Additional file 1

Causes of death

Table S1 Overview over causes of death used in the comparative risk assessment along with their ICD-10 codes

Cause of death	ICD 10 codes
Communicable diseases	
HIV/AIDS	B20-B24.9
Tuberculosis	A10-A14, A15-A19.9, B90-B90.9, K67.3, K93.0, M49.0, P37.0
Lower respiratory infections	A48.1, A70, J09-J15.8, J16-J16.9, J20-J21.9, P23.0-P23.4
Injuries	
Injuries	V00-V86.99, V87.2-V87.3, V88.2-V88.3, V90-V98.8, W00-W46.2, W49-W62.9, W64-W70.9, W73-W75.9, W77-W81.9, W83-W94.9, W97.9, W99-X06.9, X08-X39.9, X46-X47, X47.1-X47.8, X48-X48.9, X50-X54.9, X57-X58.9, X60-Y08.9, Y35-Y84.9, Y87.0-Y87.1, Y88-Y88.3, Y89.0-Y89.1
Non-communicable diseases	
Liver cirrhosis [a]	B18-B18.9, I85-I85.9, I98.2, K70-K70.9, K71.3-K71.51, K71.7, K72.1-K74.69, K74.9, K75.8-K76.0, K76.6-K76.7, K76.9
Pancreatitis [a]	K85-K86.9
Diabetes mellitus	E10-E10.11, E10.3-E11.1, E11.3-E12.1, E12.3-E13.11, E13.3-E14.1, E14.3-E14.9, P70.0-P70.2, R73-R73.9
Alcohol use disorders [a]	F10-F10.99, G31.2, G72.1, P04.3, Q86.0, R78.0, X45-X45.9
Epilepsy	G40-G41.9
Non-communicable diseases: cardiovascular diseases	
Ischemic heart disease	I20-I25.9
Ischemic stroke [b]	G45-G46.8, I63-I63.9, I65-I66.9, I67.2-I67.3, I67.5-I67.6, I69.3-I69.398
Hemorrhagic stroke [b]	I60-I61.9, I62.0-I62.03, I67.0-I67.1, I68.1-I68.2, I69.0-I69.298
Hypertensive heart disease [a]	I11-I11.9
Non-communicable diseases: cancer	
Breast cancer [c]	C50-C50.929, D05-D05.92, D24-D24.9, D48.6-D48.62, D49.3, N60-N60.99
Colon and rectum cancer [c]	C18-C21.9, D01.0-D01.3, D12-D12.9, D37.3-D37.5

Cause of death	ICD 10 codes
Larynx cancer [c]	C32-C32.9, D02.0, D14.1, D38.0
Liver cancer [c]	C22-C22.9, D13.4
Esophagus cancer [c]	C15-C15.9, D00.1, D13.0
Lip and oral cavity cancer [c]; pharynx cancer [c]	C0-C08.9, D00.00-D00.07, D10.0-D10.5, D11-D11.9, D37.01-D37.04, D37.09; C11-C11.9, D00.08, D10.6, D37.05, C09-C10.9, C12-C13.9, D10.7

a The hazard ratio used for splitting the deaths by SES was based on deaths from all causes.
b The hazard ratio used for splitting the deaths by SES was based on deaths from any type of stroke.
c The hazard ratio used for splitting the deaths by SES was based on deaths from any type of cancer.

Individual secondary data

NIDS

The National Income Dynamics Study (NIDS, [31]), Wave 4, was conducted from October 2014 to August 2015 by the University of Cape Town. NIDS is a household survey based on a clustered two-stage sampling frame, stratified by district councils (overall response rate 86.5%). While workers' hostels, convents and monasteries were included by the sampling frame, students' hostels, old age homes, hospitals, prisons, and military barracks, as well as homeless people, were excluded. Face-to-face interviews were conducted with all household members. After removing 4,078 observations with missing data on age, sex, SES, alcohol use, or survey weights, the sample comprised 22,741 adults (15+) with complete data. All analyses were performed taking survey weights into account.

It should be noted that in the nationally representative NIDS data, the race groups were highly unequally distributed across the three levels of SES. The vast majority of the white population (84%) were in the high and 13% in the middle SES group while the low SES group was mainly made up by the black African population (93% of the low SES group), followed by the 'coloured' population (6%). The terms 'white', 'black', and 'coloured', originate from the apartheid era. They are used as demographic markers, referring to people of European, African and mixed (African, European and/or Asian) ancestry, respectively. These markers were chosen for their historical significance and because they are commonly used in South Africa nowadays for purposes of sociodemographic monitoring.

Calculation of asset scores

SES is a multifaceted concept comprising aspects of income, wealth, and assets, occupation and employment, living conditions and education [18-20]. The traditional measures of SES (i.e., occupation, education and income) have downfalls regarding validity over time, disclosure (in the case of income), and gender bias (in the case of occupation) [20].

Measures of SES related to housing conditions, household assets (such as ownership of a refrigerator, TV, car), and access to basic services (i.e., water, sanitation and electricity) have gained importance in the context of low and middle income countries [19, 21, 22]. The assessment of the underlying variables has been found to be straightforward and moderately reliable [23, 24]. Another advantage of asset scores is that they capture multiple facets of SES, such as aspects of living circumstances and sanitation, as well as the ownership of assets that facilitate school attendance, pursuing a profession, accessing health services and other factors that are relevant to one's health [19, 22].

National Income Dynamics Study

For each household 27 dichotomous variables were available including electricity access of the household and ownership of the following assets: camera, cell phone, computer, donkey cart or ox cart, DVD or Bluray player, electric stove, fridge/freezer, gas stove, grinding mill, HiFi stereo , CD player, MP player, lounge suite, motor boat, motorcycle/scooter, non-motorised boat, paraffin stove, satellite dish, sewing/knitting machine, washing machine, bicycle, microwave, motor vehicle (including bakkie or truck) in running condition, plough, television, tractor, wheelbarrow, and radio.

Additionally the following two categorical variables were available:

- Water access of the household, categorized into 'piped (tab) water in the dwelling', 'Piped (tap) water on site or in yard', 'public tap', 'water-carrier/tanker', 'borehole off site/communal', 'rain-water tank on site', 'well', 'spring', 'borehole on site', 'flowing water/stream', 'dam/pool/stagnant water'.
- The type of toilet available to the household categorized into 'flush toilet with onsite or offsite disposal', 'pit latrine with ventilation pipe', 'pit latrine without ventilation pipe', 'chemical toilet', 'bucket toilet', 'none'.

The variables were combined to a continuous asset score using multiple correspondence analysis (MCA). A two-step selection process was applied for variable selection. First, all variables where over 95% of the participants reported the same category were excluded to assure stability of the model [first selection]. In the first selection ownership of a motor-cycle, non-motorised boat, a motor boat, a cart, a plough, a grinding mill and a tractor were excluded. Then missing values in individual asset variables were imputed based on an iterative MCA algorithm, using the imputeMCA command from the missMCA package [1]. After fitting the MCA on the imputed data, variables for which all categories contributed less than 1.5% to the first dimension were excluded [second selection]. In the second selection ownership of a paraffin stove and a wheelbarrow were excluded. The first dimension resulting from the MCA (explaining 69% of the total variation) was split into tertiles to represent low, middle, and high SES.

Demographic Surveillance Area

For each household 28 dichotomous variables were available including electricity access of the household and ownership of the following assets: Bed net, bed, bicycle, block maker, car, car battery, cattle, electric cooker with oven, electric hotplate, electric kettle, fridge, gas cooker, hoe/spade/fork, kombi/lorry/tractor, kitchen sink, motorcycle, other life stock, primus cooker, radio, sofa, sewing machine, table and chairs, landline telephone, cell phone, TV, videorecorder, and wheelbarrow. Additionally the following three categorical variables were available:

- Water access of the household, categorized into ‘piped water in the dwelling’, ‘piped water in the yard, water carrier or water tanker’, ‘piped public tab/kiosk’, ‘protected spring/rainwater/borehole/well/ flowing river or stream/stagnant water or dam ’.
- The type of toilet available to the household categorized into ‘flush toilet’, ‘pit latrine/chemical toilet/ bucket toilet’, and ‘none’.
- The kind of cooking fuel available to the household categorized into ‘electricity from the grid or solar energy’, ‘electricity from a generator/gas/coal’, and ‘paraffin/wood’.

The variables referring to car battery, motorcycle, kombi/lorry/tractor, and bed net ownership were excluded in the first selection. The variables referring hoe/spade/fork and block maker ownership were excluded in the second selection. The final MCA used 25 asset variables. The first dimension of the MCA (explaining 57% of the total variation) was split in three equal tertiles for the sensitivity analysis and was mapped onto the national distribution for the main analysis.

Hazard ratios

The HRs were derived from DSA data using Cox proportional hazards survival analyses for specific causes of death, as well as broader cause-categories, adjusting for age at baseline and sex. When a cause-specific HR was not available or when less than 50 deaths had been observed from a specific cause of death, a broader category (e.g. all strokes or all cancers) or an HR for all-cause mortality was used.

Table S2 Hazard ratios used for splitting deaths by socioeconomic status. The asset score measuring socioeconomic status was once mapped onto the national asset distribution, once the unmapped original hazard ratios are show

	Mapped				Unmapped			
Cause of death	**HR**	**95% CI**	**N**	**Deaths**	**HR**		**N**	**Deaths**
All causes	1		5,222	133	1		29,012	1,710
	2.07	(1.74-2.46)	33,942	2,889	1.48	(1.40-1.57)	29,007	4,069
	2.73	(2.30-3.24)	47,806	8,479	1.62	(1.53-1.71)	28,951	5,722
HIV/AIDS	1		5,222	17	1		29,012	256
	2.69	(1.65-4.36)	33,942	411	1.60	(1.38-1.86)	29,007	574
	4.24	(2.62-6.85)	47,806	1,249	2.04	(1.77-2.35)	28,951	847
Tuberculosis	1		5,222	44	1		29,012	566
	2.42	(1.79-3.28)	33,942	997	1.88	(1.71-2.07)	29,007	1,530
	3.84	(2.85-5.17)	47,806	3,093	2.14	(1.95-2.35)	28,951	2,038
Pneumonia	1		5,222	2	1		29,012	28
	1.98	(0.48-8.18)	33,942	46	1.50	(0.97-2.32)	29,007	73
	3.45	(0.85-13.93)	47,806	195	2.12	(1.41-3.20)	28,951	142
Injuries	1		5,222	18	1		29,012	215
	2.02	(1.26-3.25)	33,942	335	1.26	(1.07-1.49)	29,007	389
	2.15	(1.34-3.43)	47,806	662	1.22	(1.03-1.44)	28,951	411
Diabetes mellitus	1		5,222	3	1		29,012	49
	1.42	(0.45-4.52)	33,942	77	0.74	(0.52-1.06)	29,007	84
	1.08	(0.34-3.40)	47,806	185	0.72	(0.51-1.00)	28,951	132
Ischemic heart disease	1		5,222	1	1		29,012	10
	1.52	(0.20-11.40)	33,942	19	1.50	(0.72-3.11)	29,007	26
	2.09	(0.29-15.17)	47,806	63	1.96	(0.98-3.92)	28,951	47
Stroke	1		5,222	3	1		29,012	52
	1.94	(0.62-6.13)	33,942	105	1.55	(1.14-2.11)	29,007	184
	2.38	(0.76-7.44)	47,806	410	1.44	(1.07-1.95)	28,951	282

	Mapped				Unmapped			
Cause of death	**HR**	**95% CI**	**N**	**Deaths**	**HR**		**N**	**Deaths**
All cancer	1		5,222	9	1		29,012	109
	1.75	(0.90-3.42)	33,942	200	1.46	(1.17-1.83)	29,007	293
	2.26	(1.17-4.37)	47,806	664	1.65	(1.33-2.04)	28,951	471

HR Hazard ratio; CI confidence interval

Alcohol attributable fractions (AAF)

Table S3 Alcohol-attributable fractions (AAF) among men by cause of death, socioeconomic status (SES) and age-group in South Africa, 2015

SES		Low		Middle		High	
Cause of death	**Age**	**AAF**	**95% UI**	**AAF**	**95% UI**	**AAF**	**95% UI**
HIV/AIDS	15-34	33.6	(10.1-57.4)	5.8	(3.4-8.6)	6.0	(3.4-8.8)
	35-54	40.0	(14.8-63.1)	9.0	(5.5-12.9)	7.1	(4.2-10.4)
	55+	35.1	(10.5-59.2)	6.3	(3.7-9.4)	4.7	(2.6-7.2)
Tuberculosis	15-34	43.4	(9.0-78.5)	44.4	(9.6-78.9)	45.1	(9.7-79.2)
	35-54	55.4	(13.5-86.2)	56.0	(13.9-86.5)	49.7	(11.2-82.2)
	55+	45.2	(10.9-79.4)	47.2	(11.9-80.8)	40.4	(10.7-74.3)
Lower respiratory infections	15-34	10.8	(3.7-19.1)	11.4	(3.9-20.0)	11.7	(3.8-20.7)
	35-54	16.2	(6.2-27.2)	16.7	(6.4-27.7)	13.8	(4.8-23.6)
	55+	12.9	(5.4-21.4)	14.1	(6.3-23.0)	12.5	(5.9-19.8)
Injuries	15-34	23.8	(19.1-28.9)	24.2	(19.1-29.5)	25.0	(19.4-30.8)
	35-54	31.6	(25.0-38.1)	33.4	(26.9-39.8)	26.7	(20.1-33.4)
	55+	21.1	(15.5-26.7)	25.0	(18.4-31.8)	16.6	(11.4-21.9)
Liver Cirrhosis	15-34	69.8	(59.4-78.2)	70.4	(60.0-78.7)	70.7	(60.2-79.0)
	35-54	79.7	(71.6-85.9)	80.1	(72.1-86.3)	74.7	(65.1-82.2)
	55+	71.0	(60.5-79.3)	72.8	(62.5-81.0)	65.5	(53.4-75.3)
Pancreatitis	15-34	41.7	(21.9-62.0)	42.7	(22.7-63.1)	43.4	(23.4-63.6)
	35-54	53.5	(30.8-73.2)	54.2	(31.2-73.6)	47.9	(26.7-67.7)
	55+	43.5	(23.9-63.6)	45.5	(25.4-65.6)	38.8	(21.3-58.3)
Diabetes mellitus	15-34	0.4	(-8.5-10.9)	0.2	(-9.4-11.2)	-0.3	(-10.7-11.2)

SES		Low		Middle		High	
Cause of death	**Age**	**AAF**	**95% UI**	**AAF**	**95% UI**	**AAF**	**95% UI**
	35-54	2.9	(-10.6-17.3)	3.0	(-11.0-17.7)	0.7	(-11.4-13.9)
	55+	2.0	(-8.9-13.6)	3.1	(-9.0-15.6)	2.6	(-8.3-14.0)
Epilepsy	15-34	28.4	(21.1-36.1)	29.4	(21.8-37.2)	30.1	(22.4-38.1)
	35-54	38.5	(29.9-47.2)	39.2	(30.5-47.9)	34.0	(25.7-42.4)
	55+	30.5	(22.9-38.4)	32.2	(24.2-40.4)	27.3	(20.3-34.9)
Ischemic heart disease	15-34	-1.3	(-11.2-5.1)	-1.9	(-11.2-5.1)	-2.8	(-11.2-5.1)
	35-54	1.7	(-7.4-4.3)	1.9	(-7.4-4.3)	-1.5	(-7.4-4.3)
	55+	1.8	(-3.2-8.6)	3.0	(-3.3-8.6)	2.4	(-3.3-8.7)
Ischemic stroke	15-34	6.3	(-0.1-17.0)	6.4	(-0.3-16.9)	5.8	(0.0-17.0)
	35-54	12.2	(1.0-17.1)	12.5	(0.8-17.0)	8.1	(1.0-17.1)
	55+	8.1	(-1.5-21.3)	9.8	(-1.4-21.4)	8.6	(-1.6-21.1)
Hemorrhagic stroke	15-34	16.2	(10.3-22.5)	16.9	(10.8-23.6)	17.3	(11.2-23.9)
	35-54	23.6	(15.0-32.4)	24.2	(15.4-33.2)	20.2	(13.0-28.0)
	55+	19.0	(10.9-27.8)	20.7	(11.5-30.6)	18.3	(9.0-28.5)
Hypertensive heart disease	15-34	17.6	(14.2-21.0)	18.6	(15.1-22.2)	19.5	(15.7-23.3)
	35-54	23.6	(19.7-27.5)	24.2	(20.2-28.1)	21.9	(17.8-26.0)
	55+	19.8	(16.0-23.6)	20.9	(16.8-25.0)	18.9	(14.9-22.9)
Colon and rectum cancer	15-34	14.0	(9.9-18.4)	14.7	(10.3-19.3)	15.1	(10.6-19.9)
	35-54	20.4	(14.9-26.1)	20.9	(15.3-26.7)	17.6	(12.5-22.9)
	55+	16.1	(11.6-20.8)	17.4	(12.6-22.5)	15.1	(10.9-19.6)
Liver cancer	15-34	45.2	(34.5-54.4)	45.4	(34.4-54.9)	45.3	(33.6-55.2)
	35-54	60.2	(51.1-67.8)	60.8	(51.6-68.4)	51.2	(40.0-60.6)
	55+	46.7	(35.8-56.1)	49.6	(38.8-59.0)	39.6	(28.3-49.9)

SES		Low		Middle		High	
Cause of death	**Age**	**AAF**	**95% UI**	**AAF**	**95% UI**	**AAF**	**95% UI**
Lip, oral cavity, and pharynx cancer	15-34	50.7	(43.3-57.6)	51.8	(44.2-58.7)	52.7	(44.8-59.7)
	35-54	62.2	(55.2-68.4)	62.8	(55.8-69.0)	57.0	(49.3-63.9)
	55+	52.5	(44.7-59.5)	54.3	(46.1-61.7)	47.5	(39.0-55.3)
Larynx cancer	15-34	29.4	(22.6-36.3)	30.4	(23.4-37.5)	31.3	(24.1-38.5)
	35-54	39.3	(31.4-47.0)	40.0	(32.1-47.7)	35.0	(27.3-42.7)
	55+	31.5	(24.4-38.7)	33.1	(25.7-40.7)	28.4	(21.6-35.4)
Esophagus cancer	15-34	50.0	(26.2-73.8)	51.4	(27.7-74.5)	52.5	(28.7-75.0)
	35-54	60.4	(33.2-82.2)	61.1	(33.9-82.6)	56.4	(31.5-78.5)
	55+	51.9	(28.3-74.9)	53.4	(29.1-76.4)	47.7	(26.6-70.4)

SES socioeconomic status; AAF alcohol-attributable fraction; UI uncertainty interval

Table S4 Alcohol-attributable fractions (AAF) among women by cause of death, socioeconomic status (SES) and age-group in South Africa, 2015

SES		Low		Middle		High	
Cause of death	**Age**	**AAF**	**95% UI**	**AAF**	**95% UI**	**AAF**	**95% UI**
HIV/AIDS	15-34	14.8	(2.8-32.6)	1.9	(0.5-3.4)	2.5	(0.6-4.6)
	35-54	15.2	(4.2-31.6)	2.1	(0.8-3.6)	1.4	(0.2-3.1)
	55+	12.0	(2.6-27.1)	1.3	(0.5-2.3)	1.3	(0.3-2.7)
Tuberculosis	15-34	17.0	(5.3-43.5)	19.7	(6.9-46.4)	23.9	(7.9-53.1)
	35-54	23.2	(6.0-57.1)	20.5	(6.4-50.0)	18.3	(6.8-40.7)
	55+	17.1	(6.1-43.6)	14.7	(5.1-39.2)	16.5	(6.6-38.4)
Lower respiratory infections	15-34	6.1	(3.6-9.0)	7.8	(4.8-11.4)	9.0	(5.3-13.5)
	35-54	6.9	(3.9-10.6)	7.3	(4.4-10.9)	7.9	(4.7-11.6)
	55+	6.8	(4.3-9.8)	5.8	(3.6-8.5)	7.7	(4.6-11.2)
Injuries	15-34	10.9	(7.7-14.1)	14.1	(11-17.4)	14.7	(10.8-18.6)
	35-54	14.3	(10.7-18.1)	12.6	(8.8-16.4)	13.2	(9.6-17.0)
	55+	9.3	(6.5-12.1)	7.7	(5.1-10.7)	7.9	(5.1-11.0)
Liver Cirrhosis	15-34	59.0	(44.0-73.1)	64.4	(49.5-78)	69.4	(55.4-80.8)
	35-54	65.0	(52.1-76.3)	63.9	(49.3-76.9)	64.4	(49.7-78.0)
	55+	59.8	(43.7-75.3)	55.7	(38.9-72.3)	61.6	(44.7-77.6)
Pancreatitis	15-34	12.4	(1.1-42.5)	13.4	(0.9-44.5)	15.1	(-1-50.7)
	35-54	20.4	(3.0-57.4)	15.9	(1.9-49.4)	7.7	(-2.6-34.4)
	55+	14.0	(3.1-43.2)	11.7	(2.4-38.5)	9.8	(0.7-34.5)
Diabetes mellitus	15-34	-1.7	(-4.5-1.9)	-2.8	(-6.4-1.8)	-5.2	(-10.2-1)
	35-54	-0.5	(-3.8-3.8)	-1.6	(-5.0-2.8)	-6.6	(-10.8--1.4)

SES		Low		Middle		High	
Cause of death	**Age**	**AAF**	**95% UI**	**AAF**	**95% UI**	**AAF**	**95% UI**
	55+	-0.3	(-3.0-3.1)	-0.4	(-2.9-2.5)	-2.8	(-6.5-1.4)
Epilepsy	15-34	11.3	(7.3-15.5)	13.7	(8.9-18.7)	16.6	(10.6-22.7)
	35-54	14.5	(9.9-19.3)	13.7	(8.8-18.5)	13.4	(8.7-18.7)
	55+	11.6	(7.8-15.6)	10.0	(6.4-13.9)	12.1	(7.8-16.9)
Ischemic heart disease	15-34	4.2	(-4.3-17.3)	5.0	(-4.2-17.4)	5.0	(-4.4-17.4)
	35-54	6.0	(-3.7-11.1)	5.3	(-3.8-11.0)	2.9	(-3.8-11.1)
	55+	4.8	(-0.3-10.0)	4.0	(-0.3-10.0)	4.4	(-0.4-10.0)
Ischemic stroke	15-34	4.4	(-8.2-55.1)	3.6	(-8.3-55.2)	2.6	(-8.3-54.1)
	35-54	10.2	(-12.0-11.0)	5.7	(-12.1-10.8)	-3.2	(-12.4-10.7)
	55+	3.4	(-6.1-15.7)	2.7	(-6.4-15.2)	0.2	(-5.3-16.0)
Hemorrhagic stroke	15-34	11.4	(3.5-22.5)	13.3	(3.9-25.8)	16.8	(5.7-31.4)
	35-54	15.9	(5.8-30.2)	13.9	(4.4-26.8)	12.5	(3.7-24.4)
	55+	11.0	(2.7-22.3)	9.4	(2.3-19.8)	10.7	(2.1-22.2)
Hypertensive heart disease	15-34	8.5	(4.8-13.3)	10.4	(6.0-16.0)	12.3	(6.7-19.4)
	35-54	10.6	(6.1-16.4)	10.3	(5.9-15.9)	9.5	(5.3-15.3)
	55+	9.1	(5.6-13.5)	7.8	(4.6-11.9)	9.4	(5.4-14.4)
Breast cancer	15-34	9.5	(6.5-12.4)	11.7	(8.0-15.2)	14.1	(9.5-18.5)
	35-54	11.9	(8.6-14.9)	11.5	(7.8-14.9)	11.6	(7.8-15.5)
	55+	10.0	(7.0-12.8)	8.5	(5.7-11.3)	10.6	(7.0-14.3)
Colon and rectum cancer	15-34	6.9	(4.8-9.2)	8.8	(6.1-11.6)	10.3	(7.1-13.7)
	35-54	8.1	(5.8-10.6)	8.4	(5.8-11.0)	8.8	(6.0-11.9)
	55+	7.6	(5.3-10.0)	6.5	(4.4-8.7)	8.4	(5.5-11.6)
Liver cancer	15-34	15.1	(6.4-23.7)	16.4	(7.1-26.3)	18.9	(7.7-31.1)

SES		Low		Middle		High	
Cause of death	**Age**	**AAF**	**95% UI**	**AAF**	**95% UI**	**AAF**	**95% UI**
	35-54	25.3	(14.6-33.6)	19.2	(8.5-28.6)	11.8	(5.3-21.7)
	55+	16.7	(8.3-24.3)	14.1	(6.6-21.6)	12.4	(5.9-21.1)
Lip, oral cavity, and pharynx cancer	15-34	21.1	(12.5-28.2)	24.2	(14.4-32.2)	29.3	(17.4-38.8)
	35-54	28.1	(19.7-35.0)	25.1	(15.3-32.8)	22.7	(13.5-31.9)
	55+	20.8	(13.0-27.3)	18.1	(10.6-24.9)	20.2	(11.9-28.4)
Larynx cancer	15-34	11.9	(7.7-15.9)	14.4	(9.4-19.2)	17.5	(11.3-23.5)
	35-54	14.9	(10.4-19.4)	14.2	(9.3-18.9)	14.2	(9.2-19.6)
	55+	12.0	(8.1-15.8)	10.3	(6.7-14.1)	12.7	(8.2-17.5)
Esophagus cancer	15-34	21.9	(11.0-40.5)	25.7	(13.9-44.6)	31.4	(17.2-51.5)
	35-54	27.3	(12.6-50.9)	25.7	(13.0-46.0)	25.9	(14.9-42.3)
	55+	21.0	(10.8-39.2)	18.4	(9.0-35.7)	22.2	(12.3-38.2)

SES socioeconomic status; AAF alcohol-attributable fraction; UI uncertainty interval

Age-standardized mortality rates for all causes of death

Table S5 Age-standardized mortality rates per 100,000 adult (15+) population for alcohol-attributable causes of death in South Africa in 2015, by SES and sex (main analysis)

		Men		Women	
Cause of death	**SES**	**Mortality rate**	**95% UI**	**Mortality rate**	**95% UI**
HIV/AIDS	Low	328.4	(111.8-328.4)	143.2	(35.2-143.2)
	Middle	43.7	(15.7-43.7)	11.0	(3.0-11.0)
	High	12.8	(5.3-12.8)	4.0	(0.9-4.0)
Tuberculosis	Low	142.0	(44.2-142.0)	24.3	(6.4-24.3)
	Middle	95.9	(28.4-95.9)	14.3	(3.7-14.3)
	High	34.8	(10.6-34.8)	5.7	(1.8-5.7)
Lower respiratory infections	Low	56.3	(7.7-56.3)	17.9	(3.1-17.9)
	Middle	48.5	(3.4-48.5)	13.6	(1.1-13.6)
	High	17.1	(2.4-17.1)	7.3	(1.1-7.3)
Injuries	Low	100.8	(50.4-100.8)	13.4	(6.4-13.4)
	Middle	105.1	(49.3-105.1)	12.7	(5.9-12.7)
	High	42.0	(22.6-42.0)	6.2	(3.3-6.2)
Liver cirrhosis	Low	31.1	(23.3-31.1)	11.9	(7.8-11.9)
	Middle	24.8	(17.5-24.8)	8.9	(5.4-8.9)
	High	10.7	(7.8-10.7)	4.5	(2.9-4.5)
Pancreatitis	Low	1.7	(0.9-1.7)	0.4	(0.1-0.4)
	Middle	1.3	(0.7-1.3)	0.3	(0.0-0.3)
	High	0.6	(0.3-0.6)	0.1	(0.0-0.1)
Diabetes mellitus	Low	16.8	(-9.1-16.8)	3.4	(-3.7-3.4)

Cause of death	SES	Men		Women	
		Mortality rate	95% UI	Mortality rate	95% UI
	Middle	24.6	(-11.7-24.6)	3.2	(-4.9-3.2)
	High	13.4	(-7.2-13.4)	0.5	(-7.8-0.5)
Alcohol use disorders	Low	12.6	(11.2-14.0)	2.5	(2.3-2.8)
	Middle	9.6	(8.3-10.9)	1.9	(1.7-2.2)
	High	4.6	(4.2-5.1)	0.9	(0.8-1.0)
Epilepsy	Low	9.5	(6.6-9.5)	1.7	(1.1-1.7)
	Middle	7.7	(5.1-7.7)	1.3	(0.8-1.3)
	High	3.2	(2.2-3.2)	0.7	(0.4-0.7)
Ischemic heart disease	Low	27.3	(-7.8-27.3)	26.7	(-0.1-26.7)
	Middle	24.7	(-6.3-24.7)	26.0	(-0.1-26.0)
	High	12.2	(-3.5-12.2)	13.7	(-0.1-13.7)
Ischemic stroke	Low	22.3	(-1.0-22.3)	15.8	(-6.1-15.8)
	Middle	19.8	(-0.8-19.8)	13.7	(-5.6-13.7)
	High	8.7	(-0.5-8.7)	6.8	(-2.2-6.8)
Hemorrhagic stroke	Low	36.5	(6.5-36.5)	23.8	(2.4-23.8)
	Middle	37.2	(4.9-37.2)	19.4	(1.5-19.4)
	High	14.6	(2.9-14.6)	9.8	(0.9-9.8)
Hypertensive heart disease	Low	13.7	(9.0-13.7)	9.4	(4.1-9.4)
	Middle	11.1	(7.0-11.1)	6.4	(2.6-6.4)
	High	4.8	(3.1-4.8)	3.6	(1.4-3.6)
Breast cancer	Low	n.a.		6.1	(2.3-6.1)
	Middle	n.a.		4.8	(1.5-4.8)

Cause of death	SES	Men		Women	
		Mortality rate	95% UI	Mortality rate	95% UI
	High	n.a.		2.8	(1.2-2.8)
Colon and rectum cancer	Low	6.8	(2.5-6.8)	2.0	(0.7-2.0)
	Middle	6.3	(1.9-6.3)	1.5	(0.5-1.5)
	High	2.7	(1.1-2.7)	1.0	(0.4-1.0)
Liver cancer	Low	13.7	(5.5-13.7)	2.3	(0.7-2.3)
	Middle	12.5	(4.0-12.5)	1.7	(0.4-1.7)
	High	5.1	(2.2-5.1)	0.8	(0.2-0.8)
Lip, oral cavity, and pharynx cancer	Low	32.2	(13.6-32.2)	4.1	(1.5-4.1)
	Middle	29.6	(9.5-29.6)	3.2	(0.9-3.2)
	High	12.8	(5.9-12.8)	1.8	(0.6-1.8)
Larynx cancer	Low	3.7	(1.5-3.7)	0.2	(0.1-0.2)
	Middle	3.4	(1.0-3.4)	0.1	(0.0-0.1)
	High	1.4	(0.6-1.4)	0.1	(0.0-0.1)
Esophagus cancer	Low	35.9	(11.0-35.9)	5.8	(1.5-5.8)
	Middle	31.4	(7.9-31.4)	4.4	(0.9-4.4)
	High	14.4	(4.8-14.4)	2.5	(0.7-2.5)

SES socioeconomic status; UI uncertainty interval; n.a. not applicable

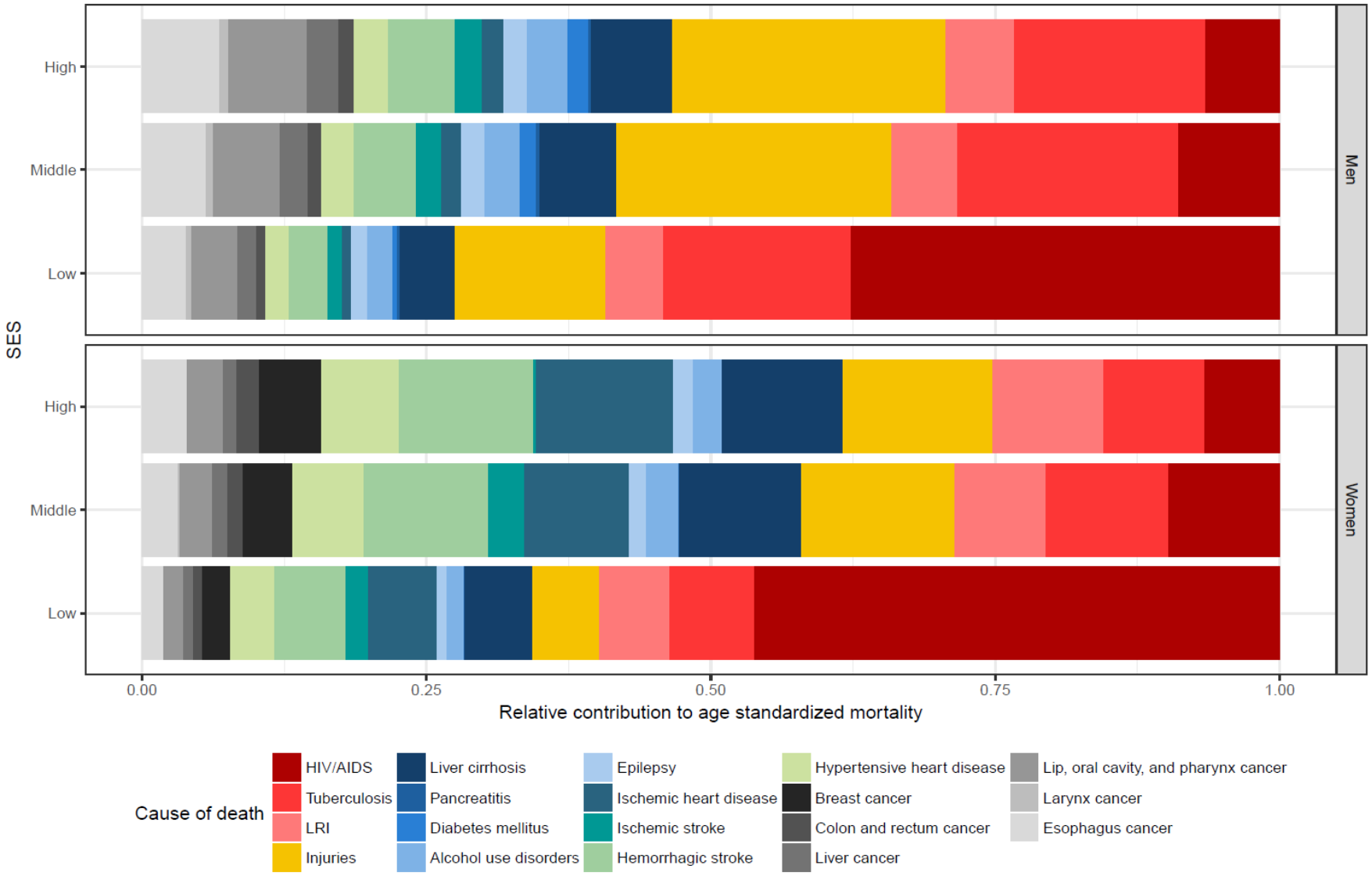

Figure S1 Relative contribution of causes of death to the overall age standardized mortality rates by SES for men and women in South Africa, 2015

Sensitivity analysis

As in the main analysis, the category with the most deaths among persons of high SES was alcohol-attributable deaths due to chronic diseases (about 5,300 deaths, 95% UI 1,600-9,900) whereas alcohol-attributable deaths due to infectious diseases constituted the largest sub-group in persons low SES (about 20,400 deaths, 95% UI 6,200-36,400). In the middle SES group deaths due to chronic (6,200, 95% UI 2,600-10,600) and infectious diseases (6,400, 95% UI 2,400-10,800) were roughly equally common. The age-standardized mortality rate from all alcohol-attributable deaths was 603 (95% UI 337-913) deaths per 100,000 adults in the low, 380 (95% UI 219-566) deaths per 100,000 adults in the middle, and 225 (95% UI 123-346) deaths per 100,000 adults in the high SES group. Thereby the alcohol-attributable mortality rate was still about 2.6 times higher at low, and about 1.4 times higher at middle SES compared to high SES. This compares to HRs of all-cause mortality of 1.48 (95% CI 1.40-1.57) for low compared to high SES and 1.62 (95% CI 1.53-1.71) for middle compared to high SES using the un-projected asset score (Additional file 1: Table S2).

Table S6 Sensitivity analysis: age-standardized mortality rates per 100,000 adult (15+) population for alcohol-attributable causes of death in South Africa in 2015, by SES and sex using unmapped hazard ratios to split deaths

		Men		Women	
Cause of death	**SES**	**Mortality rate**	**95% UI**	**Mortality rate**	**95% UI**
HIV/AIDS	Low	174.0	(98.4-251.9)	62.1	(30.3-111.0)
	Middle	28.2	(19.7-37.9)	6.5	(3.4-9.8)
	High	14.7	(10.2-19.7)	3.8	(1.7-6.3)

Cause of death	SES	Men		Women	
		Mortality rate	95% UI	Mortality rate	95% UI
Tuberculosis	Low	74.3	(36.2-110.7)	9.9	(5.3-19.2)
	Middle	67.3	(33.2-99.0)	8.0	(4.3-15.3)
	High	31.6	(15.7-48.3)	4.5	(2.6-8.0)
Lower respiratory infections	Low	24.1	(11.8-39.5)	8.7	(5.4-12.8)
	Middle	18.4	(8.9-31.5)	5.5	(3.2-8.8)
	High	10.8	(5.8-16.9)	4.7	(2.9-6.9)
Injuries	Low	62.5	(51.9-73.9)	8.1	(6.5-9.8)
	Middle	69.6	(57.7-82.4)	8.3	(6.7-10.1)
	High	47.0	(39.1-55.1)	6.8	(5.6-8.2)
Liver cirrhosis	Low	22.5	(20.0-24.7)	8.1	(6.6-9.6)
	Middle	21.0	(18.6-23.0)	7.1	(5.6-8.5)
	High	12.9	(11.2-14.4)	5.1	(4.2-6.1)
Pancreatitis	Low	1.0	(0.7-1.3)	0.1	(0.0-0.3)
	Middle	1.0	(0.7-1.3)	0.1	(0.0-0.3)
	High	0.6	(0.4-0.8)	0.1	(0.0-0.2)
Diabetes mellitus	Low	2.1	(-7.4-12.5)	-0.3	(-2.9-2.8)
	Middle	3.1	(-7.7-14.8)	-0.6	(-3.1-2.2)
	High	3.2	(-9.8-16.9)	-4.8	(-9.5-0.7)
Alcohol use disorders	Low	10.3	(9.9-10.7)	2.1	(2.0-2.2)
	Middle	9.4	(9.0-9.8)	1.9	(1.8-2.0)
	High	6.3	(6.2-6.5)	1.3	(1.3-1.3)
Epilepsy	Low	6.6	(5.6-7.7)	1.2	(0.9-1.4)

Cause of death	SES	Men		Women	
		Mortality rate	95% UI	Mortality rate	95% UI
	Middle	6.3	(5.3-7.3)	1.0	(0.8-1.2)
	High	3.8	(3.2-4.4)	0.8	(0.6-1.0)
Ischemic heart disease	Low	4.3	(-7.4-20.9)	9.8	(-0.2-21.1)
	Middle	5.5	(-5.9-17.1)	6.2	(-0.2-17.7)
	High	2.6	(-3.8-10.3)	4.3	(-0.1-10.6)
Ischemic stroke	Low	5.6	(-0.9-14.8)	2.7	(-4.7-12.0)
	Middle	7.2	(-0.9-16.0)	2.2	(-5.3-12.7)
	High	4.1	(-0.7-9.9)	0.1	(-2.8-8.5)
Hemorrhagic stroke	Low	15.2	(9.0-22.6)	8.3	(2.7-16.4)
	Middle	17.6	(10.1-26.8)	7.7	(2.5-15.7)
	High	10.0	(5.4-15.3)	5.5	(1.5-11.0)
Hypertensive heart disease	Low	9.2	(7.6-10.8)	5.4	(3.5-7.7)
	Middle	8.8	(7.2-10.5)	4.2	(2.7-6.3)
	High	5.4	(4.4-6.4)	3.4	(2.1-5.0)
Breast cancer	Low	n.a.		3.7	(2.7-4.6)
	Middle	n.a.		2.9	(2.1-3.8)
	High	n.a.		2.3	(1.7-3.0)
Colon and rectum cancer	Low	3.9	(2.8-5.1)	1.2	(0.8-1.6)
	Middle	3.7	(2.7-5.0)	0.9	(0.6-1.3)
	High	2.2	(1.6-2.8)	0.8	(0.6-1.1)
Liver cancer	Low	8.3	(6.5-10.1)	1.3	(0.8-1.8)
	Middle	7.7	(6.0-9.6)	0.9	(0.5-1.4)

Cause of death	SES	Men		Women	
		Mortality rate	95% UI	Mortality rate	95% UI
Lip, oral cavity, and pharynx cancer	High	4.3	(3.3-5.3)	0.5	(0.3-0.8)
	Low	19.9	(16.3-23.6)	2.4	(1.7-3.1)
	Middle	18.2	(14.5-22.2)	1.9	(1.3-2.6)
Larynx cancer	High	11.0	(9.1-12.9)	1.4	(0.9-1.9)
	Low	2.2	(1.7-2.7)	0.1	(0.1-0.1)
	Middle	2.0	(1.5-2.6)	0.1	(0.0-0.1)
Esophagus cancer	High	1.2	(0.9-1.5)	0.1	(0.0-0.1)
	Low	19.4	(11.5-27.5)	2.7	(1.5-4.7)
	Middle	17.7	(10.4-25.4)	2.1	(1.2-3.9)
	High	10.8	(6.6-15.5)	1.7	(1.0-2.8)

SES socioeconomic status, UI uncertainty interval, n.a. not applicable

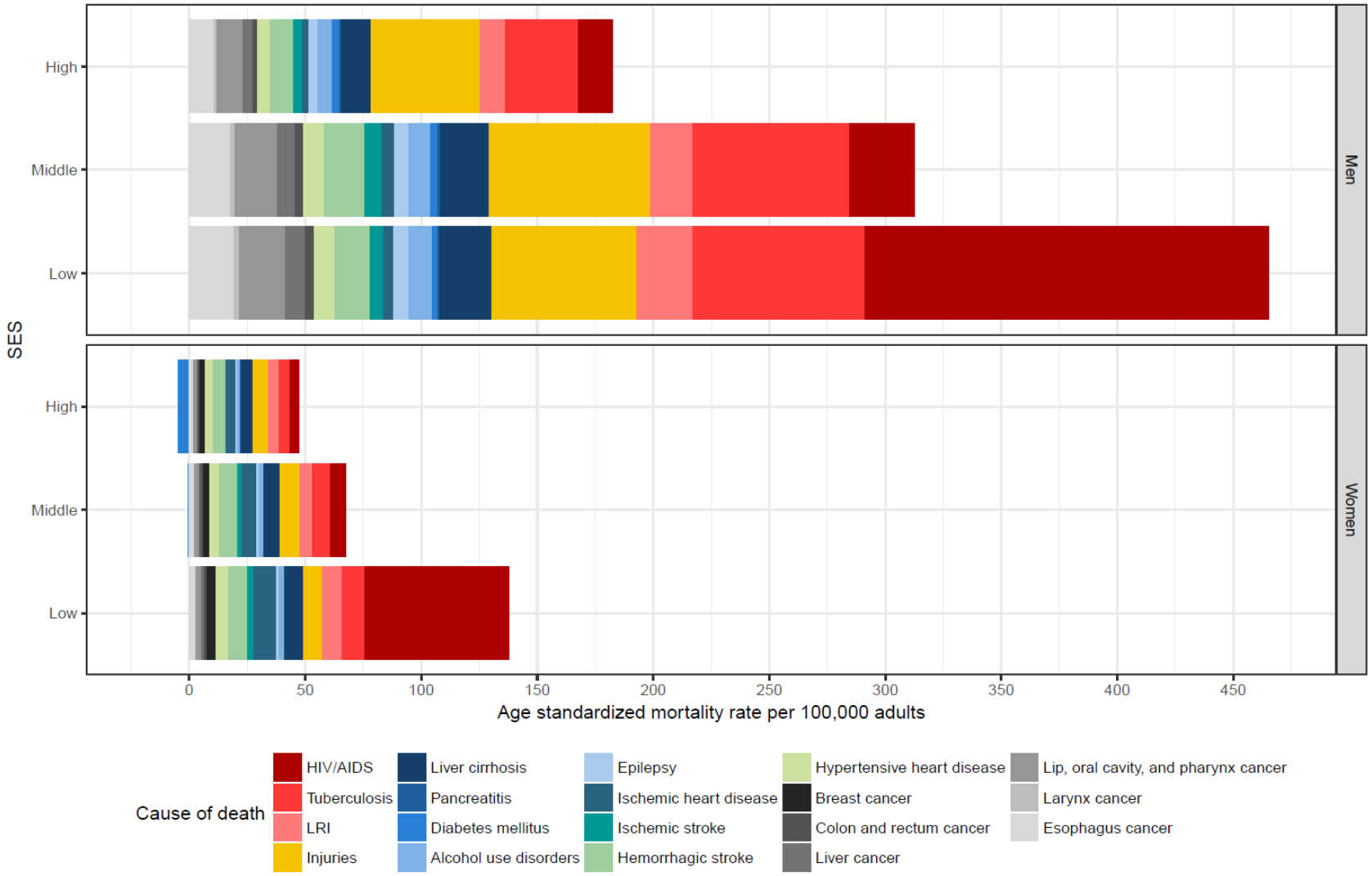

Figure S2 Sensitivity analysis: Age-standardized mortality rates per 100,000 attributable to alcohol consumption by socioeconomic status (SES) and cause of death among men and women in South Africa, 2015

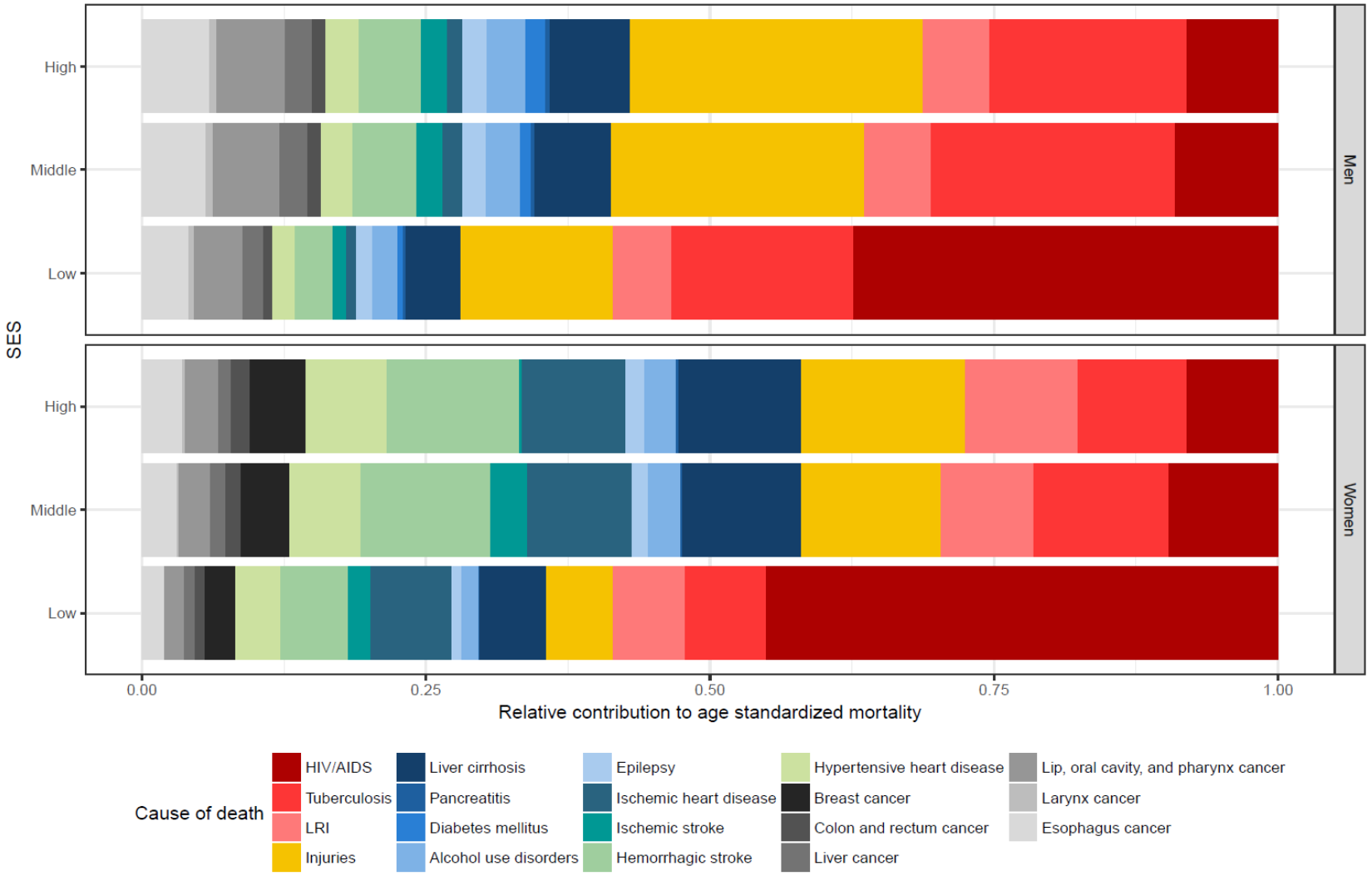

Figure S3 Sensitivity analysis: Relative contribution of causes of death to the overall age standardized mortality rates by SES for men and women in South Africa, 2015

References

1. Josse R, Husson F. missMDA: A Package for Handling Missing Values in Multivariate Data Analysis. Journal of Statistical Software 2016, 70(1):1-31.