We Need More Sex-Disaggregated Data: Unveiling the Data Gap and Showing the Benefit of Sex-Disaggregated Data Along the Health Pathways for Hypertension, Diabetes, HIV and AIDS

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Introduction

Sex and gender significantly influence health outcomes through biology, identity, and societal norms[1]. Gender norms can shape exposure to health risks and access to care, while biological sex affects physiological responses and mortality rates. Understanding differences along the "health pathway"—from risk exposure to mortality—can help identify where disparities arise and inform targeted interventions to reduce health inequities. This paper uses sex-disaggregated data to examine health pathways, recognizing that gender, as a social determinant, must be addressed to effectively reduce inequities. We illustrate this concept with global sex-disaggregated data for three conditions: hypertension, diabetes, and HIV/AIDS. Disease modelling groups, e.g., the Institute for Health Metrics and Evaluation (IHME) and NCD Risk Factor Collaboration (NCD-RisC), provide sex- and age-specific estimates for certain health pathway steps, such as risk factors, prevalence, and mortality. The "care cascade" framework, used to assess progression through stages of care (diagnosis, treatment, disease control), highlights the need for improved access and quality of care. While regional and national studies offer sex-disaggregated data for specific conditions, globally comparable data remains limited[2-7]. Our scoping review identified global sex-disaggregated cascade datasets for hypertension, diabetes, and HIV/AIDS but noted a lack of focus on sex differences within the care cascade. This study further addresses this gap by analysing sex differences at each stage of the health pathway for these conditions, aiming to enhance understanding and inform more equitable healthcare interventions.

Data and Methods

Data sources

Recognizing the scarcity of data on the care cascade compared to risk exposure and health outcomes, we conducted a scoping review to address the lack of data on the care cascade compared to risk exposure and health outcomes. Our focus was on global datasets reporting sex-disaggregated care cascade data for hypertension, diabetes, HIV and AIDS, tuberculosis, dementia, depression, chronic obstructive pulmonary disease, and lung cancer. We found suitable datasets only for hypertension, diabetes, and HIV and AIDS, which we analysed using the Global Burden of Disease (GBD) 2019 data for risk factors, prevalence, and death rates. Data sources included the IHME and NCD-RisC database for hypertension, and the GBD database for diabetes and HIV. We used the care cascade framework with three steps: Diagnosed, Treated, and Controlled, and calculated conditional steps between each stage. The NCD-RisC database covered hypertension (200 countries, 1990-2019), WHO STEPS survey covered diabetes (39 countries, 2013-2020), and UNAIDS data covered HIV (174 countries, 2015-2021, with complete data for 73 countries in 2021). Data were analysed for the most recent year available, with age and sex disaggregation.

Statistical analysis

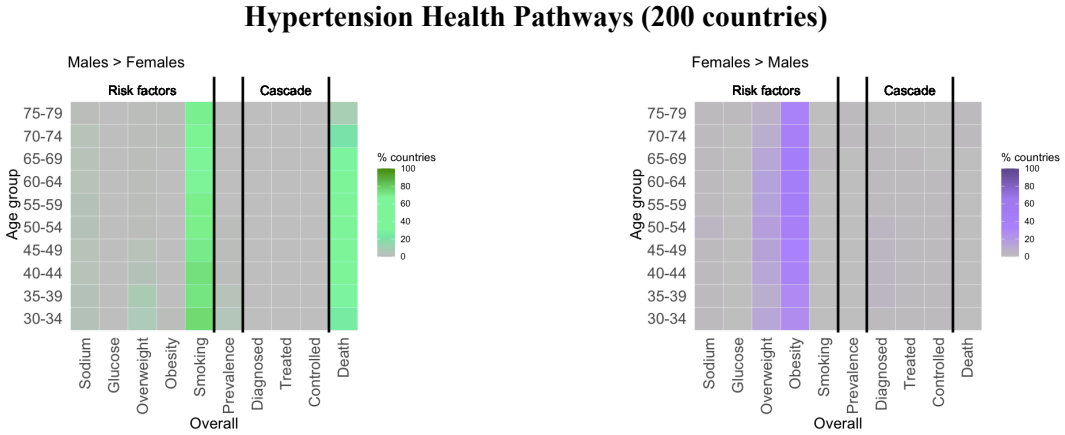
We analysed sex and age differences in health outcomes, focusing on risk factors, disease prevalence, care cascade stages, and mortality rates. Countries were categorized by World Bank income groups or regional classifications, with 63 high-income, 54 upper-middle-income, 54 lower-middle-income, and 26 low-

income countries. Regions included Europe and Central Asia (50 countries), South Asia (8), sub-Saharan Africa (44), the Middle East and North Africa (22), Latin America & the Caribbean (37), East Asia and the Pacific (33), and North America (3). Sex differences were assessed by comparing confidence intervals, considering non-overlapping intervals as significant. For diabetes, asymptotic 95% binomial confidence intervals were used. Multivariable linear regression analyses examined socio-economic and risk factor impacts on sex differences, particularly for hypertension and HIV due to limited diabetes data. Disease prevalence was included to explore its effect on sex differences in the care cascade.

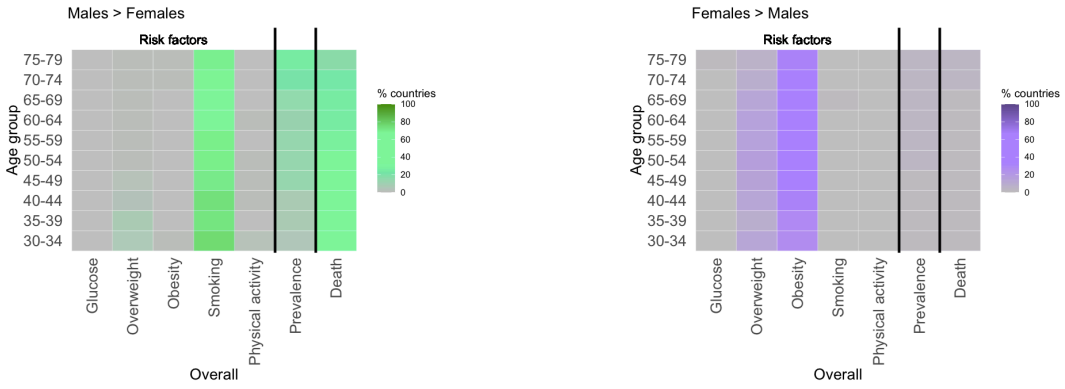
Preliminary results

Results reveal significant sex differences in health pathways across hypertension, diabetes, and HIV/AIDS (Figure 1).

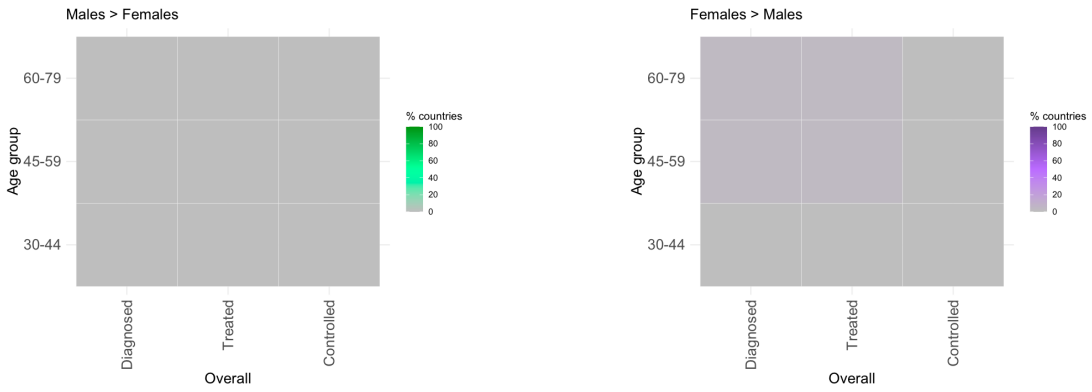
Figure 1. Sex differences (significant when non-overlapping confidence intervals of estimates between females and males) in global health pathways of hypertension, diabetes, and HIV and AIDS.



Note: Sodium (high sodium intake); Glucose (high fasting plasma glucose). Sex difference is determined by comparing the confidence intervals between females and males, and considered steps with non-overlapping confidence intervals as statistically significant.

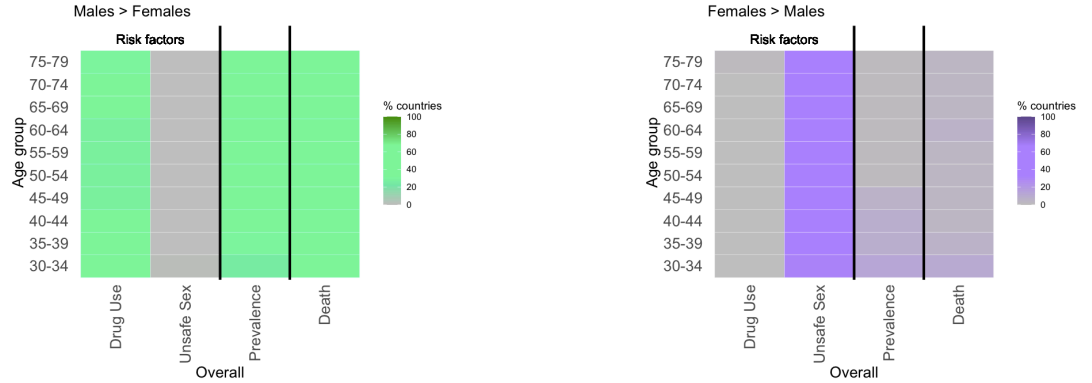


Diabetes Health Pathways* (39 countries)
Cascade of Care



* Diabetes cascade of care data are provided only for age groups 30-44, 45-59, and 60-79.
Note: For proportions of diagnosed, treated, and controlled, no confidence intervals are provided, sex comparisons are based on asymptotic 95% binomial confidence intervals. The only country with a significant difference (F>M) is Capo Verde.

HIV Health Pathways (200 countries)
Risk Factors, Prevalence, and Death



All ages diagnosed: 1 out of 73 countries (1%)
All ages treated: 1 out of 73 countries (1%)
All ages controlled: 2 out of 73 countries (3%)

All ages diagnosed: 2 out of 73 countries (3%)
All ages treated: 6 out of 73 countries (8%)
All ages controlled: 7 out of 73 countries (10%)

For hypertension, male smoking rates exceed those of females in 174 (87%) countries, with exceptions in Bhutan (ages 65-69). Female obesity rates exceed males in 129 countries (65%), except in China (ages 30-39) and Malawi (ages 70-79). High fasting plasma glucose levels are generally similar between sexes, with higher female rates in Egypt. Overweight prevalence shows variation: higher in males in 17 countries (9%) and in females in 58 countries (29%). Sodium intake differences appear in 17 countries, with higher male rates in 10 (5%) and higher female rates in 7 (4%). Globally, hypertension prevalence is similar between sexes, except for 8 countries (4%) with higher male prevalence and India with higher female prevalence at ages 70-79. The care cascade shows few significant sex differences, though female diagnosis and treatment rates are higher in certain age groups in some countries. Death rates from hypertension are higher in males in 104 countries (52%) and in females in the United Arab Emirates at ages 70-79. For diabetes, risk factors mirror those of hypertension, with low physical activity instead of high sodium intake; notable sex

differences are in Jamaica, Samoa, and Trinidad and Tobago, where males have higher low physical activity rates. Diabetes prevalence is similar globally, with higher male prevalence in 59 countries (30%) and female prevalence in 10 countries (5%). Data on the diabetes care cascade from 39 countries reveal significant sex differences only in Cape Verde. Diabetes mortality is higher in males in 98 countries (49%), in females in 9 countries (5%), and similar in 93 countries. HIV/AIDS data show higher male drug use in 135 countries (68%), with exceptions in 5 countries (3%). Unsafe sex is more prevalent among females in 110 countries (55%), except in Nepal at ages 30-34. HIV/AIDS prevalence is higher among males in 59 countries (30%) and among females in 10 countries (5%). In the care cascade for HIV, females perform better in diagnosis, treatment, and control in 2, 6, and 7 countries, respectively, while males show better performance in specific countries like Georgia, Timor-Leste, and Sao Tome. HIV/AIDS death rates are higher in males in 126 countries (63%) and in females in 24 countries (12%).

Conclusion

To address health inequities effectively, we need comprehensive global data disaggregated by sex and age, focusing initially on major conditions. Without this, we lack crucial insights and risk "walking blind" along the health pathway. Policymakers should push for better data disaggregation, public reporting, and the use of such data to address population disparities. Comparing countries can highlight trends and anomalies in sex differences, guiding targeted interventions. A collaborative approach involving WHO, private entities, and disease-specific communities could standardize data collection. Future health pathways should also consider the influence of upstream legal and policy environments.

References

1. National Academies of Sciences, Engineering, and Medicine. (2022). *Measuring sex, gender identity, and sexual orientation*.
2. Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2019 (GBD 2019). Seattle, United States: Institute for Health Metrics and Evaluation (IHME), 2020.
3. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in blood pressure from 1975 to 2015: a pooled analysis of 1479 population-based measurement studies with 19.1 million participants. Lancet. 2017; 389(10064):37–55.
4. Wade, A. N., Maposa, I., Agongo, G., Asiki, G., Boua, P., Choma, S. S., ... & Crowther, N. J. (2023). Diabetes care cascade and associated factors in 10 700 middle-aged adults in four sub-Saharan African countries: a cross-sectional study. BMJ open, 13(4), e069193.
5. Cohn, J., Ake, J., Moorhouse, M., & Godfrey, C. (2020). Sex Differences in the Treatment of HIV. Current HIV/AIDS Reports, 17, 373-384.
6. Walli-Attaei, M., Joseph, P., Rosengren, A., Chow, C. K., Rangarajan, S., Lear, S. A., ... & Yusuf, S. (2020). Variations between women and men in risk factors, treatments, cardiovascular disease incidence, and death in 27 high-income, middle-income, and low-income countries (PURE): a prospective cohort study. The Lancet, 396(10244), 97-109.
7. Foti, K., Wang, D., Appel, L. J., & Selvin, E. (2019). Hypertension awareness, treatment, and control in US adults: trends in the hypertension control cascade by population subgroup (National Health and Nutrition Examination Survey, 1999–2016). American journal of epidemiology, 188(12), 2165-2174.