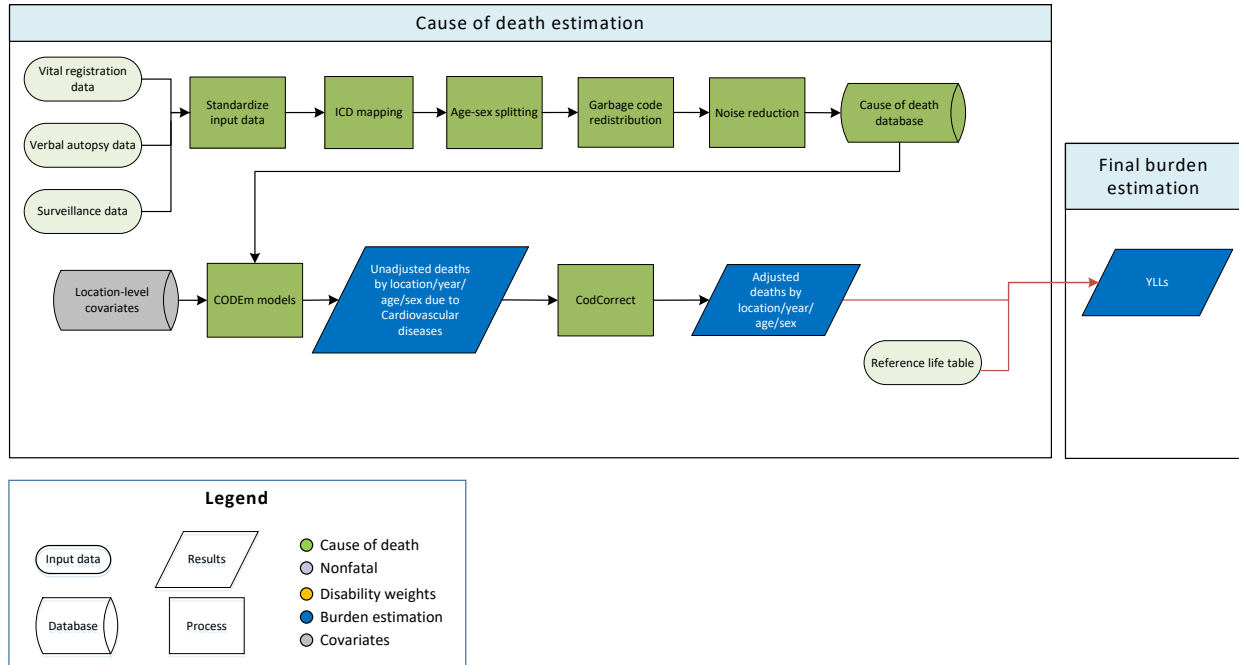


Cardiovascular diseases

Flowchart



Input data and methodological summary for cardiovascular diseases

Input data

Vital registration and verbal autopsy data were used to model the parent cardiovascular envelope. For GBD 2020, all verbal autopsy data sources included in the cardiovascular envelope were systematically reviewed. In order to maximise the reliability of the included data, verbal autopsy studies that did not meet the World Health Organization standards were excluded.¹ In addition, non-representative subnational verbal autopsies from a number of Indian states and verbal autopsy data in Nepal and Papua New Guinea that were implausible in terms of time and age trends, were outliered.

Data sources that were implausibly low in all age groups as well as ICD8 and ICD9BTL datapoints that were inconsistent with the rest of the data and created implausible time trends were also outliered. In addition, implausibly high ICD10 data from the 150 England Upper Tier Local Authorities 2014–2018 were outliered.

Modelling strategy

We used a standard CODEm approach to model deaths from cardiovascular diseases. For GBD 2020, a new approach to redistribute deaths coded to hypertension was implemented using data sources which included information on the chain of events leading to death. This update resulted in an increase in the

number of deaths that were re-assigned to cardiovascular diseases. Similarly, the method used to reduce the noise in the data, implemented after redistribution to handle both the stochastic variation across time and space and the occurrence of small number of deaths in each location/year/age/sex, was updated. This new empirical Bayesian noise reduction algorithm uses grouped data by region and data type as prior to better reflect regional patterns. A detailed description on the updates to noise reduction can be found in the cause of death methods section of the appendix.

The covariates included in the ensemble modelling process are listed in the table below. The summary exposure value scalar for CVD was dropped as these scalars were not produced for Level 2 causes after GBD 2019.

Apart from these changes to the covariates and the updates to the redistribution of deaths coded to hypertension, there are no substantive changes from the approach used in GBD 2019.

Table: Covariates used in cardiovascular diseases mortality modelling

Level	Covariate	Direction
1	Cholesterol (total, mean per capita)	1
	Smoking prevalence	1
	Systolic blood pressure (mm Hg)	1
2	Mean BMI	1
	Elevation over 1500m (proportion)	-1
	Fasting plasma glucose (mmol/L)	1
	Outdoor pollution (PM _{2.5})	1
	Indoor air pollution (all fuel types)	1
	Healthcare access and quality index	-1
3	Lag distributed income per capita (I\$)	-1
	Summary exposure value, omega-3 fatty acids	1
	Summary exposure value, fruits	1
	Summary exposure value, vegetables	1
	Summary exposure value, nuts and seeds	1
	Pulses/legumes (kcal/capita, unadjusted)	-1
	Summary exposure value, PUFA adjusted (percent)	1
	Alcohol (litres per capita)	1
	Trans fatty acid	1

References

1 WHO | Methodological trends in studies based on verbal autopsies before and after published guidelines. <https://www.who.int/bulletin/volumes/87/9/07-049288/en/> (accessed April 22, 2021).