

Fruit, vegetable and legume intake and CVD and deaths: the Prospective Urban Rural Epidemiology (PURE) study of 135,335 people in 18 countries

Andrew Mente, on behalf of the PURE investigators





Duality of Interests



None to declare with regards this presentation

Background

- Dietary guidelines recommend at least 5 daily servings (≥ 400 g) of fruits, vegetables and legumes
- Associated with lower risk of CVD and mortality, but could be influenced by health seeking behaviors
 - Few data from South America, Middle East, Africa and South Asia; Most data from N Amer, Europe, China, Japan
- Recommendations do not differentiate between raw and cooked vegetable intake

Aims

- To assess the association between fruit, vegetable and legume consumption and cardiovascular disease and mortality in 135,335 individuals in 18 countries



PURE

Design: Prospective cohort study

Population: Unbiased selection from general population in 667 urban/rural communities in 18 countries

N=135,335; aged 35-70 years, without CVD at baseline

Diet: Country-specific, validated food frequency questionnaires

Covariates: Demographics, other lifestyle, health history, center

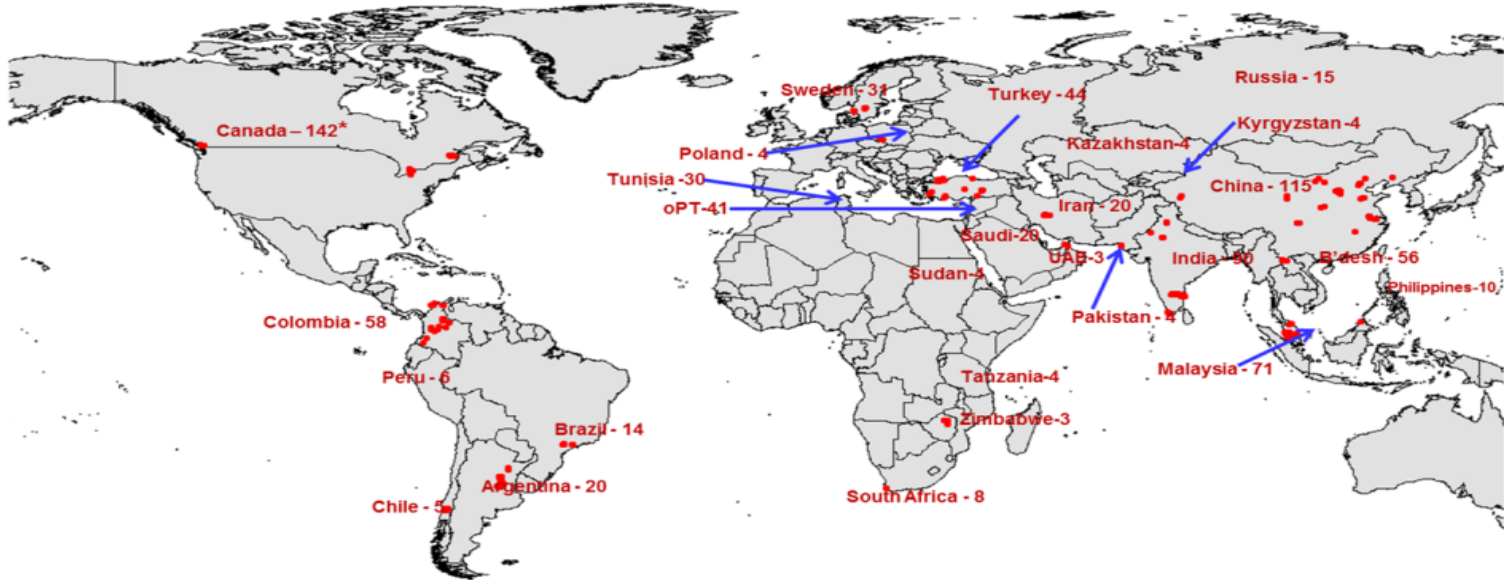
Outcomes: Major CVD (CV death and nonfatal MI, stroke, and heart failure) (n=4784), using standardized definitions; total mortality (n=5796)

Follow-up: Median 7.4 years



Study Methods

PURE: 135,335 from 667 communities in 18 (Phase 1) countries from 5 continents



Target: 200,000 people



Countries



Geographic region	Countries	N
South Asia	Bangladesh, India, Pakistan	29,560
China	China	42,152
Southeast Asia	Malaysia	10,038
Africa	South Africa, Zimbabwe	4,558
North America	Canada, Poland, Sweden,	14,916
Middle East	Iran, Occupied Palestinian Territory, Turkey, United Arab Emirates	11,485
South America	Argentina, Brazil, Chile, Colombia	22,626
Overall		135,335



Phase-1 participants included in these analyses



N=157,543 participants from 18 countries

Did not complete an FFQ (6.9%)

N=146,646 completed FFQ

Implausible values (1.9%)
Energy <500 or >5000 kcal/d

N=143,934

Missing follow-up (0.9%)

N=142,704

Baseline CVD (5.2%)

N=135,335

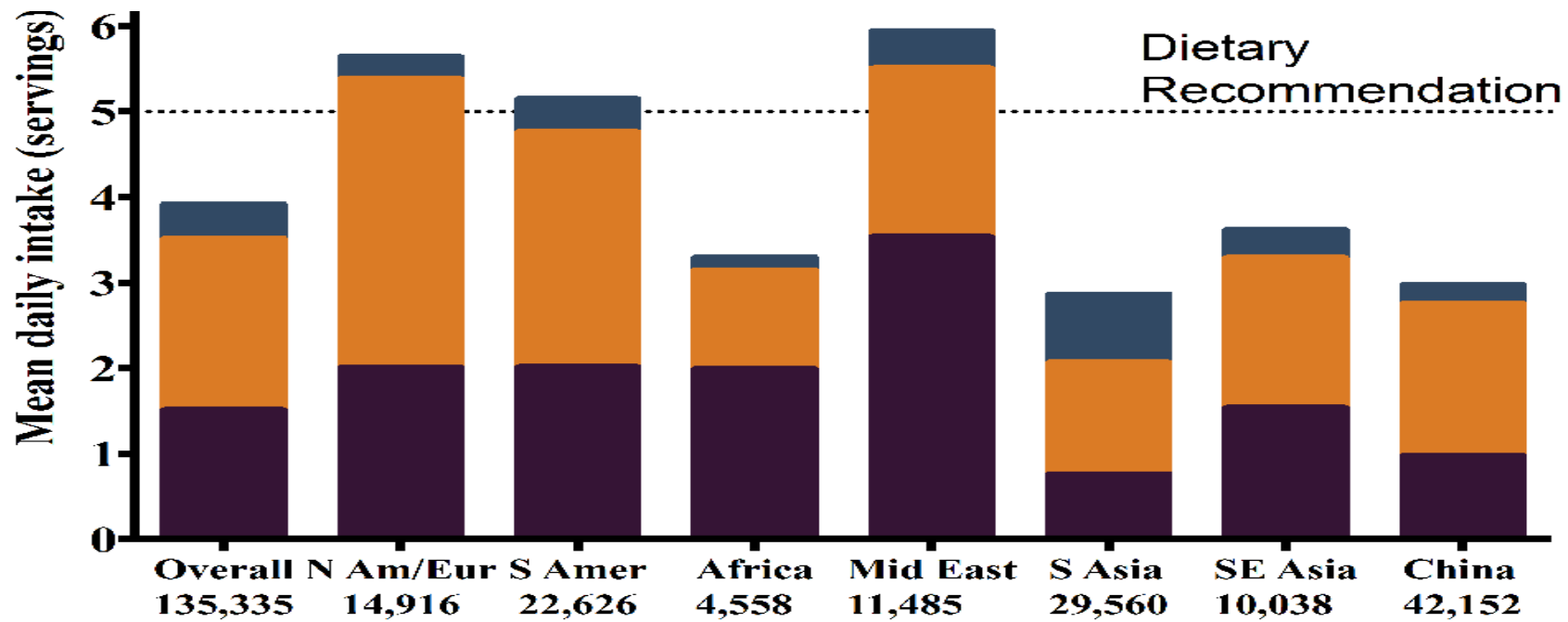


Statistical Methods



- Time to events analysis
- Multivariable Cox frailty analysis with random intercepts to account for correlation of observation within centers
- Adjusted for:
 - Age, sex, urban/rural location
 - Education, smoking, physical activity, diabetes
 - Energy intake, meats, bread & cereal
 - When reporting fruit, adjust for vegetables, and vice-versa

Mean fruit, vegetable and legume intake by region



Fruit
 Vegetable
 Legume



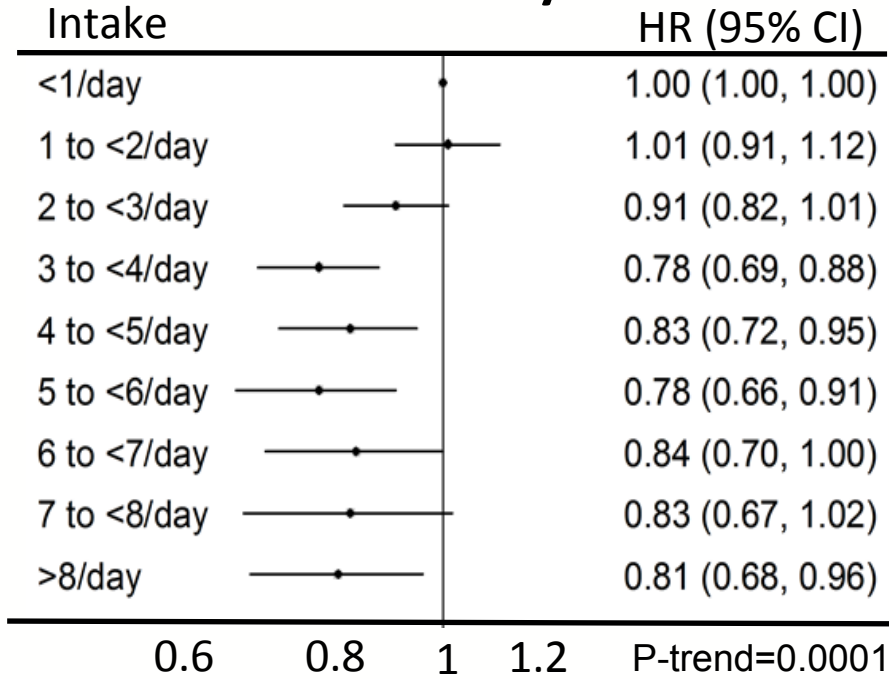
Risk of mortality by total fruit, veg & legume intake



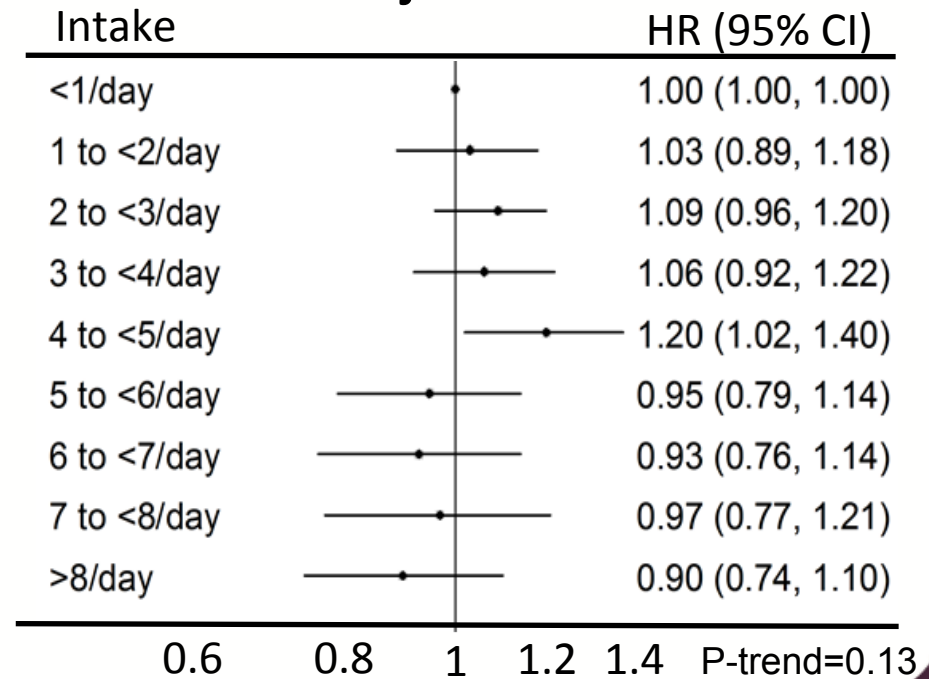
Servings/day	N	No. of deaths (%)	Age & sex adj.	Full adjusted
<1 /day	9082	736 (8.1%)	1.0 (ref)	1.0 (ref)
1 to <2 /day	19036	1371 (7.2%)	0.92 (0.84-1.01)	1.01 (0.91-1.12)
2 to <3 /day	35128	1529 (4.4%)	0.81 (0.74-0.89)	0.91 (0.82-1.01)
3 to <4 /day	24485	772 (3.2%)	0.65 (0.58-0.74)	0.78 (0.69-0.88)
4 to <5 /day	14849	468 (3.2%)	0.65 (0.58-0.74)	0.83 (0.72-0.95)
5 to <6 /day	9790	286 (2.9%)	0.62 (0.53-0.71)	0.78 (0.66-0.91)
6 to <8 /day	6945	198 (2.9%)	0.63 (0.54-0.75)	0.84 (0.70-1.00)
7 to <8 /day	4857	131 (2.7%)	0.61 (0.50-0.74)	0.83 (0.67-1.02)
>8 /day	11163	305 (2.7%)	0.58 (0.50-0.74)	0.81 (0.68-0.96)
P for trend			<0.0001	0.0001

Risk of mortality and major CVD by total fruit, vegetable and legume intake (servings/day)

Mortality

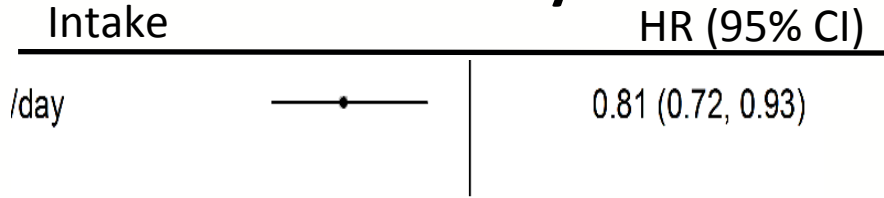


Major CVD

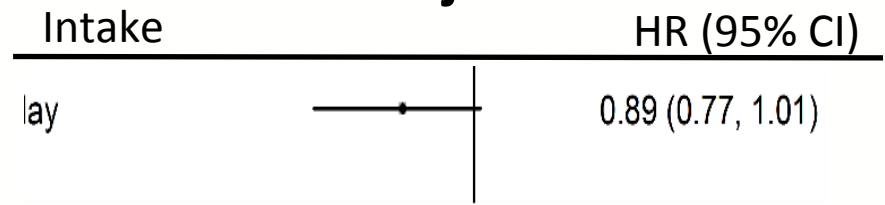


Risk of mortality and major CVD by fruit intake (servings)

Mortality



Major CVD



0.6 0.8 1 1.2 P-trend<0.0001

0.6 0.8 1 1.2 P-trend=0.11



Risk of mortality and major CVD by vegetable intake (servings/day)



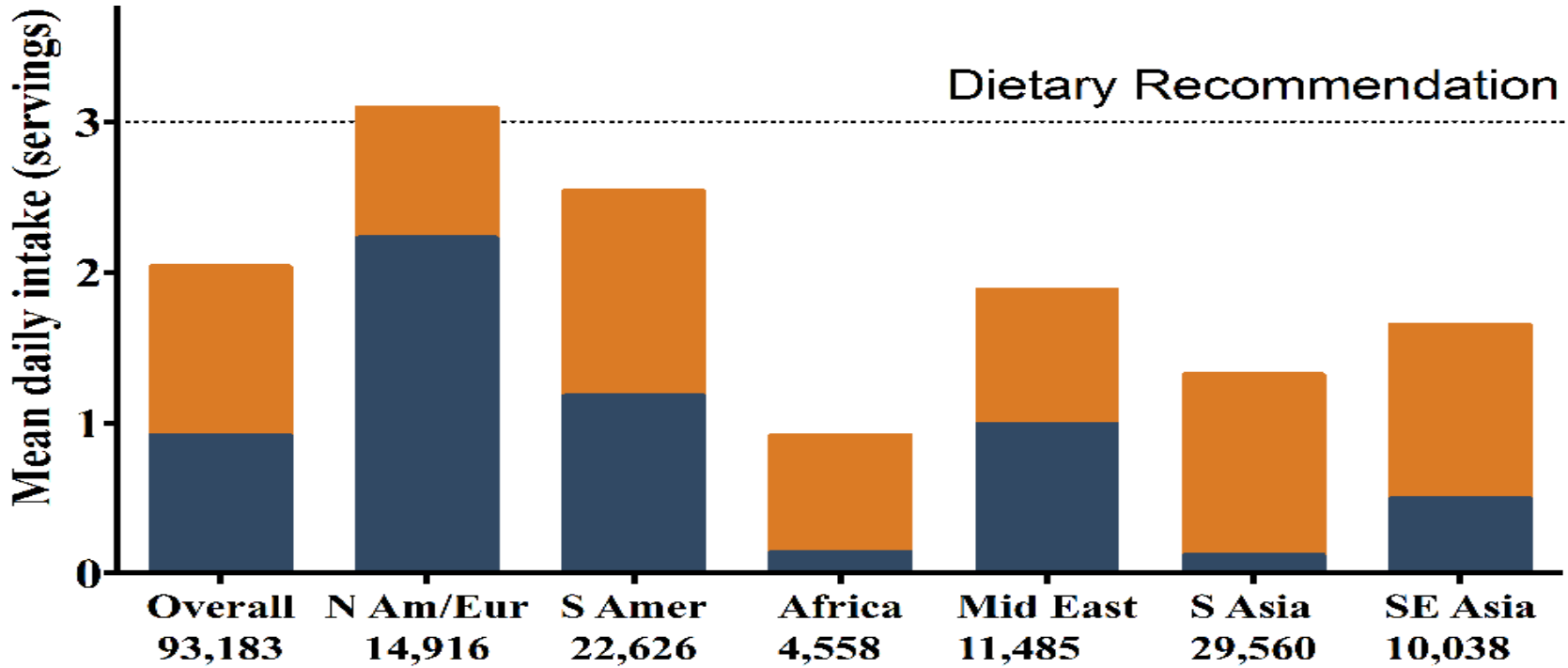
Mortality
Intake **HR (95% CI)**

Major CVD
Intake **HR (95% CI)**

0.6 0.8 1 1.2 P-trend=0.12

0.8 1 1.2 1.4 P-trend=0.38

Mean raw and cooked vegetable intake by region



Excluding China (N=42,152)

■ Raw

■ Cooked



Risk of mortality and major CVD by raw vegetable intake (servings)



Mortality

Major CVD

Intake

HR (95% CI)

Intake

HR (95% CI)

Excluding China 0.6 0.8 1 1.2 P-trend=0.0004

0.6 0.8 1 1.2 P-trend=0.27



Risk of mortality and major CVD by cooked vegetable intake (servings)



Mortality

Major CVD

Intake

HR (95% CI)

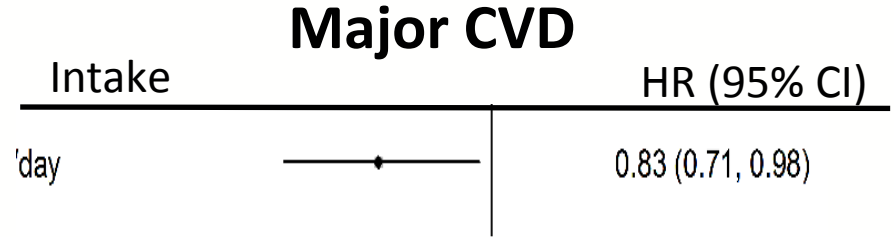
Intake

HR (95% CI)

0.6 0.8 1 1.2 P-trend=0.011

0.8 1 1.2 1.4 P-trend=0.085

Risk of mortality and major CVD by legume intake (servings)



0.6 0.8 1 1.2 P-trend=0.0013

0.6 0.8 1 1.2 P-trend=0.19

Strengths

- Prospective design, large, and covers 5 continents representing diverse diets globally
- Standardized and validated methods to measure diet using country specific food frequency questionnaire
- Extensively adjusted for dietary and non-dietary covariates

Limitations

- Random measurement error in assessment of diet; may dilute real associations
- Limited power to examine effects of individual types of fruit & vegetables
- Did not cover cooking methods (eg, fried vs boiled)
- Fewer events within countries or regions
 - Ongoing follow-up with larger sample size in PURE will provide clear answers by region



Conclusions



- Fruit, vegetables and legumes associated with a moderately lower risk of mortality, but not CVD
- Benefits appear to reach a maximum versus mortality at 3 to 4 daily servings (375 g)
- Raw vegetables appear to be more protective than cooked vegetables
- A balanced diet of >3-4 daily servings fruit, vegs. and legumes is associated with lower mortality

Fruit, vegetable, and legume intake, and cardiovascular disease and deaths in 18 countries (PURE): a prospective cohort study

*Victoria Miller, Andrew Mente, Mahshid Dehghan, Sumathy Rangarajan, Xiaohe Zhang, Sumathi Swaminathan, Gilles Dagenais, Rajeev Gupta, Viswanathan Mohan, Scott Lear, Shrikant I Bangdiwala, Aletta E Schutte, Edelweiss Wentzel-Viljoen, Alvaro Avezum, Yuksel Altuntas, Khalid Yusoff, Noorhassim Ismail, Nasheeta Peer, Jephath Chifamba, Rafael Diaz, Omar Rahman, Noushin Mohammadifard, Fernando Lana, Katarzyna Zatonska, Andreas Wielgosz, Afzalhussein Yusufali, Romaina Iqbal, Patricio Lopez-Jaramillo, Rasha Khatib, Annika Rosengren, V Raman Kutty, Wei Li, Jiankang Liu, Xiaoyun Liu, Lu Yin, Koon Teo, Sonia Anand, Salim Yusuf, on behalf of the Prospective Urban Rural Epidemiology (PURE) study investigators**

The Lancet

The Lancet Diabetes
& Endocrinol

Association of dietary nutrients with blood lipids and blood pressure in 18 countries: a cross-sectional analysis from the PURE study

*Andrew Mente, Mahshid Dehghan, Sumathy Rangarajan, Matthew McQueen, Gilles Dagenais, Andreas Wielgosz, Scott Lear, Wei Li, Hui Chen, Sun Yi, Yang Wang, Rafael Diaz, Alvaro Avezum, Patricio Lopez-Jaramillo, Pamela Seron, Rajesh Kumar, Rajeev Gupta, Viswanathan Mohan, Sumathi Swaminathan, Raman Kutty, Katarzyna Zatonska, Romaina Iqbal, Rita Yusuf, Noushin Mohammadifard, Rasha Khatib, Nafiza Mat Nasir, Noorhassim Ismail, Aytekin Oguz, Annika Rosengren, Afzalhussein Yusufali, Edelweiss Wentzel-Viljoen, Thandi Puoane, Jephath Chifamba, Koon Teo, Sonia S Anand, Salim Yusuf, on behalf of the Prospective Urban Rural Epidemiology (PURE) study investigators**

Associations of fats and carbohydrate intake with cardiovascular disease and mortality in 18 countries from five continents (PURE): a prospective cohort study

*Mahshid Dehghan, Andrew Mente, Xiaohe Zhang, Sumathi Swaminathan, Wei Li, Viswanathan Mohan, Romaina Iqbal, Rajesh Kumar, Edelweiss Wentzel-Viljoen, Annika Rosengren, Leela Itty Amma, Alvaro Avezum, Jephath Chifamba, Rafael Diaz, Rasha Khatib, Scott Lear, Patricio Lopez-Jaramillo, Xiaoyun Liu, Rajeev Gupta, Noushin Mohammadifard, Nan Gao, Aytekin Oguz, Anis Safura Ramli, Pamela Seron, Yi Sun, Andrzej Szuba, Lungiswa Tsolekile, Andreas Wielgosz, Rita Yusuf, Afzal Hussein Yusufali, Koon K Teo, Sumathy Rangarajan, Gilles Dagenais, Shrikant I Bangdiwala, Shofiqul Islam, Sonia S Anand, Salim Yusuf, on behalf of the Prospective Urban Rural Epidemiology (PURE) study investigators**

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