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Global burden of metabolic disorders among women of child-bearing age, 1990–2021: a population-based study

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Abstract

Background Metabolic disorders have a significant impact on the health of women of childbearing age (WCBA) but remain underemphasized. This study aims to assess the global, regional, and national burden of metabolic disorders in WCBA from 1990 to 2021.

Methods Prevalence, mortality, and disability-adjusted life years (DALYs) related to metabolic disorders in WCBA from 1990 to 2021 were obtained from the Global Burden of Disease (GBD) 2021. Annual percentage changes were calculated, and stratified analyses were conducted based on age, region, nation, and socio-demographic index levels to assess the distribution of metabolic disorders in WCBA.

Results Globally, the overall burden of metabolic disorders among WCBA has increased. In 2021, obesity (330.21 [148.37-518.36]) had the highest age-standardized DALYs rate, followed by hypertension (200.75 [154.67-245.47]), type 2 diabetes mellitus (175.11 [134.18-223.42]), hyperlipidemia (139.02 [101.32-173.61]), and non-alcoholic fatty liver disease (10.1 [7.17-13.92]). The most significant changes of the overall metabolic disorders burden in WCBA were observed in younger age groups. The burden of metabolic disorders was higher in less-developed regions.

Conclusions Given the marked increase in the burden of metabolic disorders among younger WCBA, it is recommended that healthcare management be reinforced for this demographic. Furthermore, based on the varying burdens observed across regions, targeted metabolic interventions for WCBA should be tailored to local conditions.

Keywords Global burden of disease, Women, Metabolic syndrome, Epidemiology

Introduction

Metabolic disorders in women of childbearing age (WCBA) affect the health of this population and are closely related to fertility and offspring health [1–5]. WCBA are a critical group for reproductive health [6], but research specifically targeting WCBA is lacking. Therefore, targeted research on metabolic disorders in WCBA is crucial for raising societal awareness and guiding the development and implementation of effective public health policies.

Although studies by Chew et al. [7] and Zhang et al. [8] have reported on the burden of metabolic diseases, they

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did not analyze WCBA as a distinct group. Additionally, a study on obesity found that from 1998 to 2017, the obesity prevalence among WCBA in South Africa increased from 24.7 to 35.2% [9]. However, this finding is limited to South Africa and does not provide age-stratified analysis or calculate disability-adjusted life years (DALYs). DALYs, introduced by the World Bank in the 1993 World Development Report, are a key measure of disease burden adopted by the World Health Organization (WHO), the United Nations, the World Bank, and government agencies worldwide [10]. As a result, previous studies fail to provide a comprehensive understanding of metabolic disorders in WCBA. The lack of attention to this vulnerable group, combined with the absence of prevention and treatment guidelines, has further exacerbated the metabolic disease burden in WCBA.

To fill these gaps, we examine the global burden of metabolic disorders in WCBA utilizing the most recent data from the Global Burden of Disease (GBD) 2021. Five major metabolic disorders are included: type 2 diabetes mellitus (T2DM), hypertension (HTN), non-alcoholic fatty liver disease (NAFLD), hyperlipidemia (HLD), and obesity. Prevalence, mortality, and DALYs are estimated and stratified by age, nation, region, and socio-demographic index (SDI). This study aims to analyze the disease burden of metabolic disorders in WCBA using the latest global epidemiological data. The goal is to enhance understanding of the metabolic status of this group. Additionally, we aim to offer possible insights to help develop and implement effective public health policies. For example, we suggest that early health education, awareness campaigns, and strategic resource allocation are crucial for providing increased medical assistance and public health education in the regions most affected. Ultimately, this could improve the health of WCBA affected by metabolic disorders and potentially enhance global reproductive health.

Methods

Data sources

This study utilized data on metabolic disorders among WCBA from the GBD 2021. All data used in this study are accessible online through the GBD Results Tool (https://vizhub.healthdata.org/gbd-results/) [10]. Detailed descriptions of the data estimation methods and statistical modeling have been previously published. Briefly, the GBD database, managed by the Institute for Health Metrics and Evaluation (IHME), collects data from various sources, including vital registration, verbal autopsy, surveys, and censuses [11].

Definitions

As mentioned in previous studies, GBD uses independently developed models to calculate mortality rates and employs DALYs as a tool for quantifying disease burden. DALYs are the sum of years lived with disability (YLDs) and years of life lost (YLLs). YLDs quantify non-fatal health losses by multiplying the morbidity rate for each disease and injury by its corresponding disability weight. YLLs quantify fatal health losses by multiplying the number of deaths for each cause by the standard life expectancy at the age of death [10].

According to the GBD definitions, we used the International Classification of Diseases-10 (ICD-10) codes to obtain the number and rate of prevalence, deaths, and DALYs for metabolic disorders. Considering the potential overlap within individuals and the characteristics of GBD 2021 data, we did not provide aggregated estimates for metabolic disorders. The data inclusion criteria were women aged 15–49 years (according to the WHO definition) [12], regardless of race or region. Data on the prevalence, deaths, and DALYs of T2DM and NAFLD were obtained and stratified by age, nation, region, SDI, and year. For HTN, HLD and obesity, which are defined as risk factors in the GBD database, prevalence data were unavailable. Therefore, only data on deaths and DALYs, stratified by age, country, region, SDI, and year, were collected. The data exclusion criterion was individuals with severely missing data. This study divided WCBA into seven age subgroups to analyze the relative proportions of deaths and DALYs due to the five metabolic disorders, and to examine the temporal changes in the age subgroup distribution.

The SDI is a composite measure developed by IHME to assess national and regional development levels. It is calculated based on the total fertility rate among females under 25, mean educational attainment in individuals aged 15 years and older, and lag-distributed income per capita. The final SDI values range from 0 to 100, with 0 indicating the lowest level of development and values approaching 100 indicating the highest levels of development. In GBD 2021, countries and regions were classified into five quintiles (low, low-middle, middle, high-middle, and high) based on their SDI for analysis [10, 13].

Statistical analysis

To estimate the global burden of metabolic disorders among WCBA, we assessed the number and age-standardized rates (ASRs) of prevalence deaths and DALYs for T2DM and NAFLD from 1990 to 2021. We also estimated the number and ASRs of deaths and DALYs for HLD, HTN, and obesity (the prevalence data for HTN, HLD, and obesity was not available in GBD database). The direct age-standardization method was used to estimate ASRs [14]. Additionally, we calculated the estimated annual percentage change (EAPC) with 95% confidence interval (CI) for ASRs as previously described [15]. If the 95% CI for EAPC included 0, the EAPC was considered

stable. Positive EAPCs with lower a 95% CI greater than 0 indicated an increase in age-standardized prevalence rate (ASPR), age-standardized mortality rate (ASMR) and age-standardized DALYs rate (ASDR). We quantified the proportion of metabolic disorders according to age and SDI, and analyzed trends in the global disease burden. We also assessed differences in the burden of metabolic disorders across 21 regions, and mapped the variations in ASMR, ASDR, and their EAPCs across 204 countries and territories. All statistical analyses were conducted using R version 4.1.2 and GraphPad Prism version 9.0.

Results

Overview

Globally, the proportion of WCBA among all age women with T2DM and NAFLD has shown a continuous upward trend (Fig. S1). Compared to all-age women, the proportion of the absolute number of metabolic disorders deaths and DALYs in WCBA has increased annually (Fig. 1A and B). For T2DM, NAFLD, and obesity, which have shown a yearly rise in ASMR and ASDR, the increase among WCBA is faster (Fig. 1C and D). Conversely, for HTN and HLD, which have seen a decline in ASMR and ASDR, the decline among WCBA is slower (Fig. 1C and D). Over the past 30 years, the proportion of T2DM and NAFLD prevalence in WCBA relative to overall disease

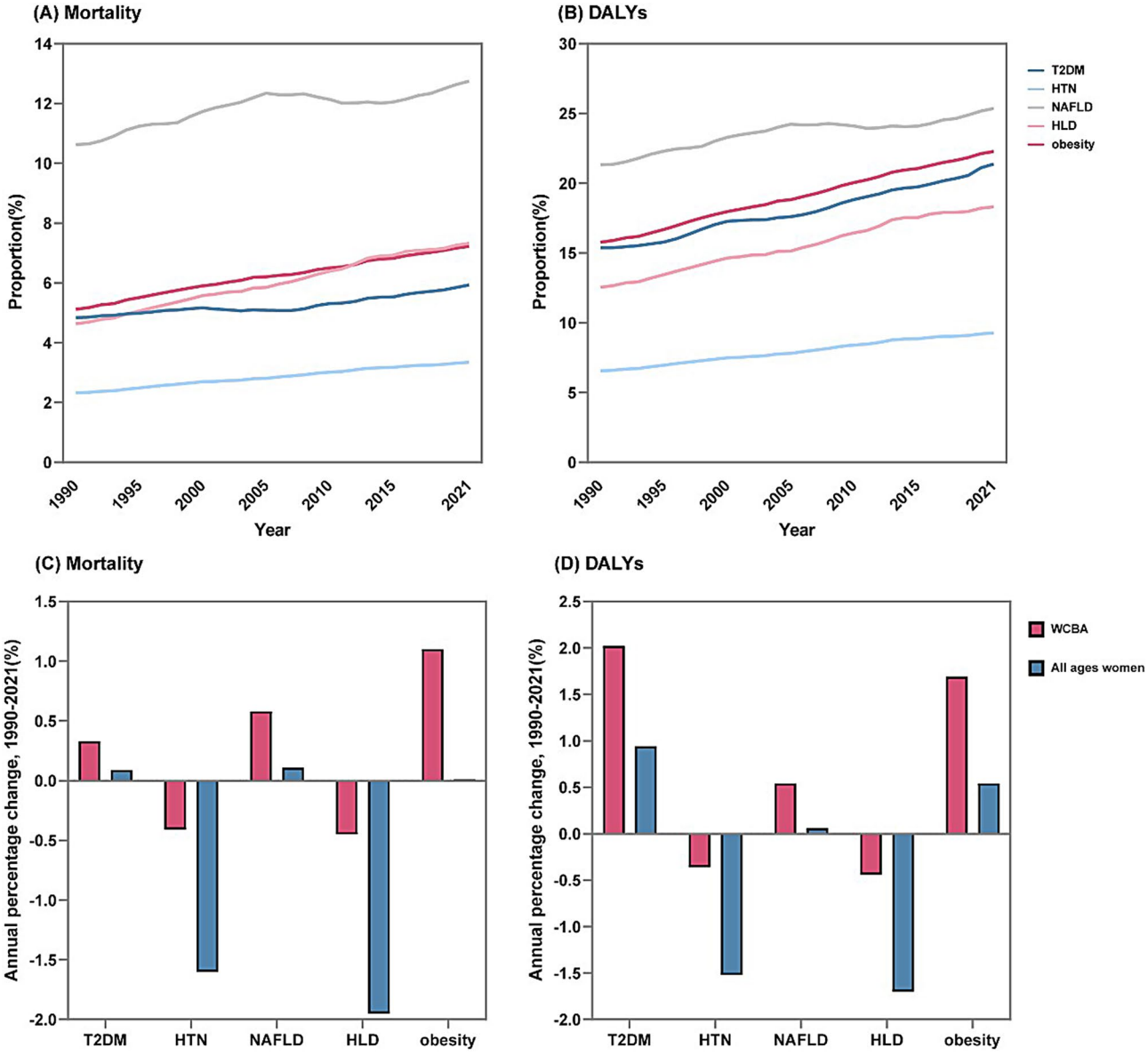

Fig. 1 The changes in the proportion of ASMR and ASDR and their EAPCs among metabolic disorders in WCBA to the overall women from 1990 to 2021. ASMR (**A**) and ASDR (**B**), and EAPCs of ASMR (**C**) and ASDR (**D**)

prevalence has gradually risen (Fig. S2). However, mortality and DALYs of the five metabolic disorders continued to rise until 2019 (Fig. S3).

From 1990 to 2021, deaths related to metabolic disorders have shown an overall upward trend. By 2021, HTN accounted for the highest number of deaths, with 149,159 (95% CI [114,783–182,185]) (Fig. 2A, Table S1). Similarly, the DALYs have steadily increased yearly. By 2021, the largest contributor of DALYs was obesity (13,003,268, 95% CI [5,842,588–20,412,332]) (Fig. 2B, Table S1). Obesity had the fastest age-related mortality growth, with an EAPC of 1.1 (95% CI [1.03–1.18]), while T2DM had the fastest DALY growth, with an EAPC of 2.02 (95% CI [1.96–2.08]) (Table S1).

Type 2 diabetes mellitus

T2DM-related prevalence, mortality and DALYs

Among WCBA, the ASPR, ASMR and ASDR of T2DM all increased, with EAPCs of 2.83 (95% CI [2.74–2.93]), 0.67 (95% CI [0.57–0.77]) and 2.02 (95% CI [1.96–2.08]) (Table S2, S3).

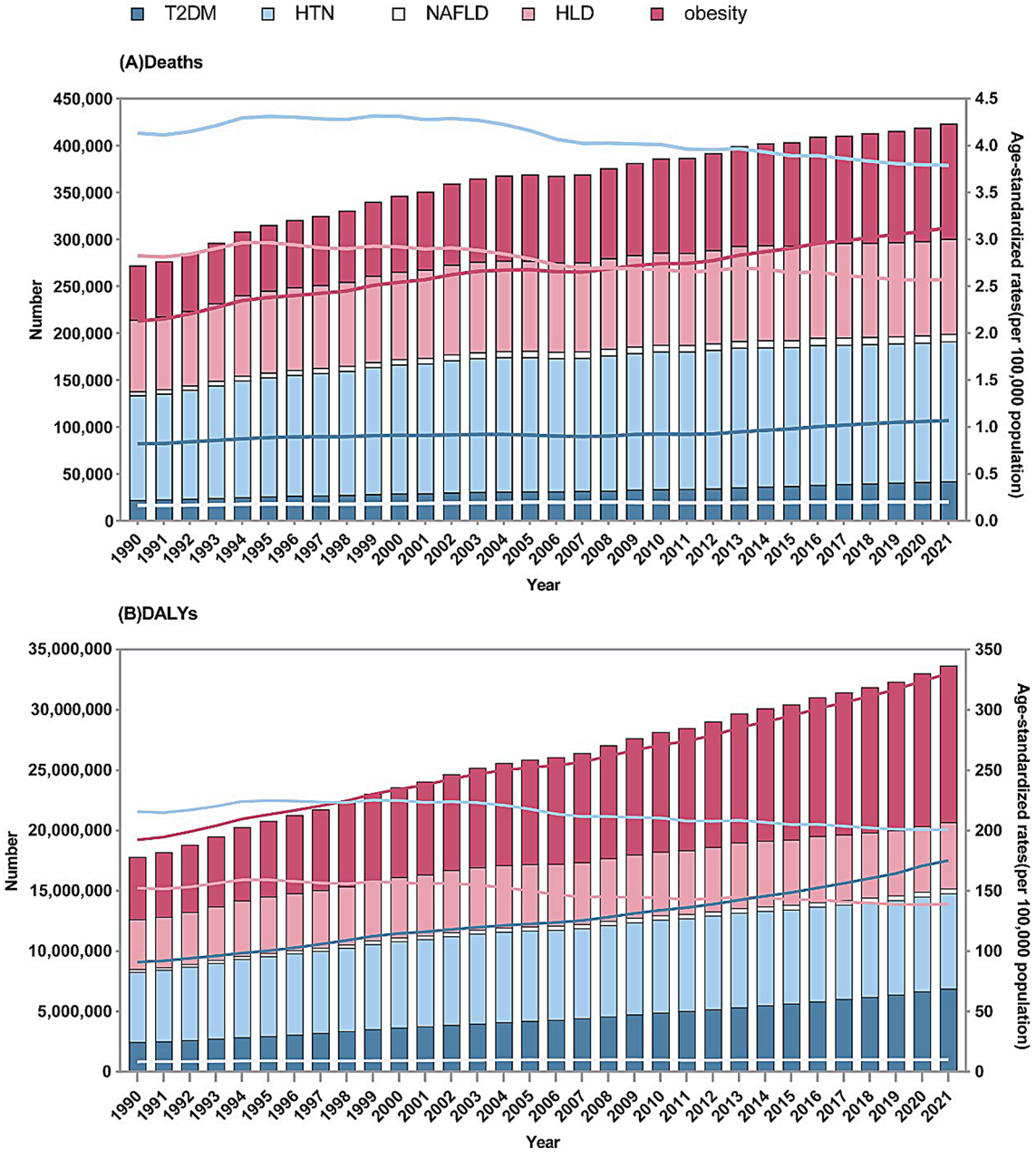

Fig. 2 The number and ASR of deaths (**A**), the number and ASR of DALYs (**B**) of metabolic disorders in WCBA, at the global level from 1990–2021

T2DM-related burden based on age

Among WCBA, the ASPR, ASMR, and ASDR for T2DM increased with age (Fig. 3, Table S2, Table S3). In 2021, compared to women aged 15–19, those aged 45–49 had ASDR over 10 times higher (Table S3). Notably, younger women displayed a marked increase in disease burden. In particular, while women aged 25–29 had the largest EAPC for ASDR at 1.9 (95% CI [1.8-2]) (Fig. 3, Table S2, Table S3). In 2021, the majority of T2DM-related deaths among WCBA occurred in women aged 35–49 (83.03%). Similarly, most DALYs were contributed by women aged 30–49 (84.57%) (Fig. S4). Additionally, women aged 15–24 had a significantly higher proportion of T2DM-related deaths and DALYs compared to other age groups among WCBA across the five metabolic disorders (Fig. S5).

T2DM-related burden based on geographical region and SDI

From 1990 to 2021, the ASPR and ASDR of T2DM increased across all five SDI countries. For ASMR, there was a yearly increase in low and low-middle SDI countries (Fig. 4, Table S2, S3). In 2021, among WCBA, the highest ASPR of T2DM was in high-middle SDI countries (Table S2). However, the ASDR was higher in middle and low-middle SDI countries (Fig. 4, Table S3). Compared to the global burden of T2DM among WCBA, the absolute values of mortality and DALYs were primarily contributed by low-middle (71.03%) and middle (63.22%) SDI countries (Fig. S6).

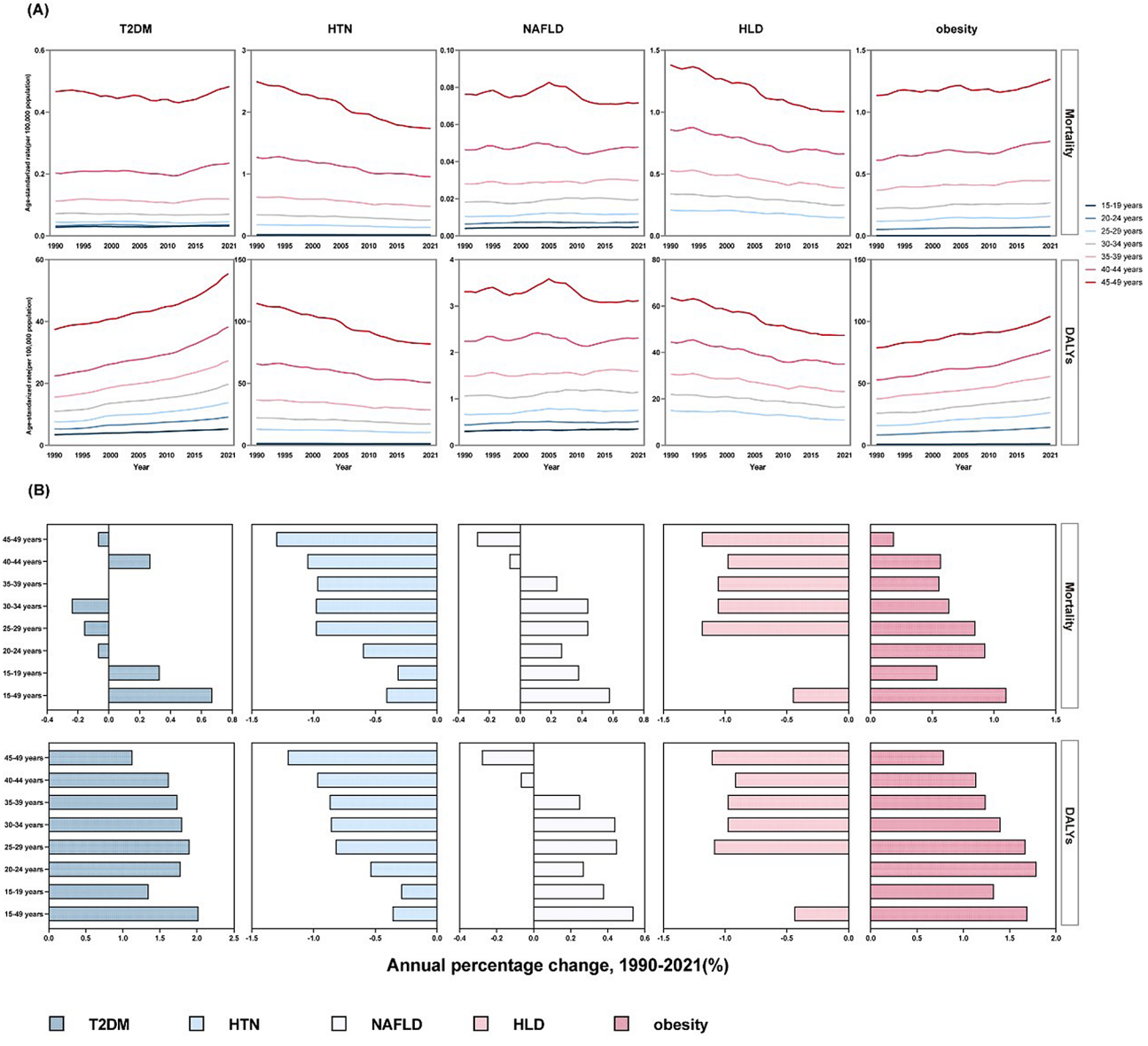

Fig. 3 The changes in the ASMR and ASDR (**A**) and their EAPCs (**B**) of metabolic disorders in WCBA from 1990 to 2021 by age

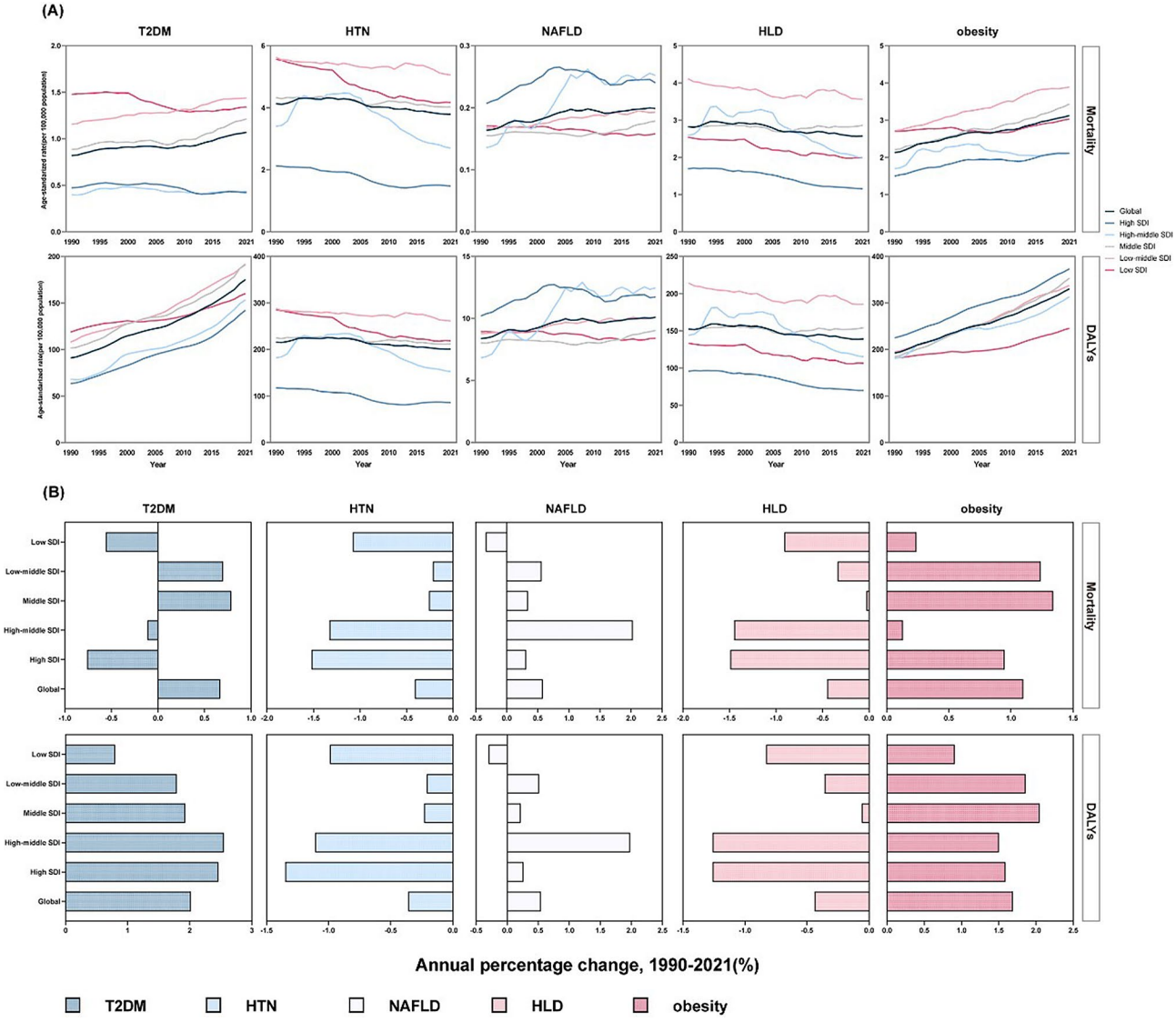

Fig. 4 The changes in the ASMR and ASDR (**A**) and their EAPCs (**B**) of metabolic disorders in WCBA from 1990 to 2021 by SDI

In 2021, the region with the highest burden of T2DM among WCBA was Oceania (Table S4). Notably, while the ASDR for T2DM declined in Eastern Sub-Saharan Africa, it increased in all other regions (Fig. 5). For nations, the highest burden of T2DM was the Marshall Islands. (Fig. S7, Table S5).

Hypertension

HTN-related mortality and DALYs

Globally, the ASMR and ASDR related to HTN showed decreasing trend, with EAPCs of -0.41 (95% CI [-0.49–-0.32]) and -0.36 (95% CI [-0.44–-0.28]) (Table S6).

HTN-related burden based on age

Among WCBA, the ASMR and ASDR related to HTN increased with age. From 1990 to 2021, the burden of HTN decreased across all age groups, with a slowest decline in younger women aged 15–19, which the EAPCs for ASMR and ASDR were -0.32 (95% CI [-0.45–-0.19]) and -0.29 (95% CI [-0.42–-0.17]) (Fig. 3, Table S6). In 2021, compared to women aged 15–19, women aged 45–49 had an ASDR that was more than 76 times higher (Table S6). In 2021, the absolute mortality and DALYs for HTN were primarily contributed by women aged 35–49, accounting for 88.56% and 84.9% (Fig. S4). The proportional burden of HTN mortality and DALYs was similar across age groups compared to the other four metabolic disorders, with lower proportions in women aged 15–24 (Fig. S5).

HTN-related burden based on geographical region and SDI

From 1990 to 2021, the ASMR and ASDR for HTN among WCBA showed a decline across all five SDI levels, with the fastest decrease observed in high SDI

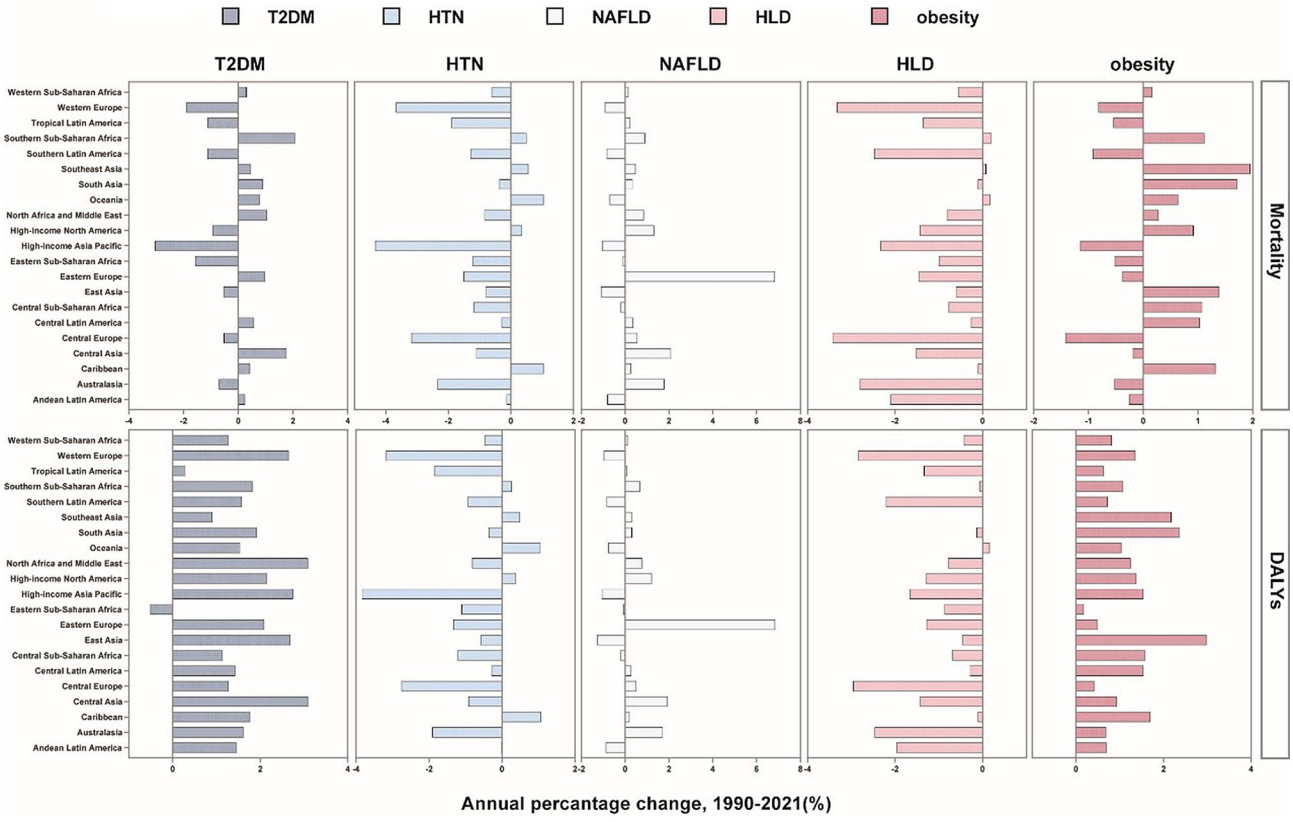

Fig. 5 EAPCs of ASMR and ASDR of five metabolic disorders in WCBA from 1990 to 2021 at regions levels

countries. In 2021, the highest ASMR and ASDR of HTN were found in low-middle SDI countries (Fig. 4, Table S6). Globally, HTN-related mortality and DALYs among WCBA were primarily driven by low-middle (68.46%) and middle (67.4%) SDI countries (Fig. S6).

In 2021, the region with the highest HTN-related burden among WCBA was Southeast Asia (Table S7). Notably, an increasing trend in HTN-related burden was observed in only five regions: Caribbean, High-Income North America, Oceania, Southeast Asia, and Southern Sub-Saharan Africa (Fig. 5). For nations, the fastest increase in ASMR and ASDR was observed in Zimbabwe (Fig. S8, Table S8).

Non-alcoholic fatty liver disease

NAFLD-related prevalence, mortality and DALYs

Among WCBA, the ASPR, ASMR and ASDR of NAFLD all increased with EAPCs of 0.93 (95% CI [0.87–0.99]), 0.58 (95% CI [0.48–0.69]) and 0.54 (95% CI [0.44–0.63]) (Table S9, S10).

NAFLD-related burden based on age

Among WCBA, the ASPR, ASMR, and ASDR of NAFLD increased with age (Fig. 3, Table S8, Table S10). In 2021, compared to women aged 15–19, women aged 45–49 had over 8 times the DALYs for NAFLD (Table S9). Notably, younger WCBA showed a more pronounced rise in NAFLD burden, particularly those aged 25–34. Among women aged 25–29, the EAPCs for ASMR and ASDR were 0.44 (95% CI [0.29–0.6]) and 0.45 (95% CI [0.29–0.6]) (Fig. 3, Table S9, Table S10). In 2021, the absolute mortality and DALYs for NAFLD among WCBA were predominantly contributed by women aged 30–49, accounting for 88.49% and 84.61% (Fig. S4). Women aged 15–24 showed a disproportionately higher share of NAFLD mortality and DALYs among the five metabolic disorders, compared to other age groups (Fig. S5).

NAFLD-related burden based on geographical region and SDI

From 1990 to 2021, among the five SDI countries, the most significant annual increase in the ASPR of NAFLD was observed in high SDI countries (Table S9). For WCBA, the ASMR and ASDR related to NAFLD have risen annually in low-middle to high SDI countries, with the highest EAPC in high-middle SDI countries. (Fig. 4, Table S10). In 2021, among WCBA, the highest ASPR of NAFLD was found in middle SDI countries (Table S9). The highest ASMR and ASDR for NAFLD were observed in high-middle SDI countries (Fig. 4, Table S10). Globally, the burden of NAFLD among WCBA was relatively balanced across the five SDI countries (Fig. S6).

In 2021, among WCBA, the highest ASPR of NAFLD was in Tropical Latin America. Eastern Europe showed the highest ASMR and ASDR (Table S11), and exhibited a significant increase (Fig. 5). For nations, the fastest increase in ASPR was observed in Iran, while the fastest increases in ASMR and ASDR were in the Russian Federation (Fig. S9 Table S12).

Hyperlipidemia

HLD-related mortality and DALYs

Globally, among WCBA, the ASMR and ASDR for HLD decreased from 1990 to 2021, with EAPCs of -0.45 (95% CI [-0.54–-0.37]) and -0.44 (95% CI [-0.52–-0.37]) (Table S13).

HLD-related burden based on age

In GBD, data on mortality and DALYs of HLD in the 15–24 age group are not available. The ASMR and ASDR for HLD increased with age, although the annual change decreased across age groups (Fig. 3, Table S13). In 2021, compared to the younger age group of 25–29 years, women aged 45–49 had an ASDR more than 4 times higher (Table S13). In 2021, among WCBA, the absolute values for HLD mortality and DALYs were predominantly contributed by women aged 35–49, accounting for 84.43% and 80.01%, respectively (Fig S4). The proportions of HLD mortality and DALYs in different age groups were similar to other metabolic disorders (Fig S5).

HLD-related burden based on geographical region and SDI

From 1990 to 2021, the ASMR and ASDR for HLD among WCBA decreased across all five SDI countries, with the fastest decline observed in high SDI countries. (Fig. 4, Table S13). Compared to the global WCBA, the burden of HLD was mainly contributed by low-middle (71.33%) and middle (69.93%) SDI countries (Fig. S6).

In 2021, among WCBA, the highest burden of HLD was observed in North Africa and the Middle East (Table S14). Only Oceania showed a year-on-year increase in ASMR and ASDR for HLD (Fig. 5). For nations, the fastest increases in ASMR and ASDR were observed in Zimbabwe (Fig. S10, Table S15).

Obesity

Obesity-related mortality and DALYs

Globally, the ASMR and ASDR for obesity has increased annually from 1990 to 2021, with EAPCs of 1.1 (95% CI [1.03–1.18]) and 1.69 (95% CI [1.65–1.72]) (Table S16).

Obesity-related burden based on age

The ASMR and ASDR for obesity increased with age, and the annual increase was observed across all age groups (Fig. 3, Table S16). In 2021, among WCBA, the absolute values for obesity mortality and DALYs were predominantly contributed by women aged 35–49, accounting for 83.9% and 75.55% (Fig. S4). The proportions of obesity-related mortality and DALYs in different age groups were most significant in the 20–24 age group among the five metabolic disorders, with the 15–19 age group showing the lowest proportion (Fig. S5).

Obesity-related burden based on geographical region and SDI

From 1990 to 2021, the ASMR and ASDR for obesity among WCBA increased annually across all five SDI countries. In 2021, highest ASDR was in high SDI countries (Fig. 4, Table S16). Compared to the global WCBA, the burden of obesity was mainly contributed by low-middle (67.33%) and middle (60.55%) SDI countries (Fig. S6).

In 2021, the highest burden of obesity was observed in Oceania (Table S17). ASDR increased annually in 21 regions (Fig. 5). For nations, the fastest increases in ASMR and ASDR were observed in Zimbabwe (Fig. S11, Table S18).

Discussion

This study systematically assessed the global disease burden of metabolic disorders among WCBA. The following findings were identified: (1) Globally, the burden of metabolic disorders in WCBA exhibited a gradual increase. (2) The EAPCs of ASMR and ASDR in WCBA were more pronounced in WCBA compared to overall women. (3) Stratified by age, the burden of metabolic disorders generally increased with age in WCBA from 1990 to 2021. However, the EAPC of metabolic disorders burden was more significant among younger-age groups. (4) Stratified by SDI, the burden of metabolic disorders decreased with increasing SDI except for NAFLD and obesity.

Similar to previous studies on the disease burden of metabolic disorders [7, 8, 16], the burden of metabolic abnormalities in WCBA showed a consistent increase from 1990 to 2021. Notably, we observed an inflection point in the ASMR and DALYs for metabolic disorders after 2019. The trend shifted from an upward trend to a decline, possibly influenced by the global COVID-19 pandemic. With the update to include COVID-19 and other pandemic-related mortality, the data from GBD 2021 are more reflective of the current real-world situation.

It was previously believed that estrogen in WCBA provided metabolic protection [17, 18]. However, it is important to note that our study found that metabolic disorders in WCBA have shown more sensitive annual changes compared to overall women. This indicates that estrogen protection may be insufficient to cover the increasing impact of other factors arising from social development and lifestyle changes. Therefore, evaluating the disease

burden and adverse effects of metabolic disorders in WCBA is more significant than previously believed [19].

We conducted a subgroup analysis by age. Our findings indicated that the burden of metabolic disorders in WCBA increases with age. Moreover, it is important to note that our focus was primarily on the changes in metabolic disorders across different age groups of WCBA over time, as these may have more direct implications for public health. From 1990 to 2021, the disease burden of T2DM and obesity increased across all age groups. However, we found WCBA aged 20–34 exhibited a faster rate of increase. The burden of NAFLD in older WCBA (ages 40–49) decreased over time, whereas it continued to rise in younger groups, particularly in those aged 25–34. Additionally, although the burden of HTN decreased across all age groups in WCBA, the decline was slower in the 15–24 age group. For HLD, after excluding the 15–24 age group for its insufficiency of data for a thorough evaluation, other age groups showed similar annual average trends. Younger WCBA assume greater responsibilities from society and family and are more susceptible to psychological stress. Thus, the negative impact of metabolic disorders on younger WCBA should be concerned particularly.

We also conducted a subgroup analysis by nation, region, and SDI. We found that the burden of metabolic disorders is more severe in underdeveloped regions, particularly regarding T2DM, HTN, and HLD. In contrast, obesity and NAFLD exhibit a higher burden in developed regions. Regarding the temporal trends in the burden of metabolic disorders across different countries, although the burden of obesity is more severe in high-SDI countries, low-middle and middle SDI countries show a faster rate of increase. Additionally, the burden of T2DM and NAFLD has grown more significantly in high-middle SDI countries. Therefore, in order to implement effective interventions, we believe that underdeveloped and developing regions should strengthen basic healthcare resources such as establishing a comprehensive healthcare system and enhancing the early detection of underlying diseases. Moreover, developed regions are expected to focus on lifestyle interventions to control specific metabolic disorders, particularly obesity [20]. For instance, as a high-middle SDI country, Mexico levied a special consumption tax on sugary drinks in 2014, aiming to reduce the consumption of easily accessible, high-calorie drinks in areas with limited resources and help prevent obesity and related metabolic disorders [21].

Metabolic disorders are often influenced by common genetic and environmental risk factors [22–25]. Similarly, related pathophysiological pathways may collectively contribute to the development and interaction of metabolic disorders [26]. Therefore, evaluating metabolic disorders as a whole can help develop preventive and therapeutic strategies to improve the overall metabolic environment of individuals. A limitation of the study design is that we did not provide aggregated estimates for metabolic disorders due to the potential overlap within individuals in GBD 2021 data. Therefore, it may diminish the reference value of our findings when discussing the synergistic or cumulative effect of metabolic multimorbidity [7].

The reliability of the estimations and conclusions about metabolic disorders burden in this study is contingent upon the quality of data sources utilized from the 2021 GBD study. To be specific, in some underdeveloped countries, lower healthcare standards can lead to misdiagnosis and missed diagnoses, which could underestimate the disease burden. Furthermore, some countries may lack rich raw data. As a result, GBD can only rely on statistical modeling methods to minimize bias [11]. Meanwhile, as a cross-century and worldwide study, it is difficult to ensure the comparability of data sources temporally and spatially, nor can researchers verify the influence of these discrepancies on the results. Therefore, the evaluation of metabolic disorders burden in WCBA still needs to be updated termly.

Conclusions

Metabolic disorders in WCBA represent a significant global public health challenge. From 1990 to 2021, the burden of metabolic disorders in WCBA consistently increased worldwide. The annual changes in WCBA exhibited similar trends to those in overall women, but were more pronounced. The overall burden increased with age, with the most significant changes observed in younger WCBA. The burden grew more rapidly in less-developed regions. This study emphasizes the need for greater attention to metabolic disorders in the WCBA population. We also highlight the importance of public health education for women at a younger age. Early health management should be prioritized to improve the prevention of metabolic disorders among WCBA. Furthermore, we suggest that different regions require targeted interventions for the metabolic health of WCBA. Underdeveloped and developing regions should strengthen basic healthcare resources, while developed regions should focus on lifestyle interventions.

Abbreviations

ASDR	Age-standardized DALYs rate
ASMR	Age-standardized mortality rate
ASPR	Age-standardized prevalence rate
ASR	Age-standardized rate
CI	Confidence interval
DALY	Disability-adjusted life year
EAPC	Estimated annual percentage change
GBD	Global burden of disease
HLD	Hyperlipidemia
HTN	Hypertension
ICD-10	International Classification of Diseases-10

NAFLD	Non-alcoholic fatty liver disease
SDI	Socio-demographic index
T2DM	Type 2 diabetes mellitus
WCBA	Women of child-bearing age

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12905-025-03749-5.

Supplementary Material 1

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Author contributions
J.C. and D.F. designed the study. J.C. analyzed and visualized the data. J.C. and D.F. prepared the first draft. All authors reviewed and revised the manuscript. All authors approved the final version for submission and agreed to be responsible for all aspects of the work ensuring integrity and accuracy.

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Data availability
This is an observational study based on the GBD database, using data from the GBD database for secondary analysis. The datasets analyzed are available in an online, open access repository, encompassing the global burden of 369 diseases and injuries and 87 risk factors, across 21 regions and 204 countries and territories from 1990 to 2021. The data underlying this article are downloaded from the Global Health Data Exchange (GHDx) query tool (https://vizhub.healthdata.org/gbd-results/). The GHDx is a data catalog created and supported by IHME which is an independent global health research center at the University of Washington. Junyu Chen, one of the scholars, is authorized to use the database. The database is publicly available with a waiver for ethical approval statements and informed consent.

Declarations

Ethics approval and consent to participate
This study is an observational population-based study utilizing the data from the GBD 2021 study, which did not require ethical approval.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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