- Estimation via SUR regressions, **uncompensated price elasticities** (Chalfant, 1987):

: Kronecker delta

- Robustness checks:
  - ANOVA test for spatially varying unit values
  - Quadratic AIDS
- Limitations: Endogeneity of total expenditure (, reverse causality, no available IV)

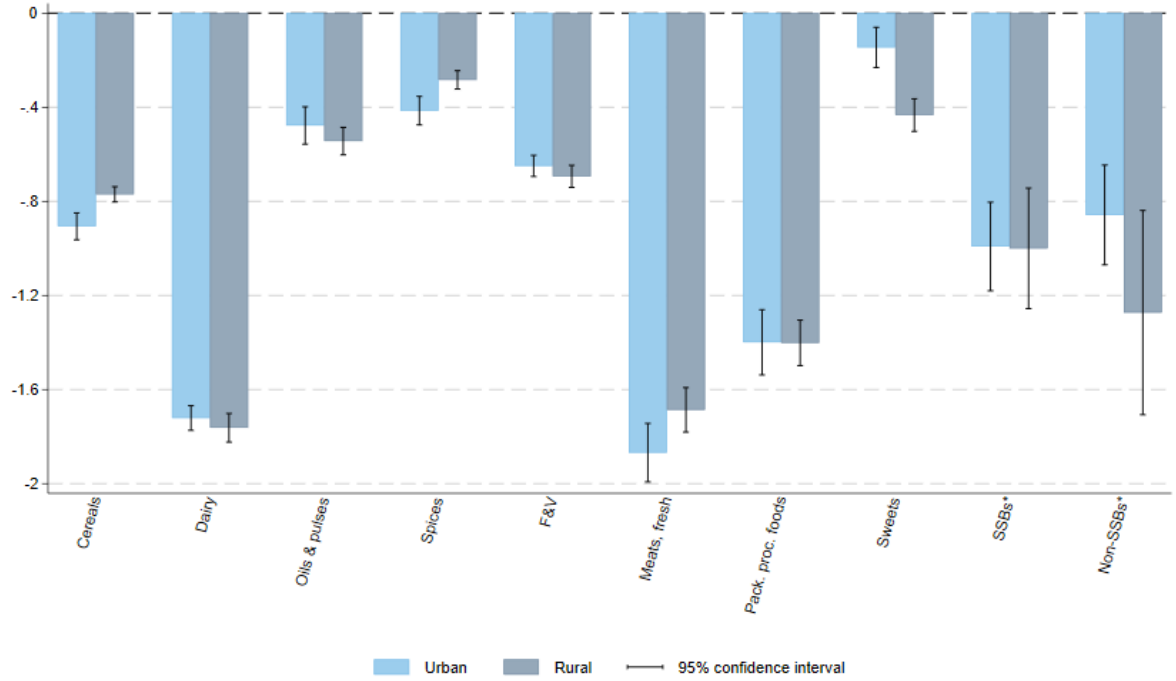
1. Preliminary results

Estimated uncompensated own-price elasticities of demand, by tercile of MPCE



** For disaggregation by SSBs vs. non-SSBs (proxied by tea), source: Rijo et al (2022) quality-adjusted AIDS estimates based on similar NSS 2011-2012 data*

Estimated uncompensated own-price elasticities of demand, by sector



Selected significant estimated uncompensated cross-price elasticities of demand (p<0.01), full sample

	Cereals	Dairy	SSB
Pack. proc.	0.670	0.692	-0.102
Sweets	0.269	-0.112	-0.049
Non-SSBs	-0.074	0.540	0.541

2. Estimation of baseline intake

2. Data and methods

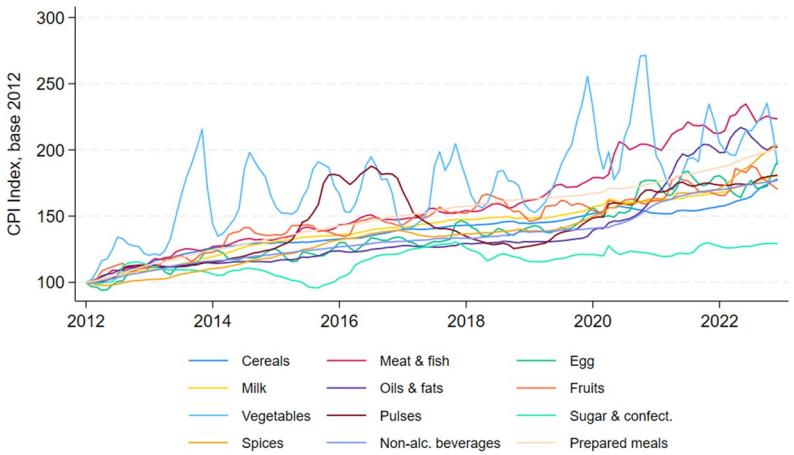
NSS 2011-2012 is old and does not contain nutrient information

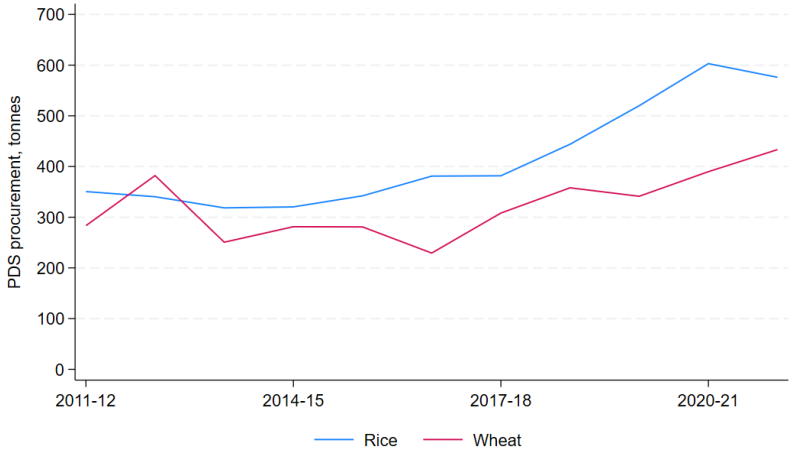
HH expenditure & quantities purchased adjustment to Dec 2022

- Using Centre for Monitoring Indian Economy (CMIE) Consumer Pyramids expenditure data (140,000+ HH)
- Further correcting CMIE trend for nominal price increase using CPI index data
- Using Public Distribution System (PDS) procurement volume (rice and wheat) (MoFCAPD, 2023) and population growth (UN, 2022)

Nutrient composition of food items

- Energy, sugar, saturated fat, fat, sodium, carbohydrates, protein, fibre, iron
- Food composition tables:
  - NIN Indian Food Composition Tables 2017
  - USDA Food & Nutrient Database for Dietary Studies 2017-2018
- Accounting for edible fractions

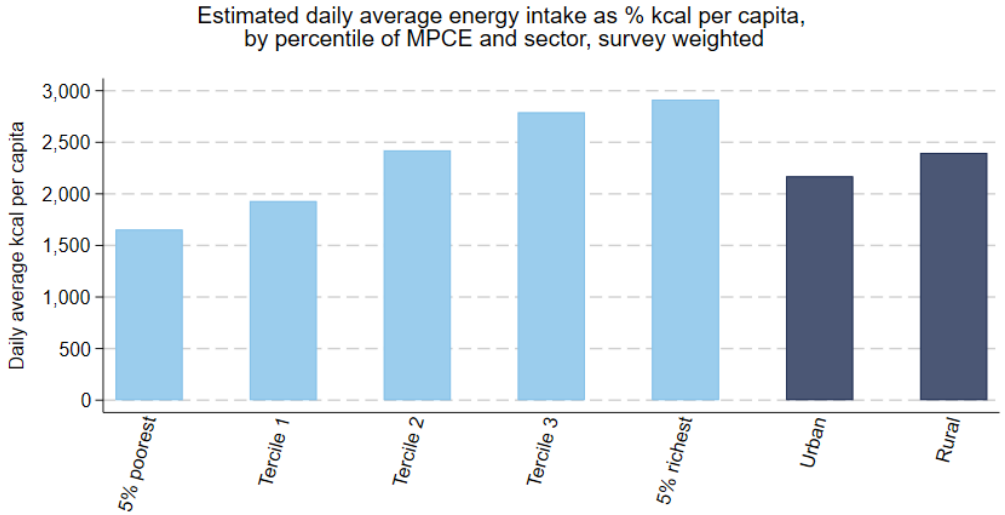


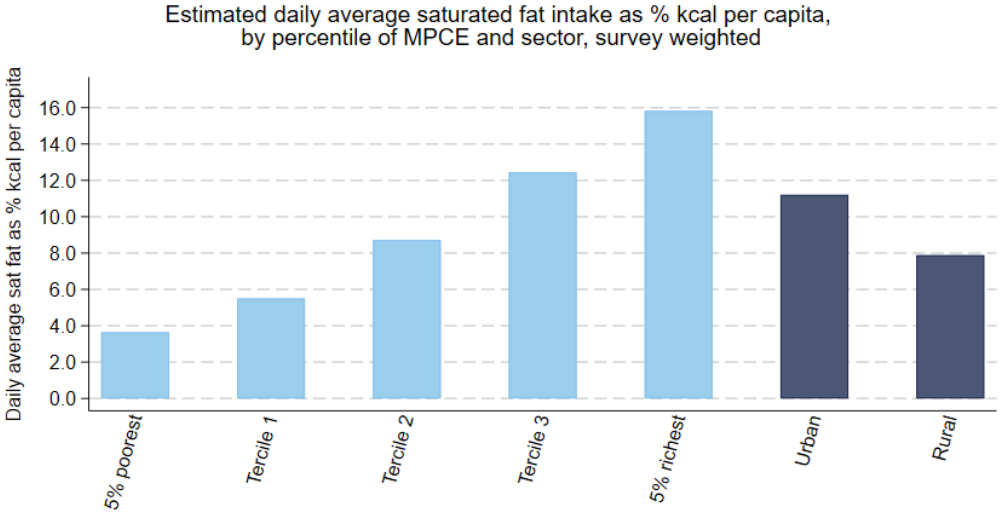


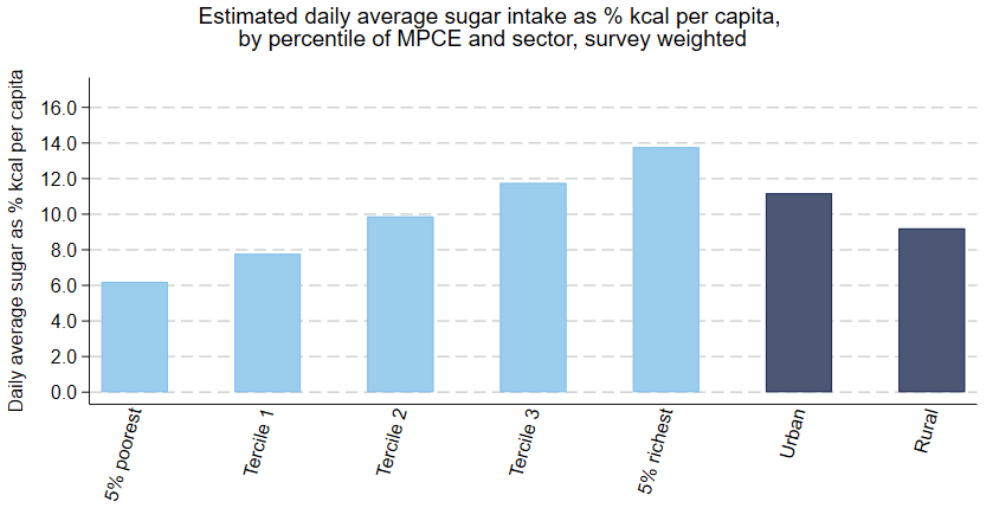
Key assumptions:

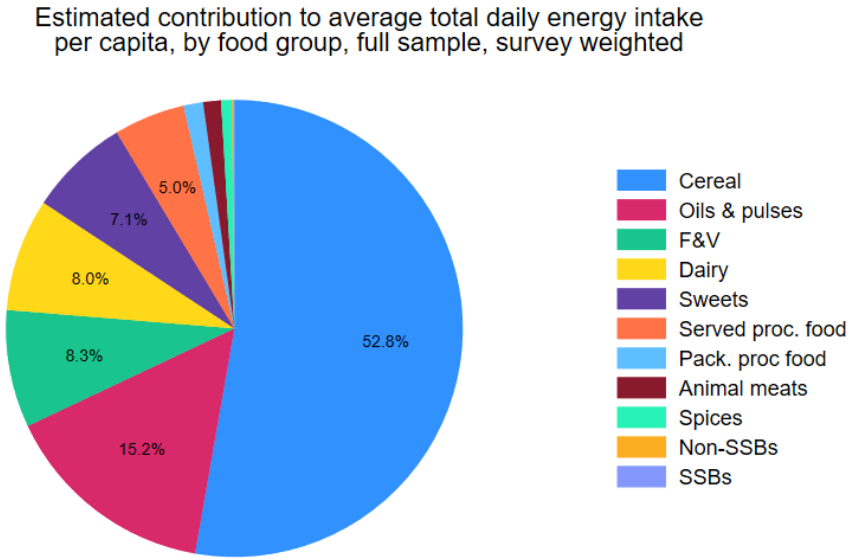
- Excluding outlier HH (1% lowest & 1% highest kcal per capita)
- Waste: 10.9% of all foods based on 50 kcal per capita for mean HH (UNEP, 2021)
- Processing level for meats: 20% (based on expert opinion, sensitivity analysis to be performed)

2. Preliminary results



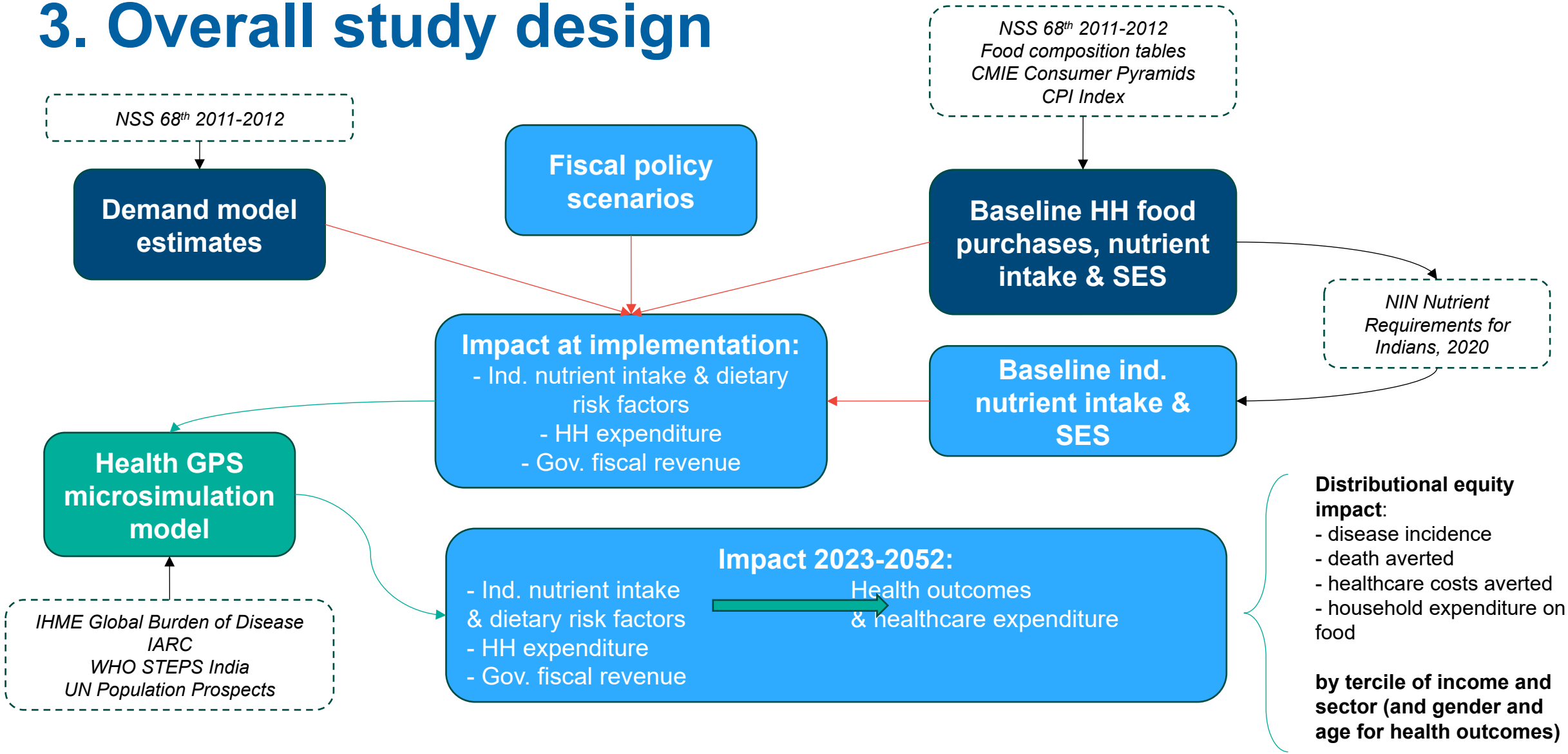






3. Proposed methods for modelling the impact on health and distributional equity

3. Overall study design



3. Individualising baseline nutrient intake

- Using daily energy recommendations from NIN Nutrient Requirements for Indians, 2020
- Using NSS 2011-2012 information on age and gender for each HH member to estimate NIN recommended total HH daily kcal
- Assuming intra-HH energy distribution to be the same for all HH and estimate the proportion of total recommended HH energy for each individual based on age and gender
- Multiplying the estimated proportion with the actual estimated baseline total HH daily energy to obtain the estimated individual baseline daily energy
- Assumptions:
  - Moderate work for adults up to 60y then sedentary work
  - Intra-HH distribution of kcal is constant across HH
  - Individual proportion of total HH intake for each nutrient is the same as for energy

NIN Nutrient Requirements for Indians, 2020

Age Group	Category	Body weights	Requirement	
			(kcal/d)[a]	(kcal/kg/day)
Men	Sedentary work	65.0	2110	32
	Moderate work	65.0	2710	42
	Heavy work	65.0	3470	53
Women	Sedentary work	55.0	1660	30
	Moderate work	55.0	2130	39
	Heavy work	55.0	2720	49
	Pregnant	55.0 + GWG[b]	+ 350	
	Lactating	55.0+[c]	+600 +520	
Infants	0-6 m	5.8	530	90
	6-12m	8.5	660	80
Children[d]	1-3y 4-6y 7-9 y	12.9 18.3 25.3	1110 1360 1700	83 74 67
Boys	10-12y	34.9	2220	64
Girls	10-12y	36.4	2060	57
Boys	13-15y	50.5	2860	57
Girls	13-15y	49.6	2400	49
Boys	16-18y	64.4	3320	52
Girls	16-18y	55.7	2500	45

3. Fiscal policy scenarios

1) **FSSAI HFSS definition, using Schedule IV INR exemption list (Draft Regulation 44272/2022)**:
   28% on HFSS items
   0% on items non-HFSS items (or only F&V as sensitivity)

2) **WHO South East Asia Region nutrient profile model (WHO SEARO, 2017)**:
   28% on items above one or more nutrient thresholds
   0% on items below all thresholds (or only F&V as sensitivity)

FSSAI HFSS food definition (**Draft Regulation 44272/2022**):

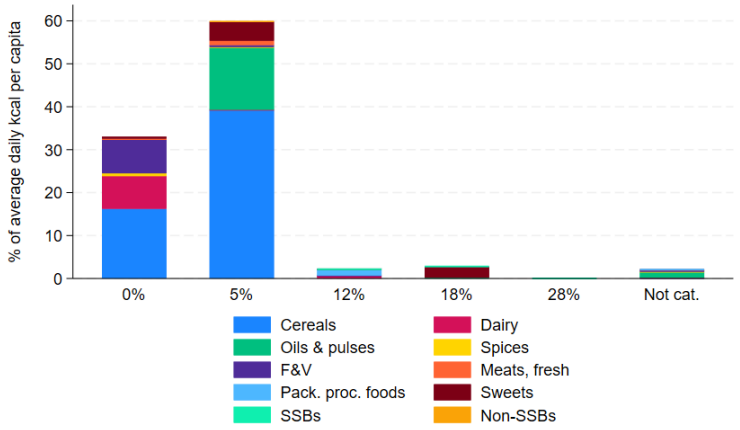
"… processed food product which has high levels of saturated fat or total sugar or sodium. The declared values of these ingredients are such that the product; does not satisfy the value of energy (kcal) from total **sugar less than 10 percent of total energy**, or from **saturated fat 10 percent of total energy**, and **sodium less than 1 mg/1 kcal**."

Stakeholder engagement meeting, 16 Jun 2023, Institute for Economic Growth, New Delhi, India

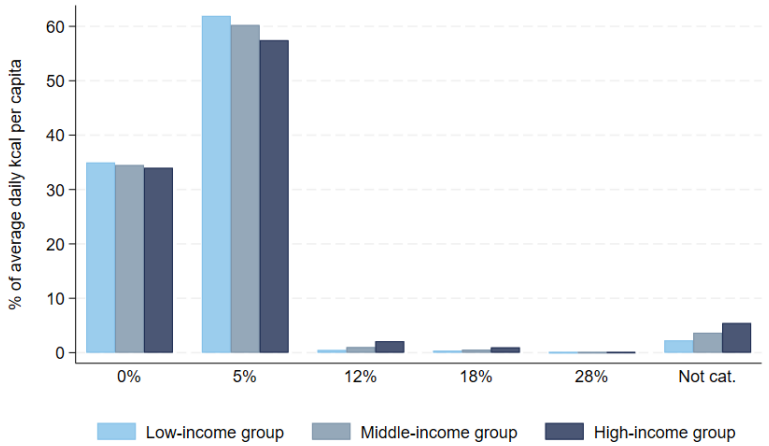
Food Category		Examples of food items[l]	Codex Food Category code	Marketing prohibited if thresholds exceed values per 100 g[j,k]					
				Total fat (g)	Saturated fat (g)	Total sugars (g)	Added sugars (g)[l]	Sodium (g)	Energy (kcal)[m]
1	Confectionery	Cocoa/chocolate bars, spreads, including imitations and chocolate substitutes, hard, soft and chewy candies, chewing gum, Indian sweets, sweet sauces, topping sauces, creamy desserts, sweet desserts, traditional desserts	5.1.1,5.1.2 (except for products used to prepare chocolate milk or hot chocolate), 5.1.3, 5.1.4, 5.1.5, 5.2, 5.3,5.4	8.0	No threshold provided	6.0	No threshold provided	No threshold provided	230
2	Fine bakery wares	Cakes, cookies, pies, doughnuts, sweet rolls, muffins, macaroons, biscuits, pancake (*ready-to-eat form*)	7.2	8.0	No threshold provided	6.0	No threshold provided	0.25	230
3	Bread and ordinary bakery wares	Bread and rolls, pita, naan, rotis, steamed bread, steamed buns, crackers, mixes for making bread and ordinary bakery wares	7.1	8.0	No threshold provided	6.0	No threshold provided	0.25	No threshold provided

Example of nutrient thresholds from WHO SEARO nutrient profile model (total: 18 food categories)

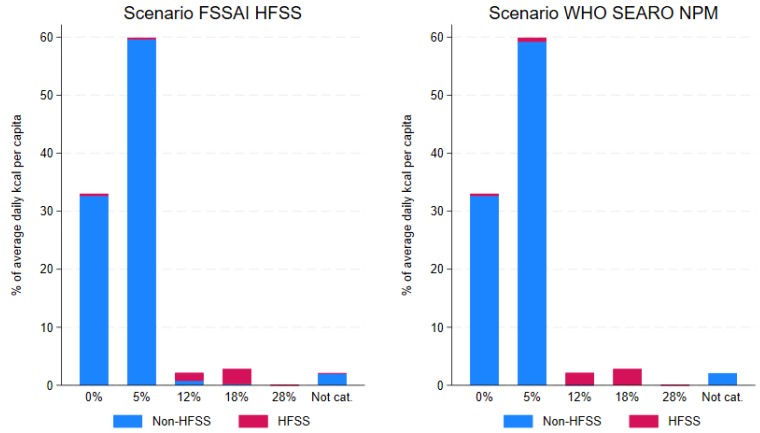
3. Fiscal policy scenarios



Share of baseline average daily kcal per capita by GST rate*, by food group



Share of baseline average daily kcal per capita by GST rate*, by tercile of MPCE



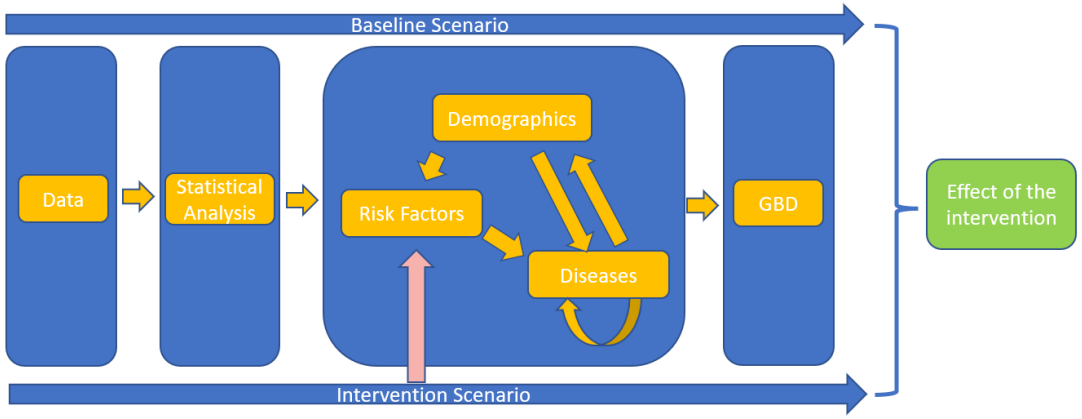
Share of baseline average daily kcal per capita by GST rate*, by scenario

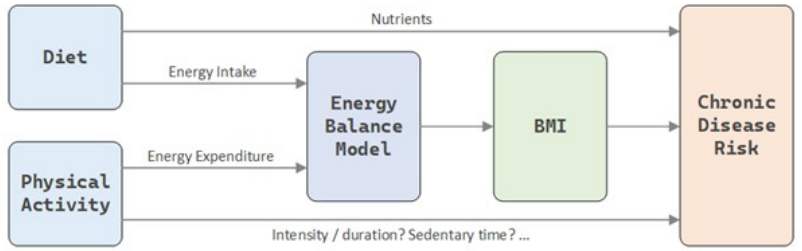
** 'Not cat.': some NSS items are named 'others' (e.g., other milk products, other cereal products). For such items, we used a consumption weighted average of the GST rates applied to all NSS items in their respective NSS category (e.g., milk category, cereal category), thus the resulting rates for these items are not one of the GST categories 0%, 5%, 12%, 18% or 28%, so we classified them as 'Not categorised'.*

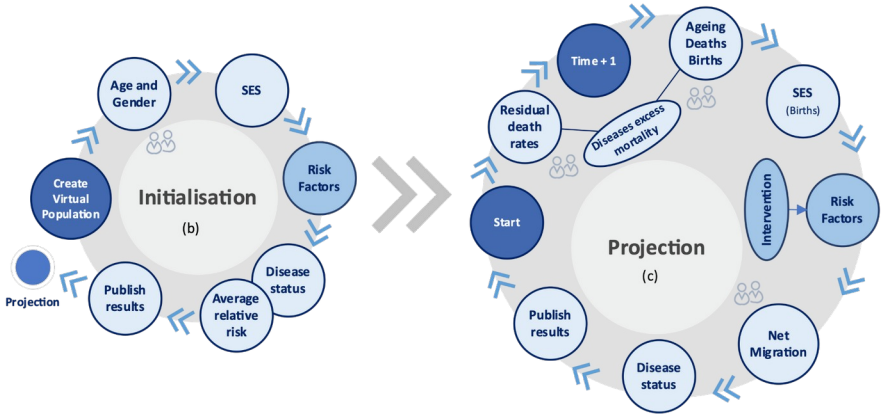
All non-PDS cereals, fresh meat/fish, arhar, khesari, curd, and honey are assumed pre-packaged (GST: not pre-packaged 0% / pre-packaged 5%). Tea / coffee cups assumed GST 5%.

3. Health GPS model

- Open-source **dynamic probabilistic microsimulation model**
- Collaboration between CHEPI (Imperial College London) & INRAE (France) as part of the European STOP childhood obesity project (2018-22)
- Create a virtual population **based on national micro data with individual-level risk exposure**
- **Multi-dimensional & dynamic interactions**:
  - Demographic-risk factors
  - Risk factor-disease effects
  - Demographic-disease effects
  - **Disease-disease effects**
- Two main risk factor-disease pathways:
  - **Energy balance model** => through BMI (Kevin Hall equation)
  - **Dietary risks** (e.g., diet high in sodium, diet low in fruits) => via relative risks
- Three main disease types:
  - Cardiovascular (e.g., ischemic heart disease)
  - Type II diabetes
  - Cancers (e.g., colon and rectum cancer)







3. Simulation assumptions / limitations

Fiscal policy scenarios

- *Passthrough rate in prices*: 80%, based on metanalysis evidence from SSB taxation (Andreyeva et al, 2022)
- *Reformulation*: 0% (sensitivity analysis to be performed up to 50% in range above scenarios' nutrient thresholds, only considering 1st degree reformulation)
- Not able to account for cross-price effects within food groups (only between)
- Not accounting for substitutions between purchased and home-grown foods & between purchased foods (off-trade) and served foods (on-trade)
- Symmetry in consumers' response (i.e., price elasticity of demand)
- Household expenditure data is not the 1st best data source to capture processed or HFSS foods, future research should make use of longitudinal household scanner data

Microsimulation

- 30-year time horizon (2022-2052) difference between intervention scenarios and counterfactual
- Counterfactual trends (food consumption and expenditure patterns) based on baseline distribution by age, sex, income, and sector
- Risk factors are the only drivers of disease, e.g., progress in healthcare or disease prevention not accounted for
- Relative risk estimates mostly from high-income countries
- Healthcare expenditure associated to disease events are assumed uniform (no differentiation by SES)
- Total healthcare expenditure only disaggregated by source (OOP, government expenditure, or private insurance) at national level (using WHO GHE database) and not by SES