Contrasting patterns of CVD, cancers and related mortality between high-, middle-, and low-income countries

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Impact of modifiable risk factors on cardiovascular disease and mortality

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On behalf of the Prospective Urban Rural Epidemiology (PURE) Study Investigators

Declaration of interest

- I have nothing to declare

Declaration of Interests

PURE was supported by the Canadian Institutes of Health Research, Heart and Stroke Foundation of Canada, Ontario Ministry of Health and Long-Term Care, Astra Zeneca, Boehringer Ingelheim, Sanofi-Aventis, Servier Laboratories and Glaxo Smith Kline; plus additional sources in participating countries.

Rationale

- Shift from communicable to non-communicable diseases and deaths globally
- Advances in prevention and treatment have reduced CV deaths in many countries
- These advances could lead to a further epidemiologic transitions in diseases and deaths from different NCDs
- Burden of some diseases & impact of risk factors may differ between countries at different economic levels

Aims

- To describe incidence of various diseases and related deaths in countries at different economic levels (HIC, MIC, LIC)
- To document relative importance of risk factors for CVD and mortality overall and in HIC, MIC and LIC

PURE Study

- ***Total of 202,000 from 27 countries: Ongoing follow-up***
- 21 countries (N=167,000) with follow-up data
- 6 additional countries with 35,000 participants – awaiting follow-up

Methods

- 166,762 community-dwelling adults: 35-70 years
- 21 countries (4 HIC, 12 MIC, 5 LIC)
- Follow-up: median 9.5 years
- Events documented through direct contact + administrative records
  - Vital status known in 98%
  - CVD and other events documented in 94%
- Standardized outcome definitions & event adjudication

Baseline Characteristics

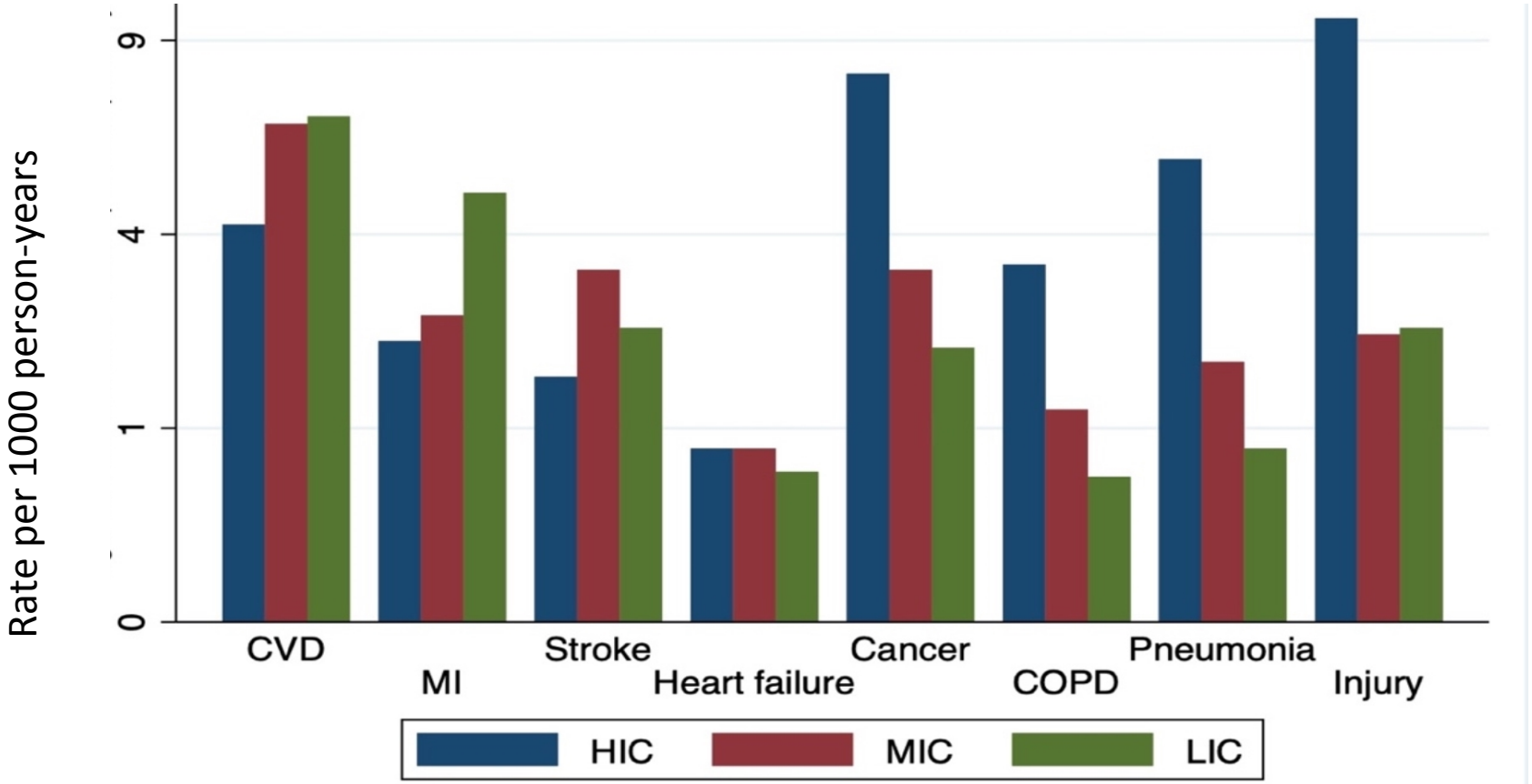
Characteristic	HIC	MIC	LIC
N	18,073	108,291	36,170
Mean age ± SD	52 ± 9.5	51 ± 9.8	49 ± 10.4
Male, %	47	41	43
INTERHEART CVD risk score*	13.1±6.2	10.5±5.8	7.9±5.0

* Age, smoking, 2nd hand smoke, diabetes, hypertension, family history, waist-hip ratio, psychosocial factors, diet, physical activity

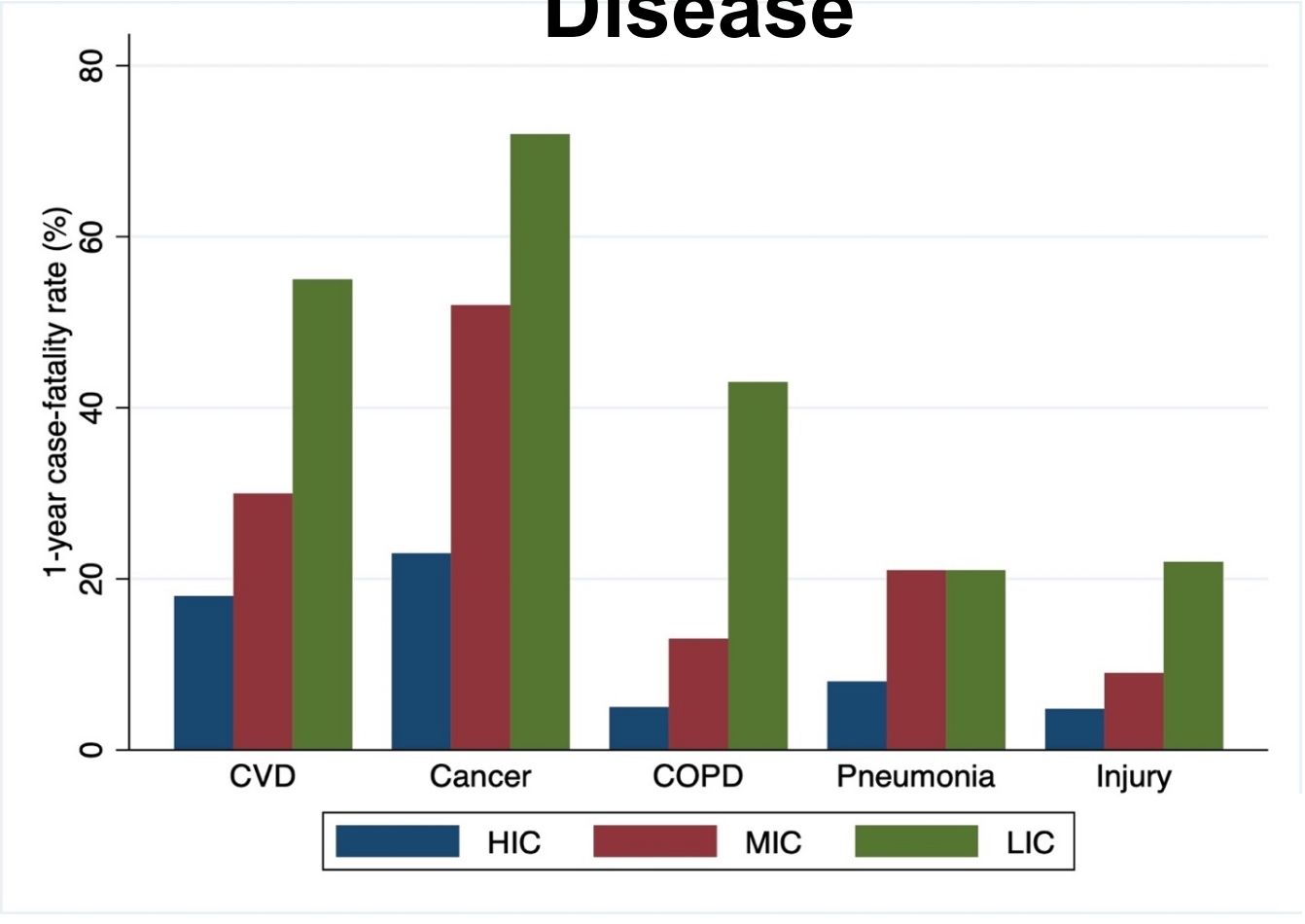
Outcomes

Incident Event	Number
Death	11,307
CVD (MI, stroke, HF, CVD death)	9,329
Cancer	5,151
COPD	1,830
Pneumonia	2,911
Injuries with hospital admission	4,386

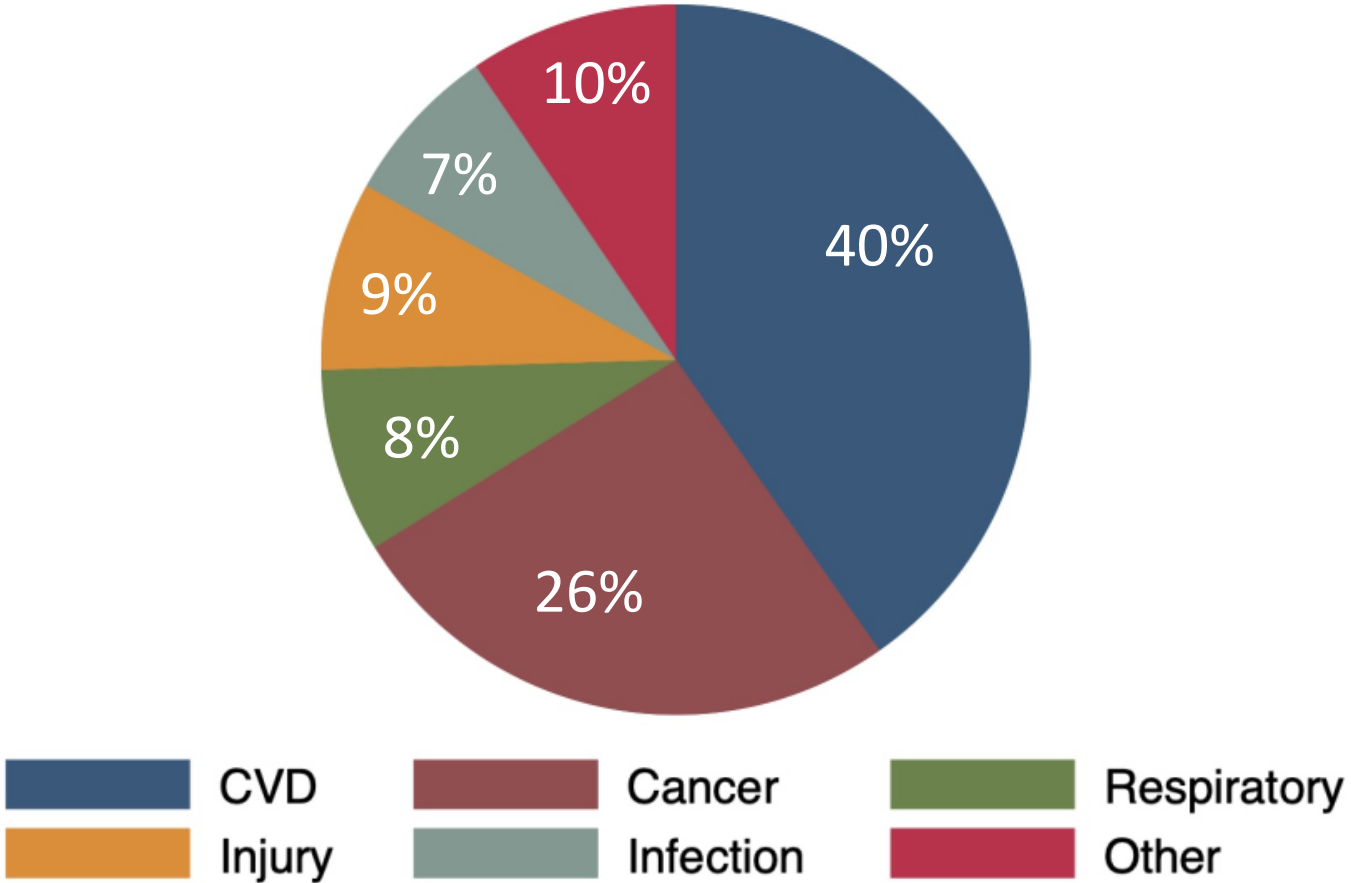
Age- & Sex-Standardized Disease Incidence Rates



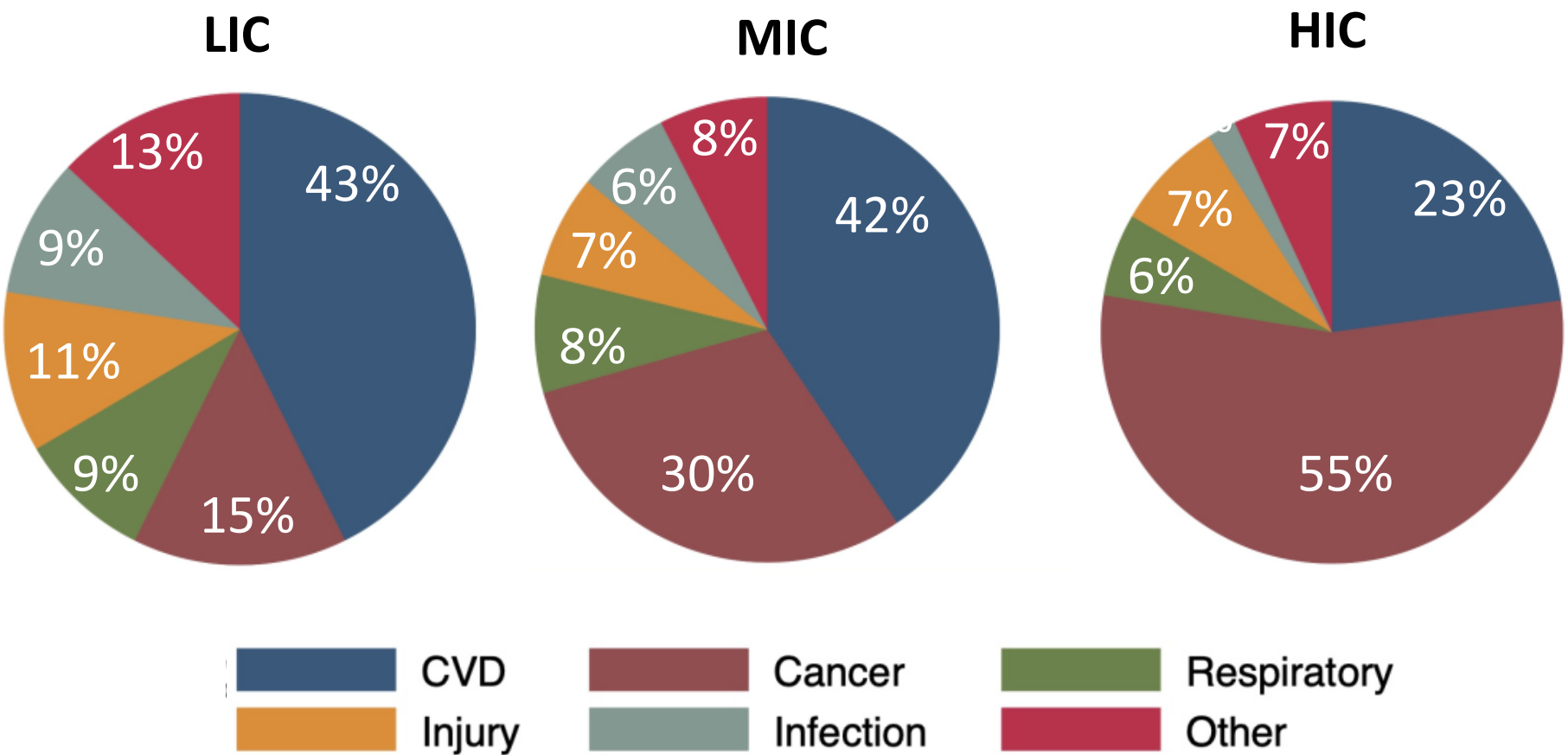
One-Year Case-Fatality after Incident Disease



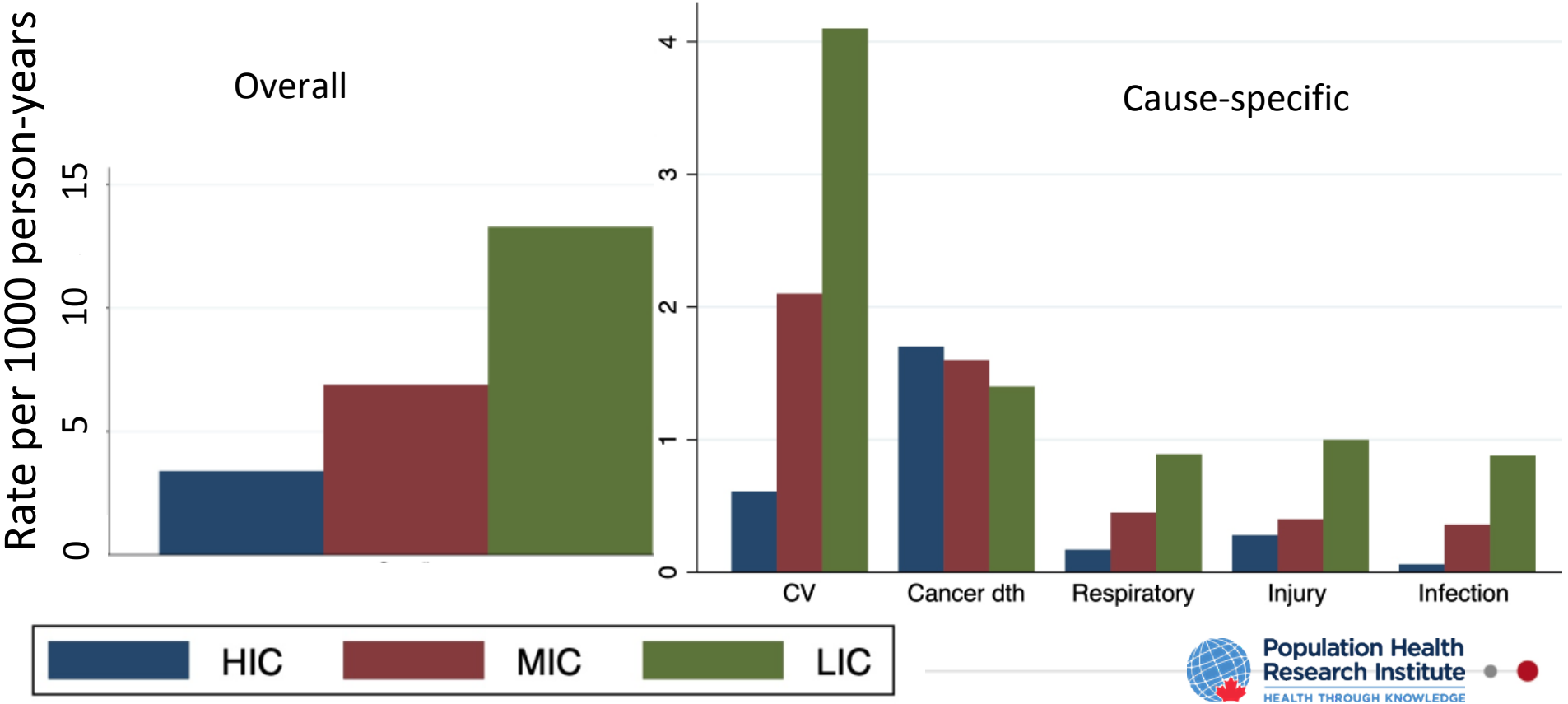
Causes of Death: Overall



Causes of Death by Country Income Level

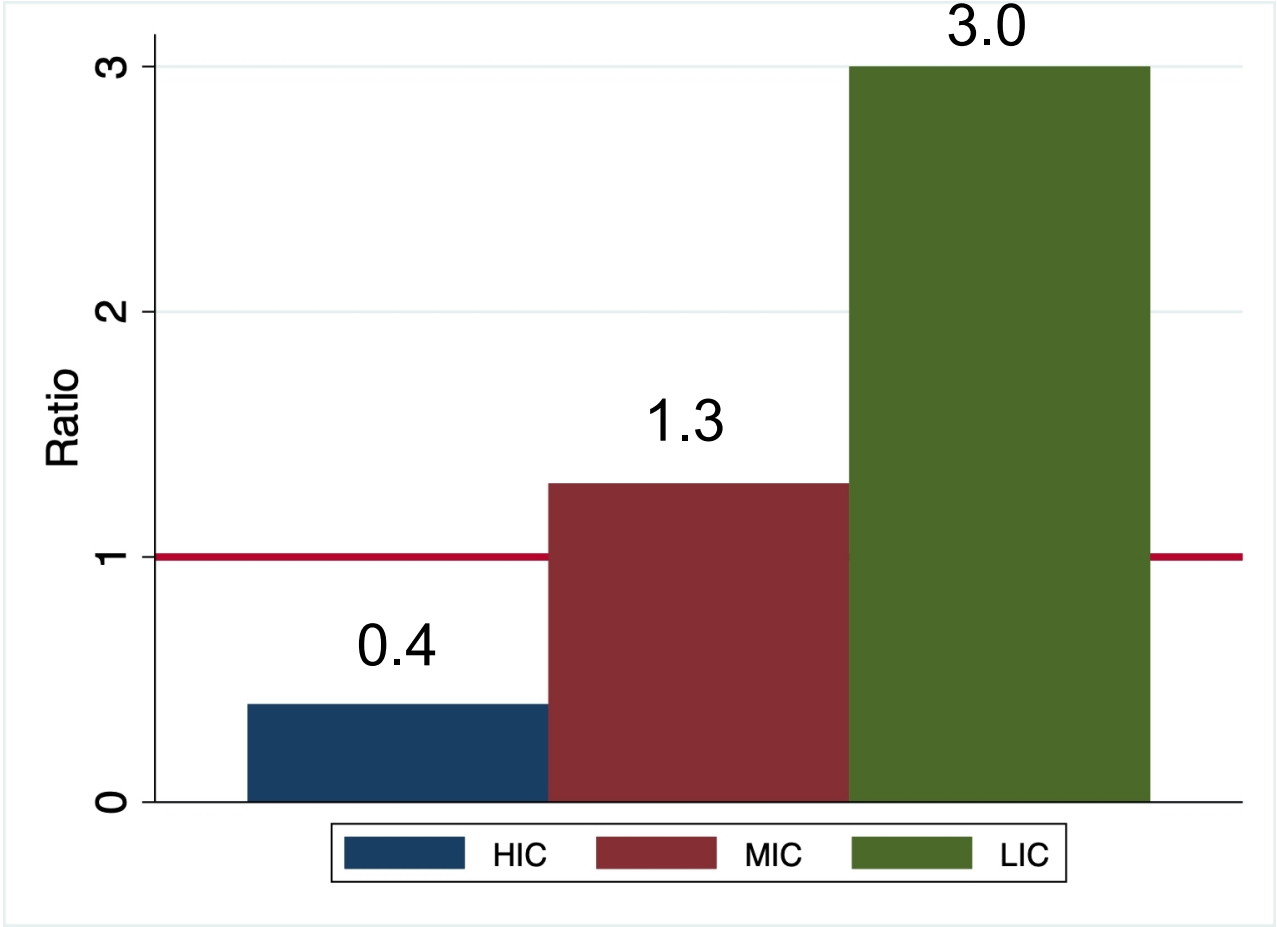


Age- & Sex-Standardized Mortality Rates

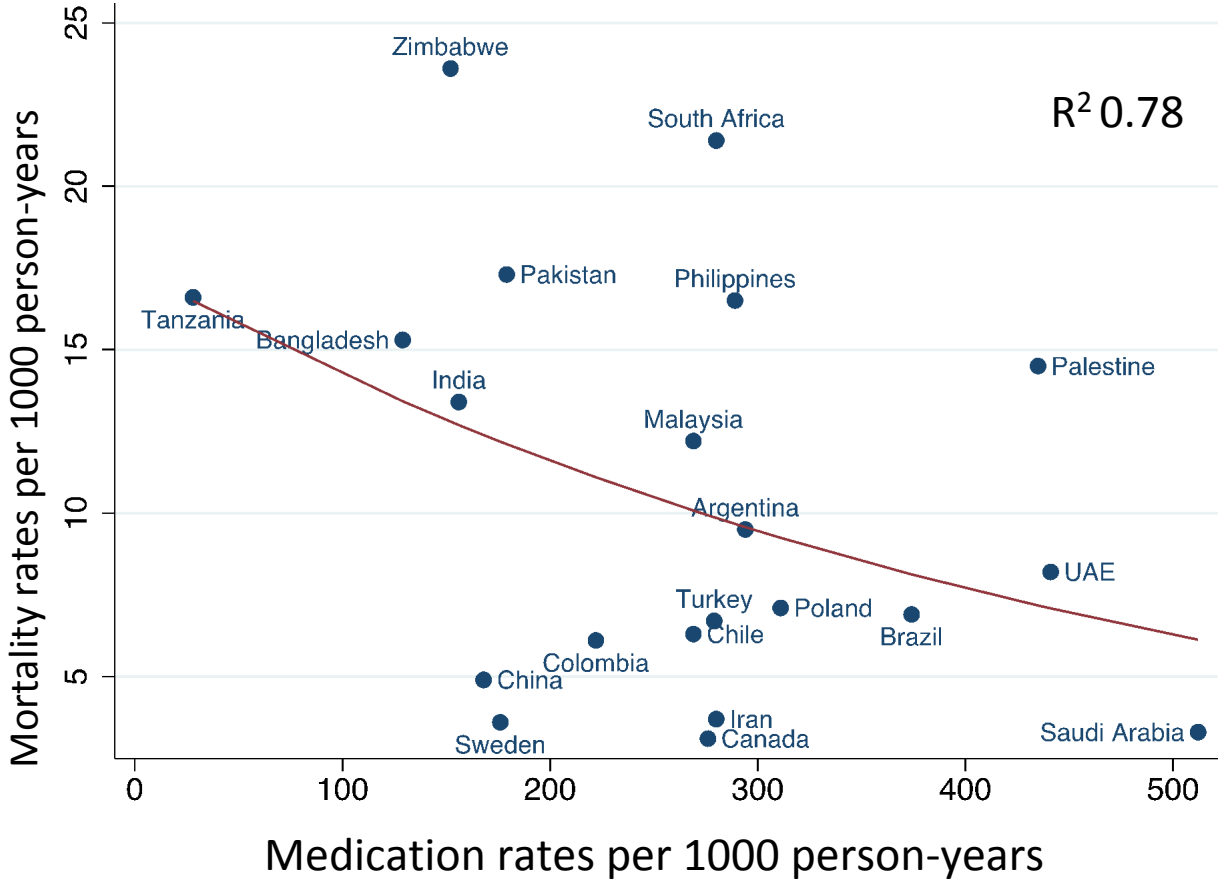


Population Health Research Institute
HEALTH THROUGH KNOWLEDGE

Ratio of CV deaths to Cancer deaths



Age & Sex-Std CV Medication vs Mortality Rates



Impact of modifiable risk factors on CVD and mortality

Objectives:

- Quantify risk for CVD and death associated with 14 common, modifiable risk factors
- Document variations in the importance of risk factors by HIC, MIC, LIC

Methods

Population: 152,722 individuals without CVD

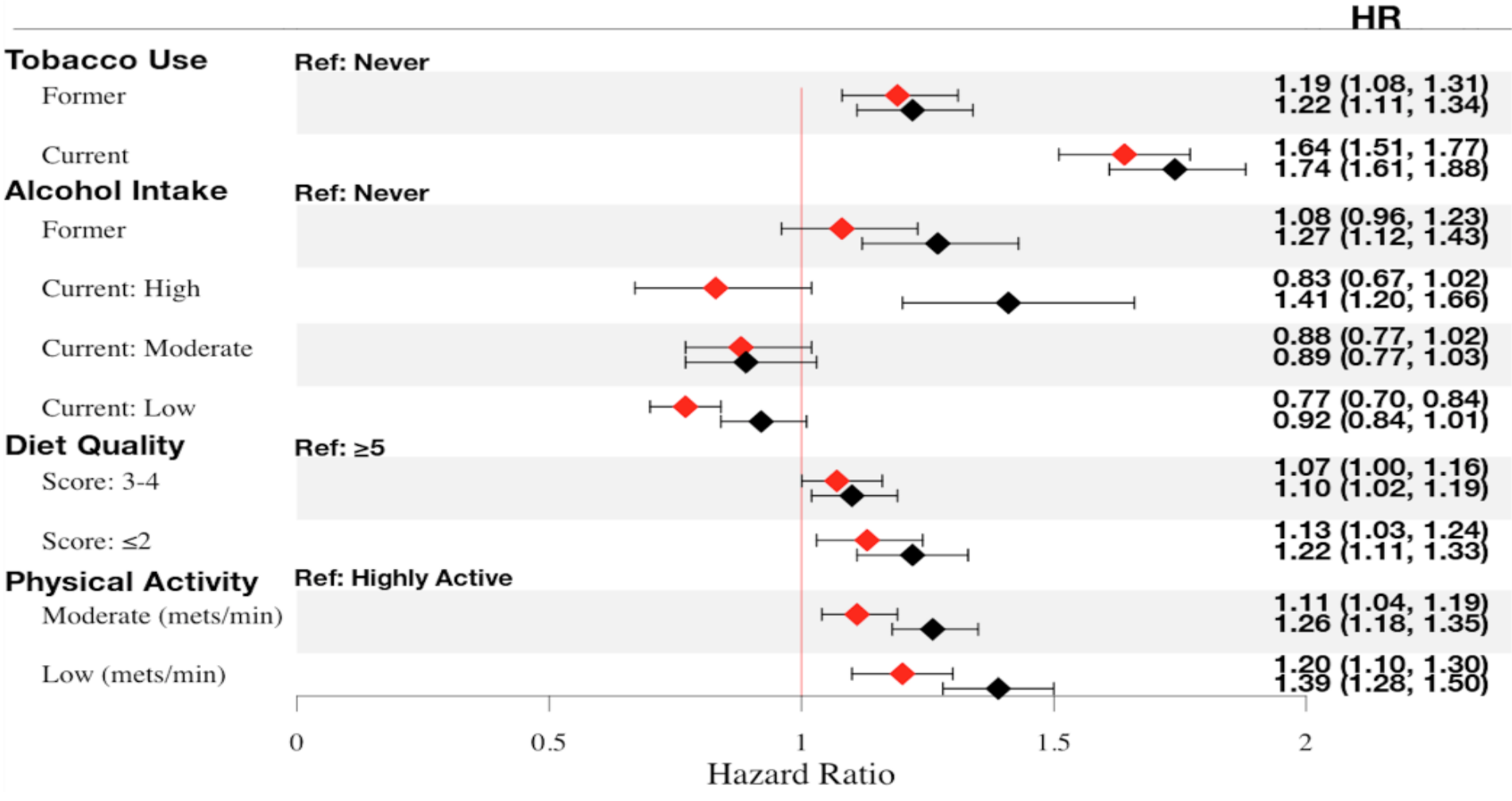
Risk Factors:

- ***Behavioral:*** tobacco, diet, alcohol, physical activity, and sodium
- ***Metabolic:*** HTN, DM, obesity, and lipids
- ***Psychosocial:*** Education, depression
- **Grip Strength**
- ***Air pollution:*** household (solid fuel use), and PM 2.5 ambient air pollution

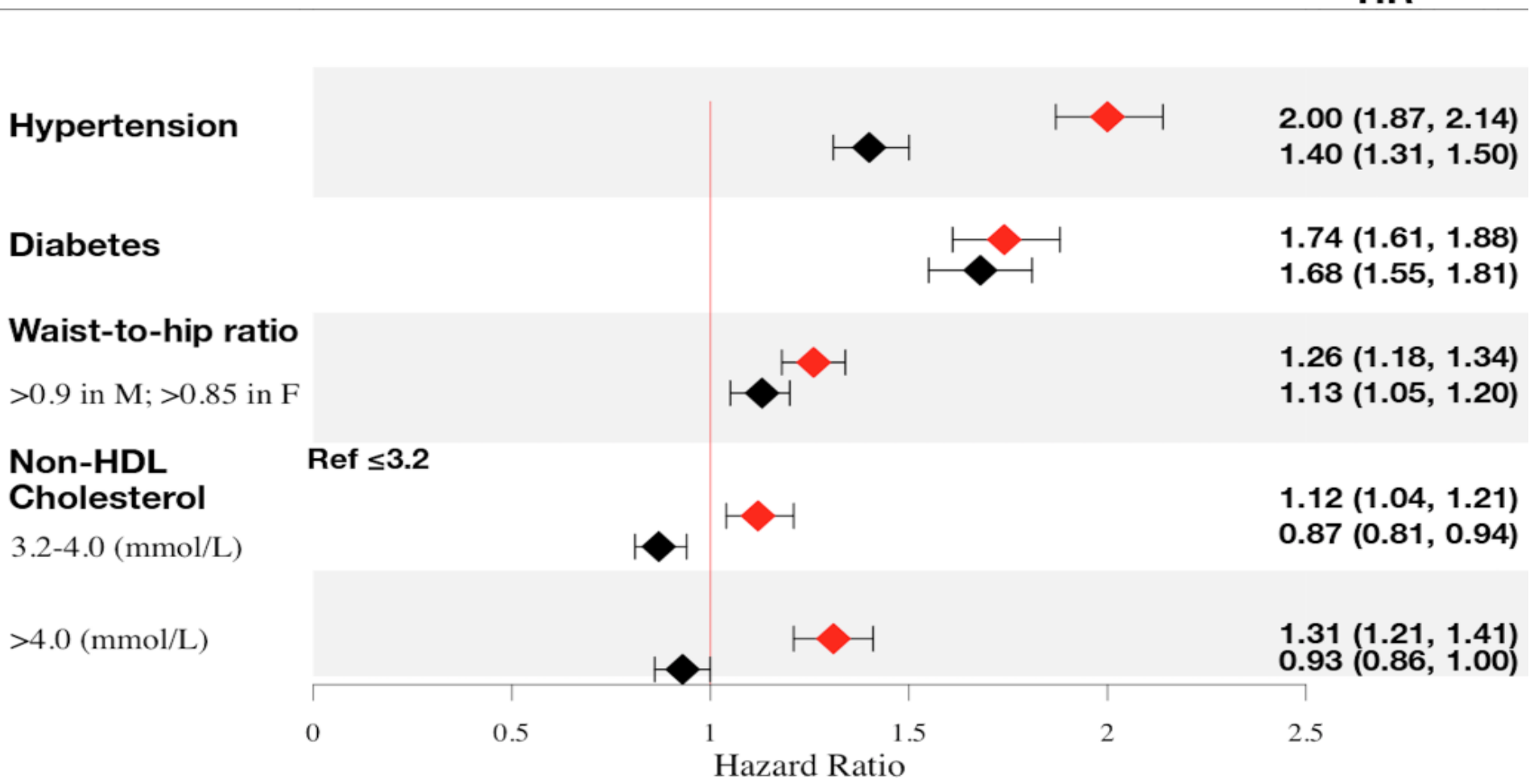
Analysis: Mutually adjusted risk (hazard ratios) and population level burden (population attributable fractions [PAF]) associated with each risk factor

*analyses performed separately

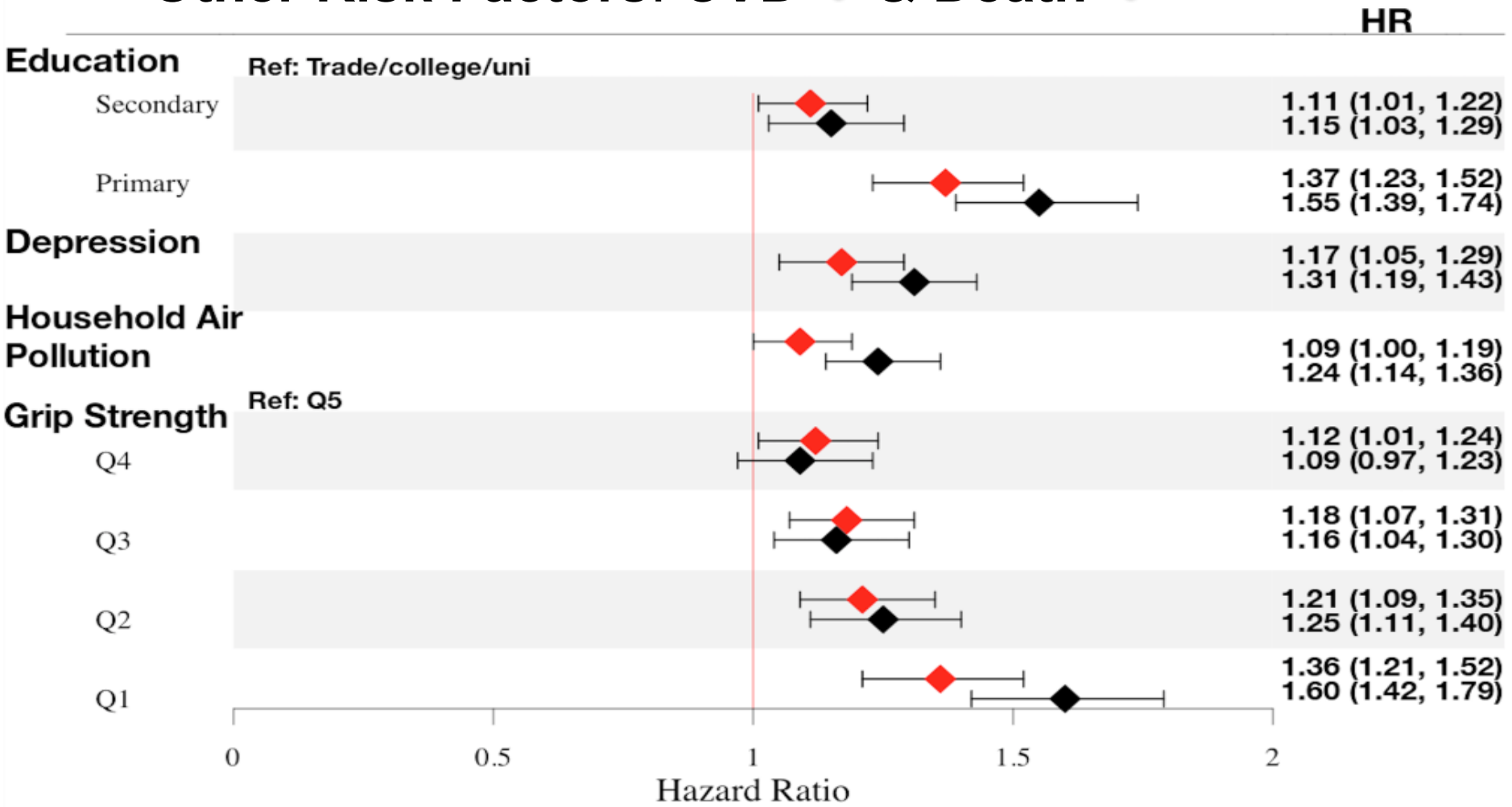
Behavioral Risk Factors: CVD◆ & Death◆



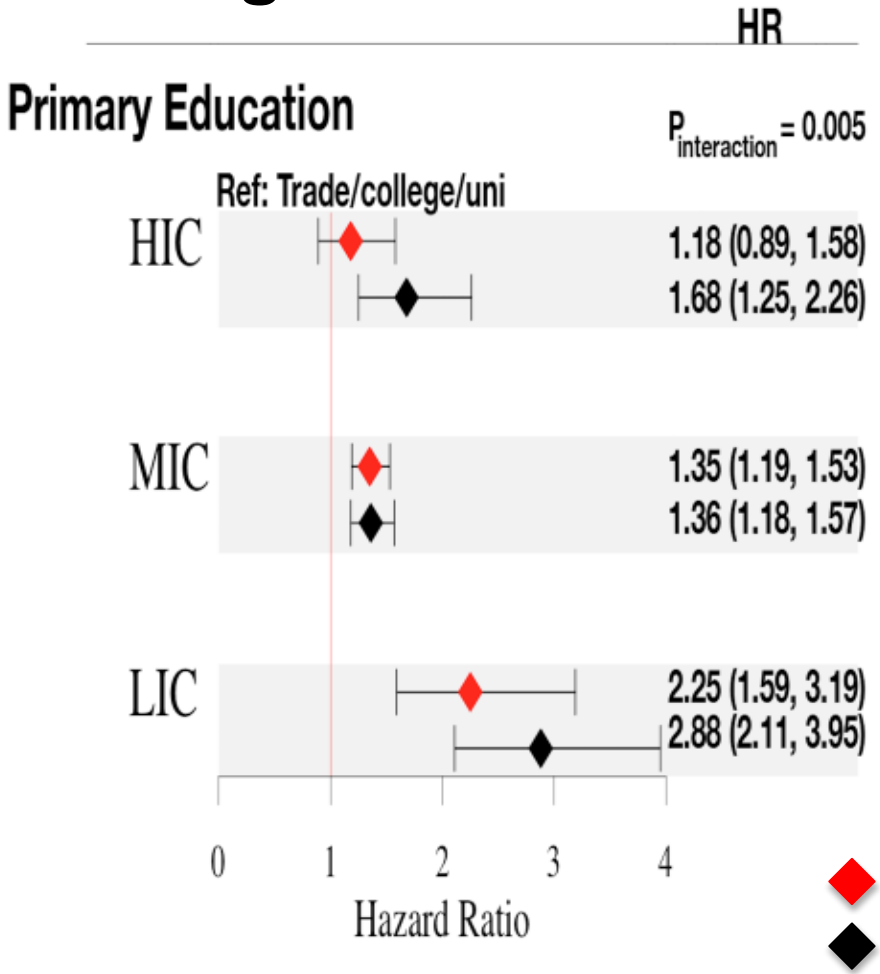
Metabolic Risk Factors: CVD ◆ & Death ◆

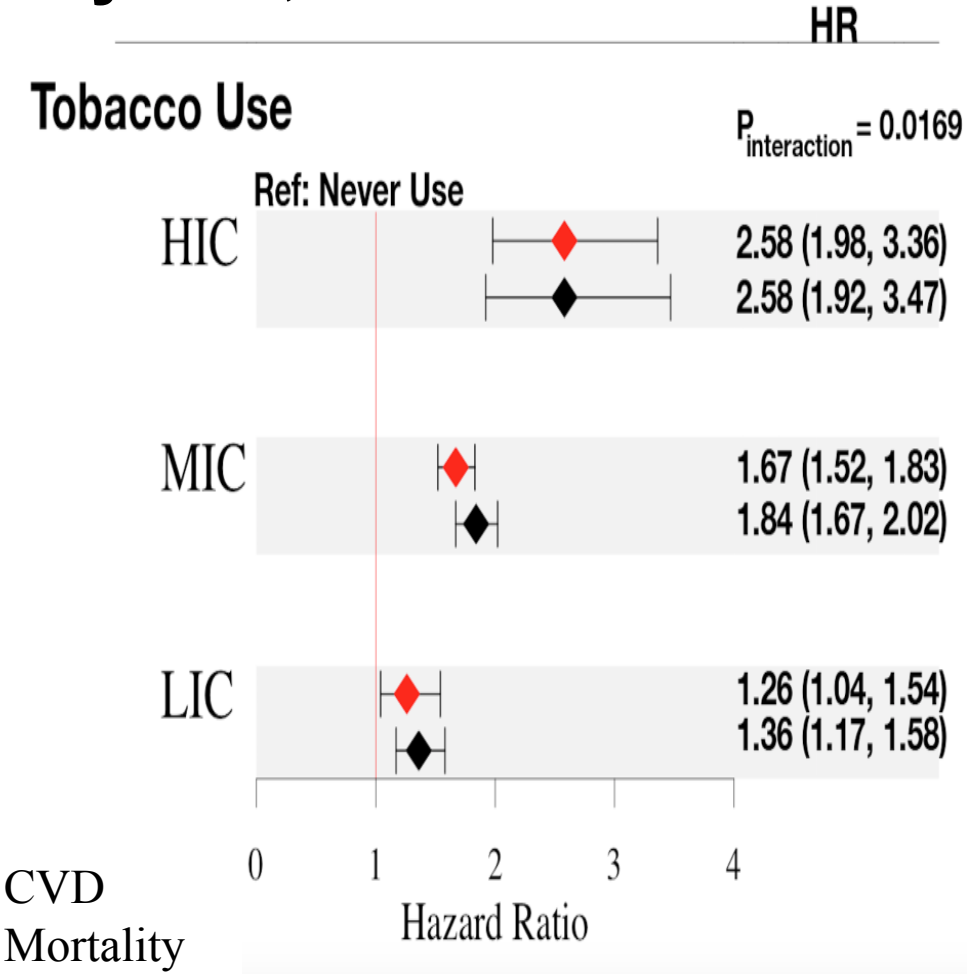


Other Risk Factors: CVD ◆ & Death ◆



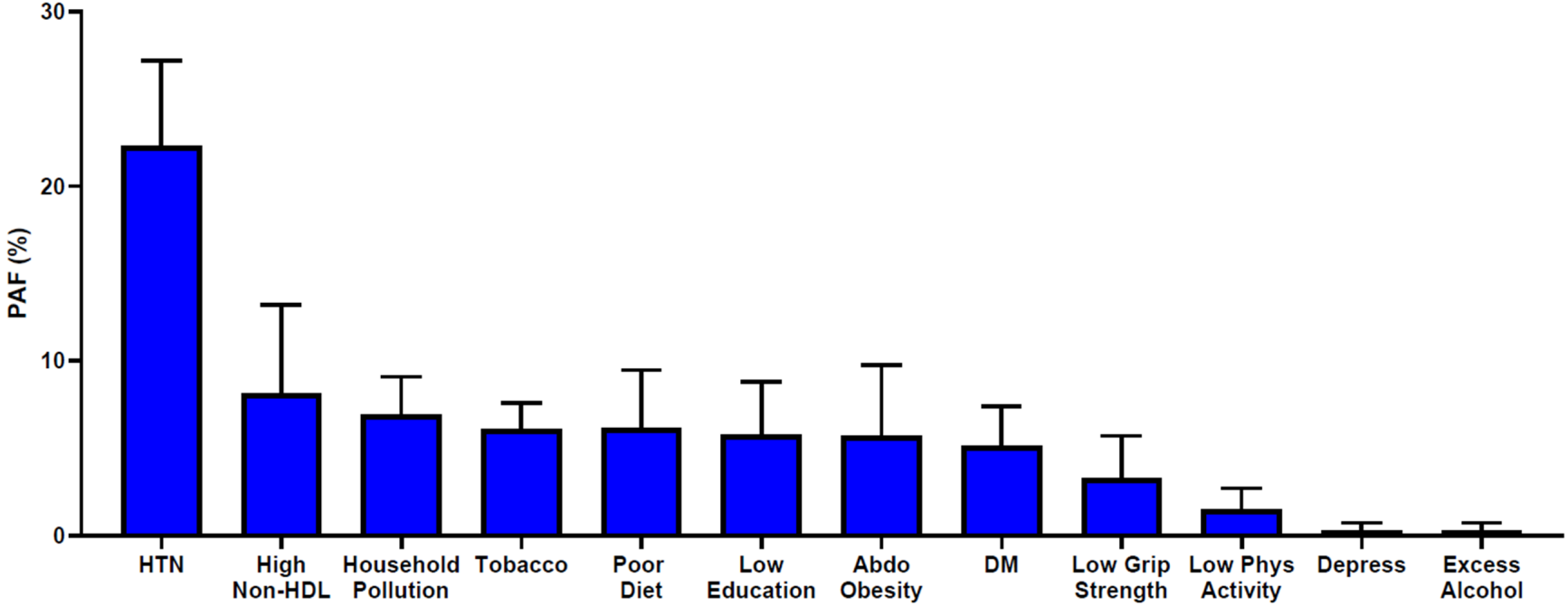
Significant Variations by HIC, MIC & LIC



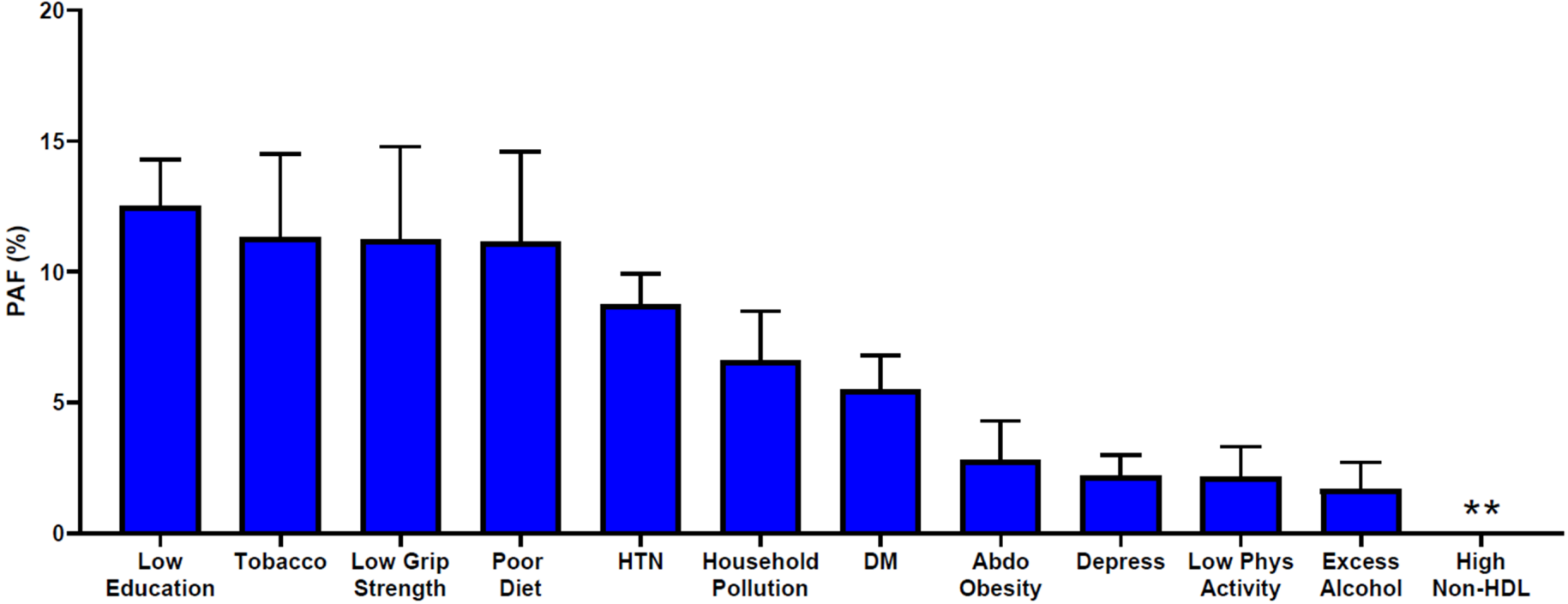


CVD
Mortality

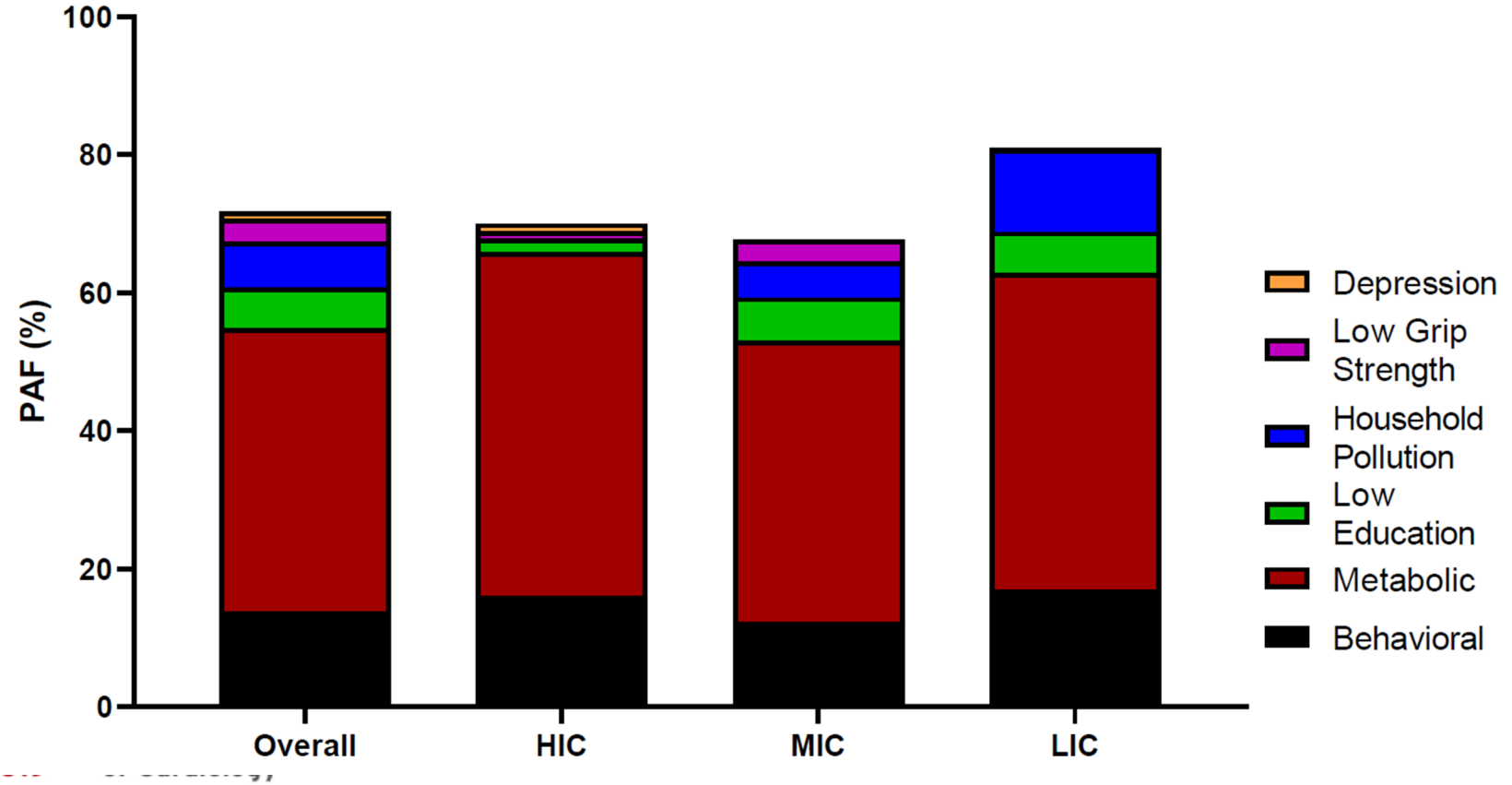
Population Attributable Fraction: CVD



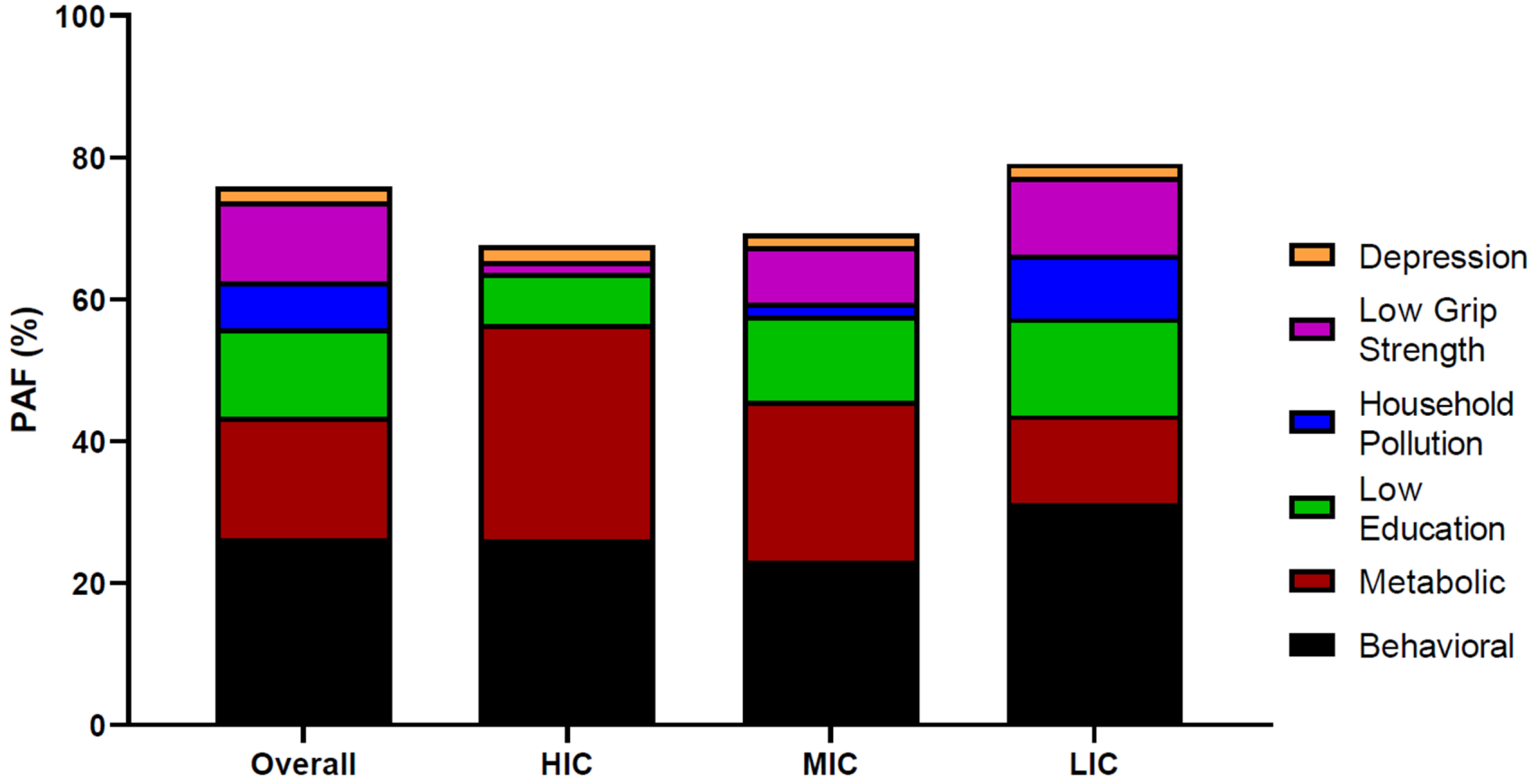
Population Attributable Fraction: Mortality



Population Attributable Fraction: CVD



Population Attributable Fraction: Mortality



Ambient Air Pollution: CVD & Death per10 µg/m3

	HR (per 10 µg/m^3 in PM $_{2.5}$)	PAF (>10 µg/m^3 in PM $_{2.5}$)
CV Mortality	1.03 (1.00-1.05)	8.7%
CVD	1.05 (1.03-1.07)	13.9%
MI	1.03 (1.00-1.06)	8.7%
Stroke	1.08 (1.05-1.11)	21.1%

PM 2.5 in Canada & Europe is 10-20 µg/m3, 50 µg/m3 in S Asia & 70 µg/m3 in China

Conclusions (1)

- CVD is more common in poorer countries
- CVD accounts for 40% of deaths globally (23% HIC, 42% MIC, 43% LIC)
- Cancer deaths more frequent than CVD deaths in several HIC and some UMIC
- Differences in CVD rates not primarily due to differences in metabolic risk factors, but may be due to differences in smoking, diet, air pollution and access to care

Conclusions (2)

- Modifiable risk factors explain about 70% of the risk of CVD and deaths
- HR of education & tobacco vary between HIC, MIC & LIC
- Importance of education, grip strength and air pollution previously under-appreciated
- Given the higher prevalence of low education, air pollution, and poor diet in LIC & MIC, their impacts are larger in these countries

Implications

Reduction of CVD and mortality requires:

- modifying risk factors which have larger effects in specific contexts, with continuing emphasis on low cost proven treatments, control of hypertension and tobacco control
- improving health care & reducing indoor and outdoor air pollution, particularly in poorer countries

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Variations in common diseases, hospital admissions, and deaths in middle-aged adults in 21 countries from five continents (PURE): a prospective cohort study

Gilles R Dagenais*, Darryl P Leong*, Sumathy Rangarajan, Fernando Lanas, Patricio Lopez-Jaramillo, Rajeev Gupta, Rafael Diaz, Alvaro Avezum, Gustavo B F Oliveira, Andreas Wielgosz, Shameena R Parambath, Prem Mony, Khalid F Alhabib, Ahmet Temizhan, Noorhassim Ismail, Jephat Chifamba, Karen Yeates, Rasha Khatib, Omar Rahman, Katarzyna Zatonska, Khawar Kazmi, Li Wei, Jun Zhu, Annika Rosengren, K Vijayakumar, Manmeet Kaur, Viswanathan Mohan, AfzalHussein Yusufali, Roya Kelishadi, Koon K Teo, Philip Joseph, Salim Yusuf

Modifiable risk factors, cardiovascular disease, and mortality in 155 722 individuals from 21 high-income, middle-income, and low-income countries (PURE): a prospective cohort study

Salim Yusuf*, Philip Joseph*, Sumathy Rangarajan, Shofiqul Islam, Andrew Mente, Perry Hystad, Michael Brauer, Vellappillil Raman Kutty, Rajeev Gupta, Andreas Wielgosz, Khalid F AlHabib, Antonio Dans, Patricio Lopez-Jaramillo, Alvaro Avezum, Fernando Lanas, Aytekin Oguz, Iolanthe M Kruger, Rafael Diaz, Khalid Yusoff, Prem Mony, Jephat Chifamba, Karen Yeates, Roya Kelishadi, Afzalhussein Yusufali, Rasha Khatib, Omar Rahman, Katarzyna Zatonska, Romaina Iqbal, Li Wei, Hu Bo, Annika Rosengren, Manmeet Kaur, Viswanathan Mohan, Scott A Lear, Koon K Teo, Darryl Leong, Martin O'Donnell, Martin McKee, Gilles Dagenais