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Supplemental Material

Health Effects of Household Solid Fuel Use: Findings from 11 Countries within the Prospective Urban and Rural Epidemiology Study

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Figure S1. Associations between solid fuel use, traditional CVD risk factors, and SES for 91,350 adults aged 35-70 from 467 urban and rural communities in 11 countries. Lines correspond to statistically significant ($p<0.05$) associations in unadjusted linear regression models, with solid blue and dotted red lines for positive and negative model coefficients, respectively. Graphs were created in JavaScript, using a modified version of the hierarchical edge bundling script created by Mike Bostock (https://beta.observablehq.com/@mbostock/d3-hierarchical-edge-bundling).

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[#] Deceased

Event Definitions

Below are event definitions used for fatal and non-fatal disease classification.

FATAL EVENTS

CVD Mortality:

Sudden unexpected cardiovascular death

Death that occurred suddenly and unexpectedly without evidence of other cause of death (examples: witnessed collapse, persons resuscitated from cardiac arrest who later died) or persons seen alive less than 12 hours prior to discovery of death (example:persons found dead in his/her bed).

Non-sudden unexpected cardiovascular death.

Death that occurred unexpectedly without evidence of other cause of death in persons seen alive more than 12 hours but less than 24 hours.

Fatal myocardial infarction (MI) (one of the following)

- Autopsy demonstrating fresh myocardial infarction and/or recent coronary occlusion, or
- ECG showing new and definite signs of MI (Minnesota code 1.11), or
- Symptoms typical or atypical or inadequately described but attributed to cardiac origin lasting more than 10 minutes and cardiac enzymes at least twice above the upper limit of normal or troponin at at least the lower level of necrosis, or
- ECG with new ischemic changes (new ST depression or T wave inversion ≥2 mm) and cardiac enzymes at least twice above the upper limit of normal or troponin at least the lower level of necrosis.

Fatal Stroke

Diagnosis of stroke by a physician based on sudden neurological deficit of vascular origin with or without neuroimaging studies (CT scan/MRI scan/angiography/Doppler) lasting 24 hours and more, occurring within 30 days of signs or symptoms of stroke or autopsy evidence of a recent stroke. If death occurred within 24 hours of onset of stroke signs, this will be Considered a definite death due to stroke.

Other cardiovascular death

Arterial rupture of aneurysm, Pulmonary embolism, Arrhythmic death (A-V block, sustained ventricular tachycardia in absence of other causes), death after invasive cardiovascular intervention, Congenital heart disease, Heart valve disease (including rheumatic heart disease, Endocarditis, Myocarditis, Tamponade

Respiratory Mortality:

Pneumonia

Diagnosis by a physician with acute cough, high fever AND (any of the following), shortness of breath/fast breathing, chest pain, blood in sputum, AND (any of the following), no wheezing, no swelling of legs, no distension of abdomen, AND treated with antibiotics AND radiological evidence of pneumonia

Tuberculosis

Positive bacteriology or positive histopathology OR Chronic cough of long duration (> 4 weeks) with fever AND any one of the following signs or symptoms: Evening rise in fever; Blood in sputum; Chest pain; Breathlessness; Loss of appetite; Chronic weight loss AND empirical diagnosis by clinician.

Chronic Obstructive Pulmonary Disease (COPD)

Diagnosis by a physician with symptoms of chronic cough, sputum production and shortness of breath AND history of exposure to smoking and/or other risk factors (include inhaled noxious particles or gases) AND confirmatory laboratory: post-bronchodilator FEV1/FVC <70%.

Other Respiratory Diseases

Excluding Pneumonia, Asthma and COPD, e.g. professional lung diseases such as Asbestosis. Acceptable ICD-10 codes: Any J (Respiratory) or Q (Respiratory Congenital) ICD-10 code that can be classified as underlying Cause of Death (CoD), excluding J Codes.

Cancer Mortality:

Classified of primary site based on ICD-10 codes where available. Definite classification based on histopathology; probably based on 1. Imaging proof and therapeutic intervention, or 2. Physician diagnosis

followed by therapeutic intervention. Possible classification based on 1. Symptoms and signs (weight loss without other cause) suggestive of cancer, or 2. Diagnostic imaging (the participant dies before histological proof or therapeutic intervention.

Other Mortality:
Death due to Other Causes (Excluding Other Cardiovascular Diseases, Other Infections and Other Respiratory Diseases). Includes Diseases of the Nervous System, Diseases of the Digestive System, Diseases of the Genito-Urinary System, and other causes (***Valid** ICD-10 Codes include ''**E'** (Endocrine)'**F'** (Mental)**'H'** (Eye)**'L'** (Skin), or '**M**' (Musculoskeletal)Any '**Q'** (Congenital) not already classified above.*

Injury Mortality:
Death due to an accident or trauma in absence of other causes

Mortality not Classified:
Death of unknown cause in a participant without documented evidence of other causes classified above.

NON - FATAL EVENTS

CVD:
Non-periprocedural myocardial infarction
- ECG showing new and definite sign of MI (Minnesota code 1.11), or
- Symptoms typical or atypical or inadequately described but attributed to cardiac origin lasting more than 10 minutes and cardiac enzymes at least twice above the upper limit of normal (ULN) or troponin at least at the lower level of necrosis, or
- ECG with new ischemic changes (new ST depression or T wave inversion ≥2 mm) and cardiac enzymes at least twice above the upper limit of normal or troponin at least the lower level of necrosis

Periprocedural myocardial infarction
ECG showing new and definite sign of MI (Minnesota code 1.11), OR cardiac marker values:
- Percutaneous coronary intervention, CKMB should be ≥ 3X ULN of troponin ≥ 5 X above lower level of necrosis,
- Coronary surgery cardiac markers CKMB should be ≥ 10X ULN or troponin ≥10X above lower limit of necrosis.

Stroke
Diagnosis of stroke by a physician based on sudden neurological deficit of vascular origin with or without neuroimaging studies (CT scan/MRI scan/angiography/Doppler) lasting 24 hours and more.

Congestive heart failure
The diagnosis of congestive heart failure requires 2 of the 3 following criteria:
- Signs (rales, increased jugular venous pressure or ankle edema) or symptoms (nocturnal paroxysmal dyspnea, dyspnea at rest of ankle edema) of congestive heart failure,
- Radiological signs of pulmonary congestion,
- Treatment of heart failure with diuretics

Respiratory Disease:
Pneumonia
Diagnosis by a physician with acute cough, high fever AND (any of the following), shortness of breath/fast breathing, chest pain, blood in sputum, AND (any of the following), no wheezing, no swelling of legs, no distension of abdomen, AND treated with antibiotics AND radiological evidence of pneumonia

Tuberculosis
Positive bacteriology or positive histopathology OR Chronic cough of long duration (> 4 weeks) with fever AND any one of the following signs or symptoms: Evening rise in fever; Blood in sputum; Chest pain; Breathlessness; Loss of appetite; Chronic weight loss AND empirical diagnosis by clinician.

Chronic Obstructive Pulmonary Disease (COPD)
Diagnosis by a physician with symptoms of chronic cough, sputum production and shortness of breath AND history of exposure to smoking and/or other risk factors (include inhaled noxious particles or gases) AND confirmatory laboratory: post-bronchodilator FEV1/VC <70%.

Lung Cancer
Classified based on primary site based on ICD-10 codes = C33-C34, C38-C39, C45 where available. Definite classification based on histopathology; probably based on 1. Imaging proof and therapeutic intervention, or 2. Physician diagnosis followed by therapeutic intervention. Possible classification based on 1. Symptoms and signs (weight loss without other cause) suggestive of cancer, or 2. Diagnostic imaging (the participant dies before histological proof or therapeutic intervention.

Asthma (Not included in overall respiratory disease category due to lack of evidence linking HAP to asthma)
Diagnosis by a physician with symptoms of wheezing, shortness of breath or chest tightness AND either abnormal spirometry and 12% improvement from baseline FEV1 15 minutes after inhaled short acting bronchodilator, OR if spirometry is normal, diagnosis may be established by methacholine challenge test.

HOSPITALIZATIONS
Hospitalization documented for the CVD and Respiratory events described above. Hospitalization includes any medical procedure occurring in a hospital environment or length of stay for at least 12 hours in a hospital, clinic, or emergency room or other similar location.

Calculation Details for Covariate Measures

Household wealth	Information on indicators of housing characteristics (e.g., type of windows and flooring, water and sanitation facilities) and assets (e.g., ownership of home, car, computer, and mobile phone) were weighted and combined with weights derived from a principal component analysis procedure. The resulting variable was standardized to a mean of 0 and standard deviation of 1 and using this index the household population was divided into thirds from poorest to richest.
Non-cholesterol INTERHEART Risk Score (IHRS)	Includes age, sex, smoking, diabetes (self-report or fasting glucose <7.0 mmol/L), high BP (measured BP >140/>90 or self-report), family history, waist to hip ratio, psychosocial factors, diet, and physical activity.
Physical activity	One-week recall of physical activity (PA) and sitting time were assessed using the long-form International Physical Activity Questionnaire, with high PA defined as metabolic equivalent task (MET) score $\geqslant$ 3000, moderate as MET score 600–3000 and low as MET score <600 MET-minutes per week (1).
Diet score	A diet score was constructed from an adaptation of the alternative healthy eating index approach described by McCullough and Willett (2). Higher scores indicated more frequent healthy food choices such as vegetables and fruits and lower scores indicated higher consumption of unhealthy foods. Each participant's total score was calculated. Recorded frequencies of consumption and portion sizes were converted to daily intake, and a modified alternative healthy eating index was calculated. The sample was separately stratified into tertiles of modified alternative healthy eating index.

Table S1. Fully adjusted HRs and 95% CIs for mortality, CVD, respiratory disease, and cardiorespiratory disease and mortality combined, stratified by individual, household and community characteristics, comparing solid fuel use for cooking to clean fuels.

		All-Cause Mortality		CVD[a]		Respiratory Disease[b]		Incident Cardiorespiratory Disease + All-Cause Mortality	
	n	Events	HR (95% CI)	Events	HR (95% CI)	Events	HR (95% CI)	Events	HR (95% CI)
Overall model	91350	6595	1.12 (1.04-1.21)	5472	1.08 (0.99-1.17)	2436	1.14 (1.00-1.30)	11111	1.12 (1.06-1.19)
Region									
China	43271	1764	1.20 (1.04-1.38)	2613	1.06 (0.94-1.20)	905	1.02 (0.80-1.29)	4239	1.13 (1.03-1.24)
South Asia[d]	28401	3381	1.06 (0.95-1.20)	1986	1.15 (0.99-1.33)	650	1.11 (0.84-1.45)	4414	1.11 (1.01-1.23)
Other[e]	19576	1450	1.15 (0.98-1.34)	873	1.10 (0.90-1.36)	881	1.23 (1.01-1.49)	2458	1.15 (1.02-1.30)
Community Location									
Urban	42993	2211	1.12 (0.96-1.31)	2328	1.23 (1.05-1.44)	1024	1.07 (0.85-1.34)	4307	1.17 (1.04-1.32)
Rural	48255	4384	1.13 (1.03-1.23)	3144	1.03 (0.94-1.14)	1412	1.18 (1.00-1.38)	6804	1.11 (1.04-1.19)
Sex									
Male	37563	3634	1.15 (1.03-1.28)	2829	1.18 (1.05-1.33)	1190	1.20 (0.99-1.45)	5691	1.19 (1.10-1.30)
Female	53685	2961	1.08 (0.97-1.22)	2643	0.98 (0.86-1.10)	1246	1.10 (0.92-1.33)	5420	1.06 (0.97-1.15)
Age									
>=60	16327	2815	1.12 (0.99-1.26)	2440	0.98 (0.86-1.12)	979	0.95 (0.77-1.17)	4914	1.06 (0.97-1.16)
<60	74921	3780	1.12 (1.01-1.24)	3032	1.15 (1.03-1.29)	1457	1.31 (1.11-1.56)	6197	1.17 (1.08-1.27)
Education									
None/Primary	40830	4239	1.16 (1.05-1.28)	2998	1.03 (0.92-1.15)	1460	1.11 (0.94-1.30)	6533	1.13 (1.04-1.22)
>=Secondary	50097	2325	1.09 (0.95-1.24)	2455	1.16 (1.02-1.33)	967	1.18 (0.95-1.48)	4532	1.14 (1.03-1.25)
Household Asset Index									
T1	31151	3042	1.22 (1.08-1.38)	2040	1.05 (0.92-1.21)	1043	1.10 (0.90-1.35)	4645	1.17 (1.06-1.29)
T2	29484	1955	1.10 (0.98-1.24)	1784	1.06 (0.93-1.21)	764	1.09 (0.88-1.34)	3484	1.06 (0.97-1.17)
T3	30542	1588	0.98 (0.82-1.18)	1643	1.20 (1.00-1.43)	627	1.40 (1.04-1.88)	2970	1.20 (1.05-1.37)
Occupation									
Professional/Skilled	31058	1326	1.01 (0.82-1.23)	1667	1.26 (1.05-1.51)	750	1.46 (1.11-1.93)	2963	1.21 (1.05-1.39)
Unskilled	22608	1576	1.17 (1.01-1.34)	1545	1.08 (0.93-1.24)	587	1.01 (0.79-1.30)	2192	1.26 (1.08-1.48)
Homemaker	24104	1900	1.13 (1.00-1.29)	1408	1.03 (0.88-1.20)	737	1.13 (0.93-1.39)	3102	1.10 (0.99-1.22)
Smoking Status									
Ever Smoker	26304	2809	1.19 (1.06-1.34)	2053	1.10 (0.95-1.26)	951	1.16 (0.95-1.42)	4341	1.15 (1.04-1.26)
Never	63741	3730	1.07 (0.96-1.19)	3356	1.06 (0.95-1.18)	1451	1.18 (0.99-1.40)	6645	1.11 (1.02-1.20)
CVD Medication Use at Baseline									
Yes	11508	1081	1.12 (0.94-1.34)	1341	1.14 (0.96-1.35)	420	1.03 (0.76-1.39)	2134	1.16 (1.02-1.33)
No	79740	5514	1.12 (1.03-1.23)	4131	1.07 (0.97-1.18)	2016	1.18 (1.01-1.36)	8977	1.12 (1.05-1.20)
Hypertension at Baseline									
Yes	34357	3166	1.02 (0.92-1.13)	3350	1.07 (0.96-1.19)	1000	1.08 (0.89-1.32)	5638	1.07 (0.99-1.17)
No	52419	2913	1.24 (1.10-1.40)	1879	1.13 (0.97-1.31)	1301	1.18 (0.98-1.41)	4801	1.19 (1.08-1.30)
Chronic Condition at Baseline[f]									
Yes	14574	2037	1.12 (0.97-1.29)	1821	1.14 (0.98-1.33)	699	1.16 (0.9-1.49)	3289	1.14 (1.02-1.28)
No	76674	4558	1.12 (1.02-1.23)	3651	1.06 (0.95-1.17)	1737	1.15 (0.98-1.34)	7822	1.12 (1.04-1.20)

BMI (kg/m3)									
< 20	13309	1802	1.15 (0.98-1.35)	787	1.23 (0.97-1.58)	570	1.08 (0.80-1.45)	2345	1.19 (1.03-1.38)
20-32	63848	3683	1.13 (1.03-1.25)	3827	1.09 (0.98-1.20)	1422	1.14 (0.96-1.35)	6923	1.12 (1.04-1.20)
>30	9581	605	0.93 (0.72-1.21)	617	1.07 (0.83-1.37)	304	1.12 (0.80-1.58)	1172	1.10 (0.92-1.32)
INTERHEART Risk Score									
T1 (<5)	26215	1210	1.27 (1.04-1.57)	457	1.16 (0.85-1.58)	375	0.83 (0.58-1.19)	1386	1.13 (0.93-1.36)
T2 (>5-11)	31878	2093	1.08 (0.94-1.24)	1860	1.15 (0.99-1.33)	989	1.21 (0.98-1.51)	4123	1.16 (1.05-1.29)
T3 (>=11)	33155	3292	1.10 (0.99-1.22)	3155	1.04 (0.93-1.15)	1072	1.18 (0.98-1.43)	5602	1.10 (1.02-1.20)
Kitchen Chimney									
Yes	13939	663	1.04 (0.80-1.34)	833	1.01 (0.81-1.26)	325	1.14 (0.79-1.66)	1456	1.12 (0.94-1.33)
No	59966	3492	1.16 (1.05-1.29)	3417	1.08 (0.97-1.20)	1590	1.18 (1.00-1.39)	6646	1.13 (1.05-1.22)
Any Kitchen Ventilation									
Yes	17343	2440	1.04 (0.91-1.20)	1222	1.10 (0.92-1.32)	142	1.04 (0.65-1.67)	3009	1.10 (0.97-1.25)
No	59966	3492	1.15 (1.05-1.27)	3417	1.08 (0.98-1.19)	1590	1.18 (1.02-1.36)	6646	1.13 (1.06-1.21)
Solid Fuel Heating									
Yes	27265	1878	1.09 (0.96-1.25)	1785	1.04 (0.91-1.20)	714	0.98 (0.76-1.25)	3362	1.06 (0.95-1.17)
No	49847	2922	1.17 (1.05-1.31)	2822	1.15 (1.02-1.31)	1343	1.26 (1.07-1.50)	5468	1.21 (1.11-1.32)
Outdoor $PM_{2.5}$ ($\mu g/m^3$)									
<50	47118	4429	1.14 (1.04-1.26)	2777	1.11 (0.99-1.25)	1417	1.29 (1.09-1.53)	6554	1.15 (1.06-1.24)
>=50	44230	2167	1.10 (0.96-1.25)	2697	1.06 (0.93-1.19)	1021	0.91 (0.74-1.12)	4561	1.08 (0.98-1.19)

Model 3: Age, sex, strata for center and urban/rural status, Interheart risk score, smoking, physical activity, alcohol use, alternative health eating index, BMI, diabetes, baseline CVD, cancer or respiratory disease, current CVD medication, hypertensive status, outdoor $PM_{2.5}$, education, % income spent on food, and strata for household wealth index tertile

[a] Death from cardiovascular causes and non-fatal myocardial infarction, stroke, and heart failure. Each sub-category included fatal and non-fatal events. Hospitalizations refer to only those events with a documented hospital visit.
[b] Death from respiratory causes and non-fatal COPD, pneumonia, tuberculosis, and lung cancer. Each sub-category included fatal and non-fatal events. Hospitalizations refer to only those events with a documented hospital visit.
[c] Composite outcome that included mortality from any cause and the first incidence of any major non-fatal CVD or respiratory outcome (MI, stroke, heart failure, tuberculosis, COPD, pneumonia, or lung cancer, but not asthma) as an indicator of all health outcomes likely related to HAP.

[d] Pakistan, India, Bangladesh
[e] Brazil, Chile, Colombia, Philippines, South Africa, Tanzania, Zimbabwe
[f] Chronic conditions include baseline CVD, diabetes, respiratory disease and HIV/AIDS

Table S2. Fully adjusted models comparing solid fuels, biomass and coal, to clean fuels for cooking, stratified by China, South Asia, and all other countries combined.

	All Solid Fuels		Biomass		Coal	
	Events	**HR (95% CI)**	**Events**	**HR (95% CI)**	**Events**	**HR (95% CI)**
All Countries						
All-Cause Mortality	6,595	1.12 (1.04-1.21)	6,118	1.14 (1.05-1.24)	3,372	1.05 (0.88-1.24)
CVD[a]	5,472	1.08 (0.99-1.17)	4,906	1.07 (0.97-1.18)	3,481	1.05 (0.90-1.21)
Respiratory Disease[b]	2,436	1.14 (1.00-1.30)	2,253	1.17 (1.02-1.35)	1,377	1.05 (0.80-1.37)
Cardiorespiratory Disease & All-Cause Mortality[c]	11,111	1.12 (1.06-1.19)	10,159	1.13 (1.06-1.21)	6,374	1.07 (0.95-1.20)
China						
All-Cause Mortality	1,764	1.20 (1.04-1.38)	1,333	1.35 (1.13-1.61)	1,145	0.99 (0.81-1.20)
CVD[a]	2,613	1.06 (0.94-1.20)	2,069	0.98 (0.83-1.15)	1,987	1.07 (0.91-1.25)
Respiratory Disease[b]	905	1.02 (0.80-1.29)	744	1.08 (0.8-1.47)	651	1.02 (0.74-1.40)
Cardiorespiratory Disease & All-Cause Mortality[c]	4,239	1.13 (1.03-1.24)	3,350	1.15 (1.02-1.30)	3,082	1.07 (0.94-1.21)
South Asia[d]						
All-Cause Mortality	3,381	1.06 (0.95-1.19)	3,361	1.06 (0.95-1.19)	1,294	1.36 (0.82-2.26)
CVD[a]	1,986	1.15 (0.99-1.33)	1,973	1.14 (0.99-1.32)	893	1.54 (0.82-2.90)
Respiratory Disease[b]	650	1.11 (0.84-1.45)	645	1.11 (0.85-1.46)	203	1.43 (0.47-4.36)
Cardiorespiratory Disease & All-Cause Mortality[c]	4,414	1.11 (1.01-1.23)	4,389	1.11 (1.01-1.23)	1,731	1.36 (0.87-2.14)
Other Countries[e]						
All-Cause Mortality	1,450	1.15 (0.98-1.34)	1,424	1.13 (0.96-1.33)	933	1.39 (0.89-2.16)
CVD[a]	873	1.10 (0.90-1.36)	864	1.13 (0.91-1.39)	601	0.86 (0.43-1.74)
Respiratory Disease[b]	881	1.23 (1.01-1.49)	864	1.22 (1.00-1.49)	523	1.15 (0.66-2.01)
Cardiorespiratory Disease & All-Cause Mortality[c]	2,458	1.15 (1.02-1.30)	2,420	1.15 (1.02-1.30)	1,561	1.10 (0.76-1.58)

Model 3: Age, sex, strata for center and urban/rural status, Interheart risk score, smoking, physical activity, alcohol use, alternative health eating index, BMI, diabetes, baseline CVD, cancer or respiratory disease, current CVD medication, hypertensive status, outdoor $PM_{2.5}$, education, % income spent on food, and strata for household wealth index tertile

[a] Death from cardiovascular causes or non-fatal myocardial infarction, stroke, and heart failure. Each sub-category included fatal and non-fatal events. Hospitalizations refer to only those events with a documented hospital admission.

[b] Death from respiratory causes, and non-fatal COPD, pneumonia, tuberculosis, and lung cancer. Each sub-category included fatal and non-fatal events. Hospitalizations refer to only those events with a documented hospital admission.

[c] Composite outcome: mortality from any cause or the first incidence of any major non-fatal CVD (MI, stroke, HF) or respiratory outcome (tuberculosis, COPD, pneumonia, or lung cancer, but not asthma) as an indicator of all health outcomes likely related to HAP.

[d] Pakistan, India, Bangladesh.

[e] Brazil, Chile, Colombia, Philippines, South Africa, Tanzania, Zimbabwe

Table S3. Fully adjusted models comparing solid fuels, biomass and coal, to clean fuels for cooking, stratified by urban and rural status.

	Urban/Rural Combined		Rural		Urban	
	Events	**HR (95% CI)**	**Events**	**HR (95% CI)**	**Events**	**HR (95% CI)**
All Cause-Mortality	6,595	1.12 (1.04-1.21)	4,384	1.13 (1.03-1.23)	2,211	1.12 (0.95-1.31)
Cause-Specific Mortality[a]						
CVD	2,104	1.04 (0.91-1.19)	1,360	1.04 (0.89-1.22)	744	1.06 (0.82-1.39)
Respiratory	356	1.34 (0.95-1.89)	231	1.35 (0.87-2.08)	125	1.26 (0.71-2.23)
Cancer	1,126	1.15 (0.96-1.38)	725	1.11 (0.90-1.36)	401	1.32 (0.91-1.91)
Other Causes	1,034	1.25 (1.00-1.55)	777	1.18 (0.92-1.52)	257	1.52 (0.97-2.37)
Injury	393	1.24 (0.89-1.72)	286	1.52 (1.02-2.28)	107	0.72 (0.36-1.42)
Not Classified	1,544	1.07 (0.91-1.25)	968	1.12 (0.94-1.34)	576	0.92 (0.65-1.32)
CVD (fatal+non-fatal)[b]	5,472	1.08 (0.99-1.17)	3,144	1.03 (0.94-1.14)	2,328	1.23 (1.04-1.44)
MI	2,363	1.07 (0.94-1.22)	1,351	1.01 (0.87-1.18)	1,012	1.20 (0.96-1.50)
Stroke	2,685	1.12 (0.99-1.27)	1,509	1.12 (0.97-1.28)	1,176	1.20 (0.93-1.53)
Heart Failure	476	1.13 (0.85-1.5)	273	1.06 (0.76-1.49)	203	1.33 (0.79-2.23)
CVD Hospitalizations[c]	4,407	1.10 (1.00-1.22)	2,192	1.10 (0.98-1.24)	2,215	1.14 (0.96-1.36)
Respiratory (fatal+non-fatal)[d]	2,436	1.14 (1.00-1.30)	1,412	1.18 (1.00-1.38)	1,024	1.07 (0.85-1.34)
TB	530	1.29 (0.95-1.74)	379	1.35 (0.94-1.92)	151	1.24 (0.68-2.26)
COPD	708	1.15 (0.91-1.44)	386	1.28 (0.95-1.72)	322	0.90 (0.61-1.32)
Pneumonia	893	1.17 (0.94-1.46)	446	1.23 (0.93-1.63)	447	1.04 (0.72-1.48)
Lung Cancer	239	0.79 (0.53-1.18)	135	0.78 (0.50-1.21)	104	0.87 (0.36-2.10)
Respiratory Hospitalizations[e]	1,517	1.17 (0.98-1.38)	813	1.16 (0.94-1.43)	704	1.20 (0.90-1.61)
Incident Cardiorespiratory Disease + All-Cause Mortality[f]	11,111	1.12 (1.06-1.19)	6,804	1.11 (1.04-1.19)	4,307	1.17 (1.04-1.32)
Asthma[g]	693	0.88 (0.69-1.11)	481	0.86 (0.64-1.14)	212	0.91 (0.59-1.38)
Injury Events[h]	3,461	1.01 (0.90-1.14)	2,171	1.00 (0.86-1.15)	1,290	1.03 (0.80-1.32)
Injury Hospitalizations	1,213	1.02 (0.85-1.22)	813	1.01 (0.81-1.25)	400	0.97 (0.68-1.38)

Model 3: age, sex, baseline year, strata for center and urban/rural status, Interheart risk score, smoking, physical activity, alcohol use, alternative health eating index, BMI, baseline chronic condition, baseline CVD medication use, baseline hypertensive status, outdoor $PM_{2.5}$, education, % income spent on food, and strata for household wealth index tertile

[a] Cause-specific death (see Supplemental Material for details)
[b] Fatal and non-fatal myocardial infarction, stroke, and heart failure
[c] Documented hospital admissions for myocardial infarction, stroke, or heart failure
[d] Fatal and non-fatal COPD, pneumonia, tuberculosis, and lung cancer
[e] Documented hospital admissions for COPD, pneumonia, tuberculosis, and lung cancer
[f] Composite outcome: mortality from any cause or the first incidence of any major non-fatal CVD (MI, stroke, HF) or respiratory outcome (tuberculosis, COPD, pneumonia, or lung cancer, but not asthma) as an indicator of all health outcomes likely related to HAP.
[g] Physician diagnosis of asthma. Not included as a major respiratory disease outcome due to lack of evidence for association with HAP
[h] Fatal or non-fatal injury. Hospitalizations refer to injuries with a documented hospital admission.

Table S4. Sensitivity of fully adjusted models to removing or adding additional variables.

	Model 3	Model 3 - Causal Pathway Variables[i]	Model 3 - Household Wealth Index[j]	Model 3 - Outdoor PM2.5[k]	Model 3 + Second Hand Smoking[l]	Model 3 + Occupational Class[m]	Model 3 + Additional Diet Variables[n]	Model 3 + Lipids[o]	Model 3 + Community Random Effect[p]
All Cause-Mortality	1.12 (1.04-1.21)	1.12 (1.03-1.21)	1.17 (1.09-1.26)	1.12 (1.04-1.21)	1.12 (1.04-1.21)	1.12 (1.03-1.21)	1.11 (1.03-1.21)	1.12 (1.03-1.21)	1.11 (1.03-1.20)
Cause-Specific Morality[a]									
CVD	1.04 (0.91-1.19)	1.04 (0.91-1.18)	1.11 (0.98-1.25)	1.04 (0.91-1.18)	1.04 (0.91-1.19)	1.03 (0.90-1.18)	1.04 (0.91-1.20)	1.04 (0.91-1.19)	1.04 (1.04-1.04)
Respiratory	1.34 (0.95-1.89)	1.34 (0.95-1.89)	1.37 (0.99-1.89)	1.37 (0.97-1.93)	1.34 (0.95-1.89)	1.34 (0.95-1.88)	1.30 (0.91-1.85)	1.32 (0.94-1.87)	1.34 (0.95-1.89)
Cancer	1.15 (0.96-1.38)	1.15 (0.96-1.38)	1.18 (1.00-1.4)	1.15 (0.96-1.38)	1.16 (0.97-1.39)	1.15 (0.96-1.38)	1.14 (0.95-1.38)	1.15 (0.96-1.38)	1.15 (0.95-1.38)
Other Causes	1.25 (1.00-1.55)	1.23 (0.99-1.54)	1.35 (1.10-1.67)	1.25 (1.00-1.55)	1.25 (1.00-1.55)	1.24 (1.00-1.55)	1.21 (0.96-1.52)	1.24 (0.99-1.54)	1.24 (1.00-1.55)
Injury	1.24 (0.89-1.72)	1.24 (0.89-1.72)	1.24 (0.91-1.68)	1.24 (0.89-1.72)	1.23 (0.89-1.71)	1.23 (0.88-1.71)	1.27 (0.90-1.80)	1.24 (0.89-1.72)	1.24 (1.24-1.24)
Not Classified	1.07 (0.91-1.25)	1.06 (0.91-1.24)	1.10 (0.95-1.27)	1.07 (0.92-1.26)	1.06 (0.91-1.24)	1.07 (0.91-1.25)	1.05 (0.89-1.24)	1.06 (0.91-1.24)	1.06 (0.91-1.25)
CVD (fatal + non-fatal)[b]	1.08 (0.99-1.17)	1.08 (0.99-1.18)	1.09 (1.01-1.18)	1.07 (0.98-1.17)	1.08 (0.99-1.17)	1.07 (0.99-1.17)	1.06 (0.98-1.16)	1.08 (0.99-1.17)	1.08 (0.99-1.18)
MI	1.07 (0.94-1.22)	1.07 (0.94-1.21)	1.07 (0.95-1.20)	1.06 (0.93-1.20)	1.07 (0.94-1.21)	1.07 (0.94-1.22)	1.05 (0.92-1.20)	1.07 (0.94-1.21)	1.07 (0.94-1.22)
Stroke	1.12 (0.99-1.27)	1.14 (1.01-1.29)	1.13 (1.01-1.28)	1.11 (0.99-1.26)	1.12 (0.99-1.27)	1.12 (0.99-1.26)	1.11 (0.98-1.25)	1.12 (1.00-1.27)	1.12 (0.99-1.27)
Heart Failure	1.13 (0.85-1.50)	1.13 (0.85-1.5)	1.18 (0.9-1.55)	1.13 (0.85-1.51)	1.13 (0.85-1.50)	1.13 (0.85-1.50)	1.11 (0.83-1.48)	1.13 (0.85-1.5)	1.13 (1.13-1.13)
CVD Hospitalization[c]	1.10 (1.00-1.22)	1.10 (1.00-1.22)	1.10 (1.00-1.21)	1.09 (0.99-1.21)	1.10 (1.00-1.22)	1.10 (1.00-1.22)	1.09 (0.99-1.21)	1.10 (1.00-1.21)	1.09 (0.98-1.21)
Respiratory Disease (fatal + non-fatal)[d]	1.14 (1.00-1.30)	1.15 (1.01-1.31)	1.19 (1.05-1.35)	1.15 (1.00-1.31)	1.14 (1.00-1.30)	1.14 (1.00-1.30)	1.14 (1.00-1.31)	1.14 (1.00-1.30)	1.13 (0.99-1.29)
TB	1.29 (0.95-1.74)	1.28 (0.95-1.74)	1.39 (1.04-1.85)	1.31 (0.97-1.77)	1.28 (0.95-1.73)	1.29 (0.95-1.75)	1.34 (0.97-1.84)	1.29 (0.95-1.75)	1.28 (0.94-1.73)
COPD	1.15 (0.91-1.44)	1.15 (0.91-1.45)	1.19 (0.96-1.49)	1.16 (0.92-1.46)	1.15 (0.91-1.44)	1.14 (0.90-1.43)	1.12 (0.89-1.42)	1.15 (0.91-1.45)	1.09 (0.86-1.38)
Pneumonia	1.17 (0.94-1.46)	1.18 (0.95-1.47)	1.18 (0.96-1.46)	1.16 (0.93-1.44)	1.17 (0.94-1.45)	1.16 (0.94-1.45)	1.19 (0.96-1.49)	1.18 (0.95-1.47)	1.14 (0.91-1.42)
Lung Cancer	0.79 (0.53-1.18)	0.79 (0.53-1.18)	0.81 (0.55-1.20)	0.80 (0.54-1.19)	0.79 (0.53-1.18)	0.79 (0.53-1.18)	0.78 (0.52-1.16)	0.79 (0.53-1.18)	0.79 (0.79-0.79)
Respiratory Hospitalization[e]	1.17 (0.98-1.38)	1.16 (0.98-1.38)	1.23 (1.04-1.44)	1.16 (0.98-1.38)	1.16 (0.98-1.38)	1.16 (0.98-1.38)	1.21 (1.01-1.44)	1.17 (0.98-1.38)	1.12 (0.94-1.33)
Incident Cardiorespiratory Disease + All-Cause Mortality[f]	1.12 (1.06-1.19)	1.12 (1.06-1.19)	1.15 (1.09-1.22)	1.12 (1.06-1.19)	1.12 (1.06-1.19)	1.12 (1.05-1.19)	1.11 (1.05-1.18)	1.12 (1.06-1.19)	1.11 (1.05-1.18)
Asthma[g]	0.88 (0.69-1.11)	0.88 (0.69-1.12)	0.95 (0.76-1.18)	0.88 (0.70-1.12)	0.87 (0.69-1.11)	0.88 (0.70-1.12)	0.90 (0.70-1.15)	0.87 (0.69-1.11)	0.87 (0.68-1.10)
Injury Events[h]	1.01 (0.90-1.14)	1.01 (0.90-1.14)	1.06 (0.95-1.18)	1.01 (0.90-1.15)	1.01 (0.89-1.14)	1.01 (0.89-1.14)	1.00 (0.88-1.14)	1.00 (0.88-1.13)	1.01 (0.88-1.14)
Injury Hospitalization	1.02 (0.85-1.22)	1.02 (0.85-1.22)	1.11 (0.93-1.31)	1.02 (0.85-1.23)	1.02 (0.85-1.22)	1.02 (0.85-1.23)	1.07 (0.89-1.30)	1.02 (0.85-1.22)	1.02 (1.02-1.02)

Model 3: age, sex, baseline year, strata for center and urban/rural status, Interheart risk score, smoking, physical activity, alcohol use, alternative health eating index, BMI, baseline chronic condition, baseline CVD medication use, baseline hypertensive status, outdoor $PM_{2.5}$, education, % income spent on food, and strata for household wealth index tertile

[a] Cause-specific death (see Supplemental Material for details)
[b] Fatal and non-fatal myocardial infarction, stroke, and heart failure
[c] Documented hospital admissions for myocardial infarction, stroke, or heart failure
[d] Fatal and non-fatal COPD, pneumonia, tuberculosis, and lung cancer
[e] Documented hospital admissions for COPD, pneumonia, tuberculosis, and lung cancer
[f] Composite outcome: mortality from any cause or the first incidence of any major non-fatal CVD (MI, stroke, HF) or respiratory outcome (tuberculosis, COPD, pneumonia, or lung cancer, but not asthma) as an indicator of all health outcomes likely related to HAP.
[g] Physician diagnosis of asthma. Not included as a major respiratory disease outcome due to lack of evidence for association with HAP
[h] Fatal or non-fatal injury. Hospitalizations refer to injuries with a documented hospital admission. [f] Model 3 minus hypertension, baseline chronic conditions and use of CVD medication.

[i] Model 3 minus baseline chronic conditions, hypertension, CVD medication.
[j] Model 3 minus household wealth index.

[k] Model 3 minus outdoor $PM_{2.5}$.
[l] Model 3 plus second hand smoking (yes, no, missing). 30,935 individuals coded as missing.
[m] Model 3 plus occupational class (unskilled worker, skilled worker, professional/manager, homemaker, missing). 13,522 individuals coded as missing.
[n] Model 3 plus additional diet variables (% energy intake from protein and carbohydrates, AHEI scores for vegetables, fruits and nuts, total saturated fatty acids, total dietary sodium). All variables were categorized into quartiles with a missing category. 4,216 individuals coded as missing.f
[o] Model 3 plus lipids. Variables include cholesterol, glucose, HDL, LDL, and Triglyercides. All variables were categorized into quartiles with a missing category. 22,805 individual's coded as missing.
[p] Model 3 plus random effects for community (n=467)

Table S5. Results and pooled random effects meta-regression of fully adjusted center models for all-cause mortality and the cardiorespiratory events and mortality composite separated by region.

	Events	HR (95% CI)	I2[b]	p-value[b]
All-Cause Mortality				
Overall	6,595	1.10 (0.99-1.23)	18.8	0.19
South Asia	3,381	1.04 (0.81-1.34)	65.4	0.01
China	1,764	1.16 (1.01-1.35)	1.0	0.51
Other	1,450	1.15 (0.98-1.35)	1.0	0.90
Incident Cardiorespiratory Disease + All-Cause Mortality[a]				
Overall	11,111	1.11 (1.02-1.20)	23.9	0.13
South Asia	4,414	1.06 (0.86-1.31)	63.9	0.01
China	4,239	1.11 (0.98-1.26)	13.6	0.31
Other	2,458	1.13 (1.00-1.28)	1	0.70

Model 3: age, sex, baseline year, strata for center and urban/rural status, Interheart risk score, smoking, physical activity, alcohol use, alternative health eating index, BMI, baseline chronic condition, baseline CVD medication use, baseline hypertensive status, outdoor $PM_{2.5}$, education, % income spent on food, and strata for household wealth index tertile

[a] Composite outcome: mortality from any cause or the first incidence of any major non-fatal CVD (MI, stroke, HF) or respiratory outcome (tuberculosis, COPD, pneumonia, or lung cancer, but not asthma) as an indicator of all health outcomes likely related to HAP.

[b]Random effects meta-regression used to pool center results overall and by region. I2 refers to the % of total variability due to between-region heterogeneity. P value of heterogeneity was estimated using the Cochran's Q test.

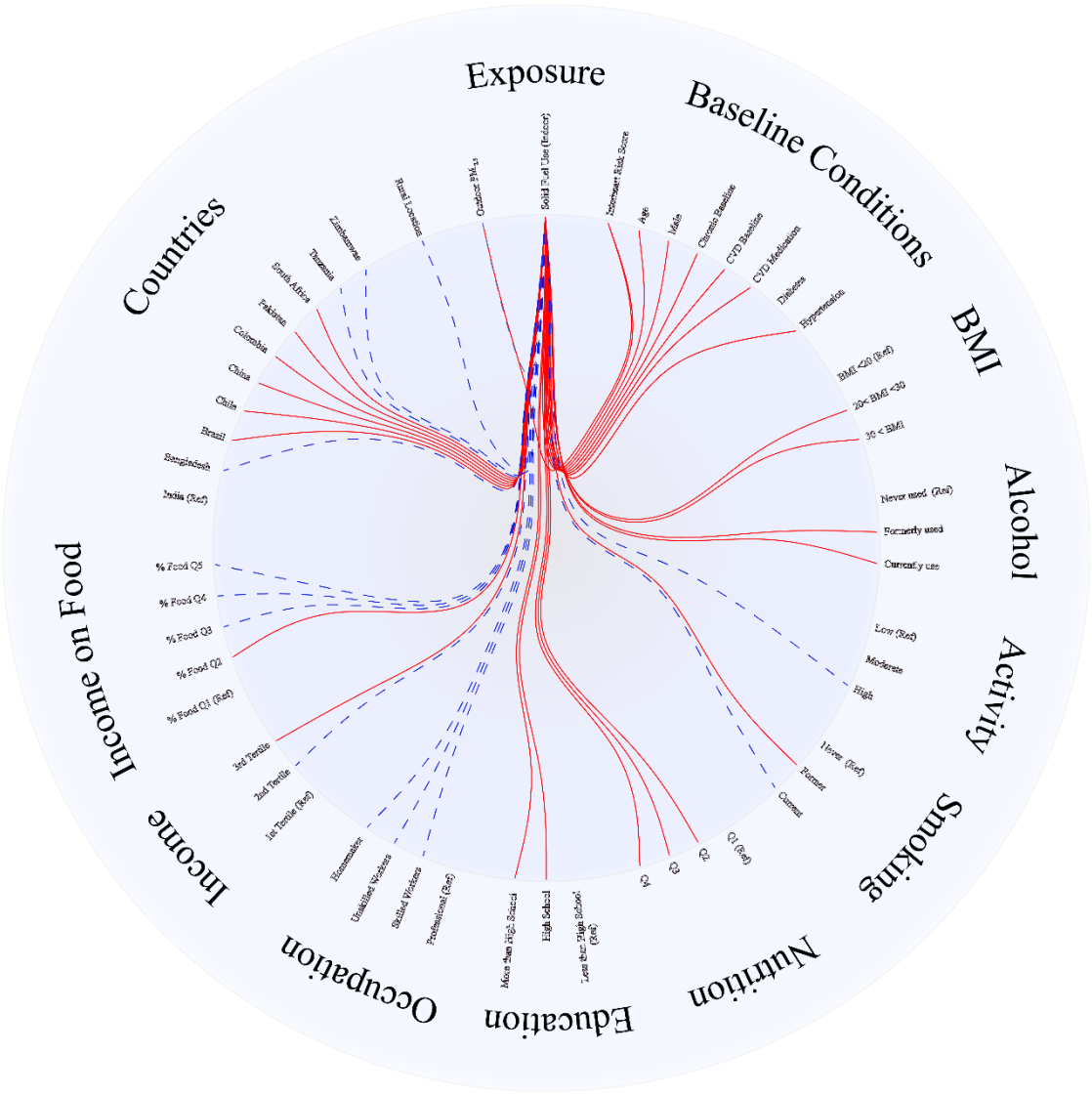

Figure S1. Associations between solid fuel use, traditional CVD risk factors, and SES for 91,350 adults aged 35-70 from 467 urban and rural communities in 11 countries. Lines correspond to statistically significant ($p<0.05$) associations in unadjusted linear regression models, with solid blue and dotted red lines for positive and negative model coefficients, respectively. Graphs were created in JavaScript, using a modified version of the hierarchical edge bundling script created by Mike Bostock (https://beta.observablehq.com/@mbostock/d3-hierarchical-edge-bundling).