

PERSPECTIVE PAPER

Trends in diabetes prevalence in relation to socioeconomic proxies in African regions from 2011 to 2021

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ABSTRACT

Diabetes mellitus affects more than 500 million adults globally, representing a growing public health burden. This study analyzed and interpreted trends in diabetes prevalence from 2011 to 2021 in relation to key socioeconomic indicators across eight Western–Central and Eastern–Southern African countries, aiming to provide actionable insights using World Bank data. Five socioeconomic proxy indicators were examined: education attainment and internet use (2021); labor force participation, urban population growth, and current health expenditure (CHE, % of GDP) from 2011 to 2021. Descriptive analysis and exploratory Pearson correlation analysis were performed on the cleaned datasets using SPSS version 27. Data analysis revealed varied regional and country-level trends in diabetes prevalence. Botswana exhibited high educational attainment, the highest decrease in diabetes prevalence, and improvements in other indicators. In contrast, Ethiopia and Rwanda showed increases in diabetes prevalence, low educational attainment, and reduction in CHE. Internet use varied across study countries, with Botswana showing the highest rate. Nigeria, Kenya, Ghana, Benin, and Burkina Faso exhibited differing trends in the reduction of diabetes prevalence and the five socioeconomic proxy indicators, with Burkina Faso showing the major increase in CHE. These descriptive analyses indicated that socioeconomic indicators act collectively on diabetes prevalence. Additionally, exploratory Pearson correlations linked urban population growth to higher diabetes prevalence and internet use to lower prevalence. Overall, the study illustrates the dual influence of socioeconomic factors on trends in diabetes prevalence in Africa, emphasizing the importance of balanced, context-specific approaches to address diabetes amid evolving socioeconomic conditions.

KEYWORDS:

African countries, Current health expenditure, Diabetes prevalence, Education attainment, Internet use, Labor force participation, Socioeconomic proxy indicators, Urban population growth

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INTRODUCTION

Diabetes mellitus is a growing global health challenge, affecting over 500 million adults and placing increasing pressure on health systems, particularly in low- and middle-income countries.¹ Understanding how socioeconomic factors influence disease patterns is essential for developing effective, context-specific public health responses. This study examined changes in diabetes prevalence between 2011 and 2021, the only two available data points, across eight African countries selected based on the availability of education data and their representation of diverse geographic and socioeconomic contexts. By focusing on five key socioeconomic indicators, education attainment, labor force participation, urban population growth, current health expenditure, and internet use, the study adopts a descriptive perspective to explore how broader structural conditions may shape diabetes prevalence and inform equitable health planning.

According to the World Health Organization (WHO), global diabetes prevalence nearly doubled from 1980 to 2014, reaching an estimated 422 million adults.² The steepest increases have occurred in low- and middle-income countries, where limited access to medical care contributes to rising prevalence.³ By 2022, more than half of all diabetes cases were concentrated in India, China, the United States, and Pakistan, reflecting widening global health disparities.³ In sub-Saharan Africa (SSA), over 24 million individuals were living with diabetes in 2021, highlighting the region's growing burden.⁴ SSA faces a dual challenge of communicable and non-communicable diseases, straining already resource-limited health care systems.⁴ Urbanization has driven significant lifestyle changes, with shifts toward high-calorie diets and reduced physical activity contributing to rising diabetes rates.⁵⁻⁷ According to the International Diabetes Federation (IDF), 14.2 million people in SSA were living with diabetes in 2015.⁸ Limited access to quality health care further compounds the problem.^{9,10}

At the country level, South Africa exemplifies this trend, with diabetes prevalence increasing from 3.4% in 2003 to 5.4% in 2017, disproportionately affecting urban residents, women, and older adults.¹¹ Notably, among men, higher educational attainment was linked to increased diabetes prevalence, suggesting complex socioeconomic dynamics.¹¹ A 2024 study conducted across six African countries, including Ghana and South Africa, found that individuals in the highest wealth quintiles were significantly more likely to develop diabetes, by factors of 2.26 and 4.57, respectively, highlighting the interplay between affluence and health risks in emerging economies.¹² These patterns highlight the need to examine the broader socioeconomic factors that contribute to diabetes prevalence.

Higher education levels are positively associated with better diabetes management due to increased health awareness, improved access to health care, and enhanced prevention efforts.¹³ Additionally, advancing World Bank Income Groups (WBIG) correlates with higher diabetes prevalence, reflecting the impact of socioeconomic and demographic transitions, which exacerbate the disease burden.¹³

Labor force participation, particularly among adults of working age, provides insight into the broader economic implications of the disease. Diabetes, especially type 1 and type 2, imposes a substantial economic burden when diagnosed during working age, as chronic complications can lead to workforce exits, reduced quality of life, and productivity losses, collectively termed "productivity costs".^{14,15} These challenges underscore the societal impact of diabetes, concurrent with research highlighting a strong correlation between diabetes-related complications and premature workforce withdrawal.¹⁶

Urbanization and lifestyle transitions are also key considerations, as they influence agriculture, food supply chains, and market dynamics, affecting food access and pricing.¹⁷ While urban areas provide diverse food environments and broader access to various foods, they also promote the consumption of processed and convenience items.^{18,19} These dietary shifts and sedentary urban lifestyles contribute to nutritional transitions and rising noncommunicable diseases like diabetes.

Health care access and expenditure significantly influence diabetes prevalence and outcomes in Africa. Improved systems in Ghana and Nigeria aid diagnosis and management, increasing reported prevalence, while limited infrastructure elsewhere exacerbates complications.⁶ Higher health care expenditure, as in South Africa and Tunisia, enhances access to diagnostics and education, improving control. Conversely, lower expenditure in Chad and the Democratic Republic of Congo leads to undiagnosed cases and complications.^{20,21}

Technological advancements and increased internet use have reshaped daily routines, contributing to sedentary lifestyles and rising obesity rates in both children and adults.^{22,23} This trend is particularly pronounced in low socioeconomic groups, where social inequities exacerbate health risks.^{24,25}

Global diabetes prevalence has risen sharply in recent decades, with substantial variation across countries and regions, as shown by the NCD Risk Factor Collaboration's pooled analysis.²⁶ In Africa, while some countries have stabilized diabetes rates through public awareness and robust policies, others are experiencing sharp increases driven by rapid urbanization and limited access to health care. Despite this variation, few studies have examined how structural and behavioral socioeconomic factors collectively shape these trends across different settings. This perspective addresses that gap through two main objectives:

1. To analyze and interpret trends in diabetes prevalence from 2011 to 2021 in relation to socioeconomic proxy indicators [lower secondary education attainment, labor force participation, urban population growth, current health expenditure (% of GDP), and individuals using the internet (% of population)] in selected African countries.
2. To identify strategies for targeted public health interventions addressing disparities in diabetes prevalence, considering socioeconomic factors and regional barriers.

METHODS

This cross-regional descriptive study examined the relationship between differences in diabetes prevalence and selected socioeconomic proxy indicators across eight African countries, using secondary data from the World Bank and United Nations repositories. In 2021, the age-adjusted prevalence of diabetes mellitus in Africa was 5.3% among individuals aged 20–79 years.²⁷ African Western-Central (AWC) and African Eastern-Southern (AES) countries were the target study settings. Diabetes prevalence nearly doubled in 26 AES countries (4.6% to 7.4%) and declined slightly in 22 AWC countries (4.4% to 3.4%) from 2011 to 2021, based on World Bank and IDF data.²⁸ No data were available for intervening years.

The benchmark for selection of the African countries in this study was the availability of a nearly complete data on lower secondary education attainment from 2019 to 2021.²⁹ Based on this, eight countries were purposively selected: Nigeria, Ghana, Benin, and Burkina Faso from AWC countries; Botswana, Kenya, Ethiopia, and Rwanda from AES countries.²⁹ The socioeconomic proxy indicators, represented as percentages, included: education attainment,²⁹ labor force participation rate (ages 15–64),³⁰ urban population growth,³¹ spending on health, assessed using current health expenditure (% of GDP),³² and internet use as a proxy for sedentary lifestyle.³³ Education attainment and internet use data were

obtained for 2021 only, whereas labor force participation, urban population growth, and current health expenditure data were obtained for both 2011 and 2021.

Percentage data on diabetes prevalence and the five socioeconomic proxy indicators for 2011 and 2021 were downloaded from the World Bank website and extracted into Excel sheets. Only complete, cleaned percentage datasets were included in the analysis. Descriptive analysis was first performed to summarize the data in Table 1, Table 2, and Figure 1. For indicators with two time points, differences were calculated as the 2021 value minus the 2011 value for each country, while for indicators available for 2021 only, differences represent variation across the eight countries. Summary data were then entered into SPSS version 27, and exploratory Pearson correlation analysis was conducted to examine the relationships between differences in diabetes prevalence (dependent variable) and differences in each of the five socioeconomic indicators (independent

variables) across the eight countries (Supplementary Table). A p-value < 0.05 was considered statistically significant. These correlations were performed as exploratory analyses to identify potential patterns, rather than to infer causal relationships, given the small sample size (N = 8 countries) and the limited number of time points.

RESULTS

Descriptive analysis

Trends in diabetes prevalence in AWC and AES countries

From 2011 to 2021, varied reductions in diabetes prevalence rates were observed in Nigeria, Ghana, Benin, and Burkina Faso from AWC countries; Botswana and Kenya from AES countries, with the most prominent decrease in Botswana (10.8% to 5.2%), followed by Ghana (5.0% to 2.6%) (Table 1). Conversely, diabetes prevalence increased in Ethiopia (3.4% to 5.0%) and Rwanda (3.1% to 6.5%) from AES countries (Table 1).

Table 1. Diabetes prevalence in 2011 and 2021, and educational attainment in 2021 in selected AWC and AES countries

AWC Countries	Diabetes prevalence in 2011	Diabetes prevalence in 2021	Education attainment in 2021	AES Countries	Diabetes prevalence in 2011	Diabetes prevalence in 2021	Educational attainment in 2021
Ghana	5.0%	2.6%	54.2%	Botswana	10.8%	5.2%	71.2%
Burkina Faso	3.0%	2.1%	11.5%	Kenya	5.1%	4.0%	72.8%
Benin	2.0%	1.1%	13.4%	Ethiopia	3.4%	5.0%	17.8%
Nigeria	4.8%	3.6%	49.8%	Rwanda	3.1%	6.5%	23.2%

Source: World Bank (<https://data.worldbank.org/>)

Diabetes prevalence trends in relation to socioeconomic indicators

Diabetes prevalence trends in relation to educational attainment

The reductions in diabetes prevalence in Kenya, Botswana, Ghana, and Nigeria were observed alongside high educational attainment in 2021 (72.8%, 71.2%, 54.2%, and 49.8%, respectively), while the minimal reductions in Burkina Faso and Benin, and the increases in Ethiopia and Rwanda,

coincided with the lowest educational attainment (11.5%, 13.4%, 17.8%, and 23.2%, respectively) (Table 1).

Diabetes prevalence trends in relation to internet use and labor force participation

In 2021, the greatest rate of internet use was observed in Botswana (75.2%), followed by Ghana (68.6%), both of which had the highest reductions in diabetes prevalence, with Botswana showing

the greatest reduction, followed by Ghana (Table 2). In contrast, Ethiopia, Burkina Faso, and Rwanda had the lowest rates of internet use (16.7%, 18.1%, and 29.4%, respectively), which occurred alongside the previously mentioned increases in diabetes prevalence in Ethiopia and Rwanda, and

the minimal reduction in Burkina Faso (Table 2). Botswana was the only country to show a positive difference in labor force participation from 2011 to 2021 (5.6%), while Benin experienced a substantial negative difference (-9.6%) (Table 2).

Table 2. Differences in diabetes prevalence and labor force participation from 2011 to 2021, and internet use in 2021 in selected AWC and AES countries

AWC Countries	Difference in diabetes prevalence from 2011 to 2021	Difference in labor force participation from 2011 to 2021	Internet use in 2021	AES Countries	Difference in diabetes prevalence from 2011 to 2021	Difference in labor force participation from 2011 to 2021	Internet use in 2021
Ghana	-2.4%	-1.4%	68.6%	Botswana	-5.6%	5.6%	75.2%
Burkina Faso	-0.9%	-3.1%	18.1%	Kenya	-1.1%	-0.1%	38.2%
Benin	-0.9%	-9.6%	30.7%	Ethiopia	1.6%	-0.8%	16.7%
Nigeria	-1.2%	-1.3%	32.3%	Rwanda	3.4%	-2.7%	29.4%

Source: World Bank (<https://data.worldbank.org/>)

Diabetes prevalence trends in relation to urban population growth and current health expenditure

The decreases in diabetes prevalence in Botswana and Ghana (-5.6% and -2.4%, respectively) occurred concurrently with reductions in urban population growth from 2011 to 2021 (-1.7% and -0.7%, respectively) (Figure 1). Rwanda, however, showed increases in both diabetes prevalence (3.4%) and urban population growth (0.6%) (Figure 1). Nigeria and Botswana exhibited positive differences in current health expenditure (0.8% and 0.4%, respectively), while Burkina Faso had the highest increase (1.7%) (Figure 1).

Exploratory Pearson correlation analysis between differences in diabetes prevalence and socioeconomic indicators

Exploratory Pearson correlation analysis of the differences in diabetes prevalence and the values of the five socioeconomic proxy indicators between 2011 and 2021 showed negative correlations with education attainment, labor force participation, current health expenditure, and internet use, and a positive correlation with urban population growth. Correlations for urban population growth and internet use were statistically significant ($p = 0.001$). Full correlation coefficients are presented in the Supplementary Table.

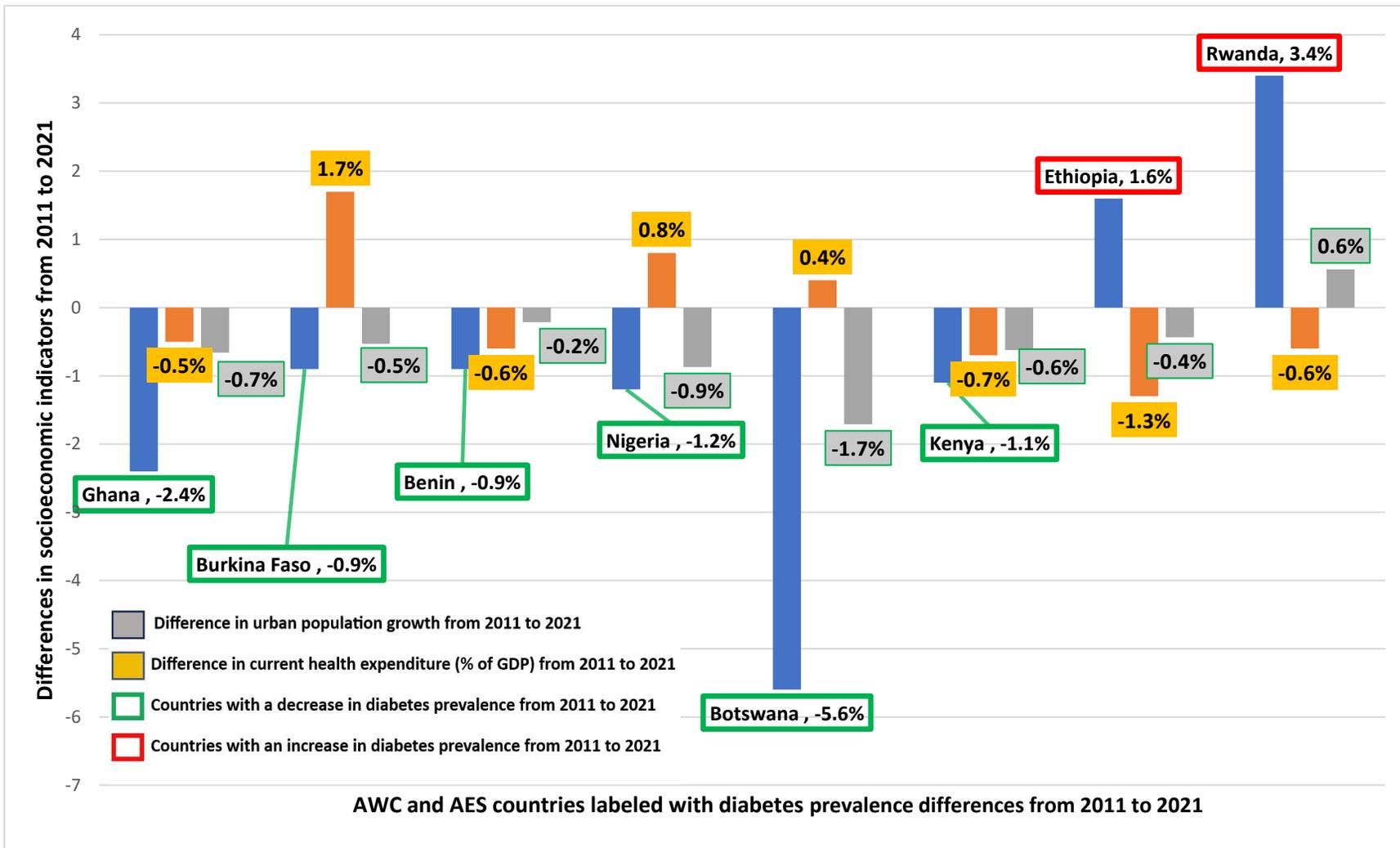


Figure 1. Differences in diabetes prevalence, current health expenditure (% of GDP), and urban population growth in selected AWC and AES countries from 2011 to 2021. Source: World Bank (<https://data.worldbank.org/>)

DISCUSSION

The trends in diabetes prevalence observed across AWC and AES countries from 2011 to 2021 reflect the context-specific effects of multiple socioeconomic factors acting in combination. The study indicators, education attainment, labor force participation, urban population growth, current health expenditure, and internet use, demonstrated varied relationships with diabetes prevalence depending on regional and country-level contexts. In AES countries, contrasting trends between advantaged and disadvantaged settings highlight the influence of structural conditions on health outcomes. Conversely, in AWC countries, reductions in diabetes prevalence coincided with declines in urban population growth and labor force participation, suggesting underlying demographic or systemic shifts that warrant further investigation. Exploratory Pearson correlations revealed patterns between differences in diabetes prevalence and the study indicators. Differences in urban population growth and internet use were statistically significant, highlighting their strongest relationships with diabetes prevalence across the study countries. Collectively, the descriptive and analytical findings highlight the need for context-sensitive public health strategies, consistent with global evidence on the relationship between socioeconomic disparities and diabetes prevalence.^{10,25,26}

This study has several limitations that should be considered when interpreting the findings. First, the small number of countries (N = 8) and the use of only two time points a decade apart limit statistical power and preclude causal inference. The Pearson correlations were conducted as exploratory analyses to provide a preliminary view of potential associations and should therefore be interpreted cautiously. Second, the descriptive, cross-regional nature of the analysis, along with reliance on secondary data sources and proxy indicators, may reduce the precision and completeness of some measures, particularly those reflecting socioeconomic and health system factors. Despite these limitations, the study provides valuable insights into patterns of diabetes

prevalence and its potential links to socioeconomic conditions across the region, highlighting the need for further research using larger datasets and more robust study designs.

The relationship between education and diabetes prevalence highlights the significant role of education in shaping health outcomes. Higher diabetes prevalence was observed in Ethiopia and Rwanda, where low educational attainment was prevalent, consistent with research linking lower education to increased diabetes risk.^{22,25} Conversely, the lower prevalence in Nigeria, Ghana, Botswana, and Kenya, with higher educational attainment, supports findings that education fosters healthier lifestyles²⁵ and improves health outcomes.^{16, 25} These results emphasize the need for educational equity in strategies to reduce diabetes prevalence. For AES countries, sustaining progress requires targeted policies to reduce inequalities, while AWC countries would benefit from greater investment in education, health care access, and health promotion programs. This approach mirrors findings that identify education as a key determinant in shaping health outcomes.²⁶

In Benin, the largest decline in labor force participation (-9.6%) did not yield a proportional diabetes prevalence decrease, suggesting other factors like health care and education are critical. Botswana, however, showed the greatest reduction in diabetes prevalence (-5.6%) alongside increased labor force participation, indicating the potential benefits of economic growth and improved working conditions. In contrast, the minor reduction in diabetes prevalence in Kenya and the increases in Ethiopia and Rwanda, despite declines in labor force participation point to the influence of additional socioeconomic and lifestyle factors. Consistent with Pedron et al.,³⁴ robust prevention strategies remain essential. This study highlights labor force participation and other socioeconomic indicators as key to understanding diabetes prevalence variations across AES and AWC countries.

The relationship between urban population growth and diabetes prevalence varied regionally. In AWC countries, modest declines, especially in Nigeria and Ghana, aligned with reduced diabetes prevalence, suggesting slower urbanization may reduce risks like inactivity and dietary changes. In contrast, smaller declines in Benin and Burkina Faso, with limited diabetes prevalence reduction, indicate that health care systems and population behaviors may be more influential. Among AES countries, the sharpest decline in Botswana (-1.7%) coincided with the notable decline in diabetes prevalence, highlighting a potential link between controlled urbanization and improved health outcomes. However, Kenya's slight decline and Ethiopia's rising diabetes prevalence rates indicate limiting urbanization alone is insufficient without additional public health measures. The concurrent rise in urban population growth and diabetes prevalence in Rwanda further highlights the need for urban planning that prioritizes health care and prevention. This aligns with Bricas et al.,¹⁷ who emphasize urbanization's challenge to food system sustainability and the need for integrated strategies to address diabetes prevalence.

Countries with higher health expenditures (Burkina Faso, Nigeria, and Botswana) exhibited a reduced diabetes prevalence, highlighting the differing patterns of health investment across regions and the critical role of robust health systems and strategic resource allocation in improving diabetes outcomes through enhanced care and prevention strategies.²¹ Overall, regional disparities in health expenditure, efficiency, and infrastructure appear to influence trends in diabetes prevalence, emphasizing the role of resource allocation in shaping health outcomes. Whiting et al.¹⁰ highlight the importance of health care access in these regions, consistent with our finding that health expenditure plays a role in diabetes prevalence trends.

The variation in internet use across the study countries highlights its paradoxical role in diabetes management. For example, Botswana, with the highest internet use (75.2%), showed the greatest decrease in diabetes prevalence, suggesting that

effective digital access can support diabetes care through tools and remote support. Conversely, internet use is also linked to sedentary behaviors that increase diabetes risk, underscoring the importance of context, such as health care infrastructure and patient engagement, in shaping outcomes. Countries with lower internet access and rising diabetes prevalence may lack these enabling conditions. As emphasized by Dhediya et al.³⁵ and Lee et al.³⁶, tailored, context-sensitive digital health strategies are essential to improve chronic disease outcomes.

Initiatives like the Africa CDC's HealthTech Marketplace³⁷ exemplify efforts to expand digital tools in the region. However, systemic inequities and local barriers continue to limit equitable health benefits, indicating that digital innovations and infrastructure investments must be integrated with broader socioeconomic and health system strengthening to effectively reduce diabetes burden across diverse settings.

These findings underscore the complex relationship between socioeconomic factors and diabetes prevalence, highlighting the value of comparing prevalence patterns across multiple countries using standardized, publicly available data. A key strength of this study is its multidimensional perspective, which captures regional variation and aligns with the Sustainable Development Goals (SDGs). By including countries from diverse socioeconomic and geographic contexts, the study offers a regional overview that supports more targeted, evidence-based public health planning. The emphasis on digital health and structural determinants provides a relevant foundation for future policy development. While descriptive in nature, the consistent use of indicators over time contributes to a broad understanding of evolving patterns in diabetes prevalence.

The contrasting effects of urban population growth and internet use highlight the need for balanced development strategies that strengthen public health infrastructure and support context-specific interventions. This is especially important given the

varied socioeconomic trends across AES and AWC countries. To address the rising diabetes burden in these dynamic settings, policymakers should prioritize reducing disparities and expanding access to care through inclusive digital innovations and targeted prevention programs. Enhancing health literacy and education is vital to sustainable behavioral change. Concurrently, health-conscious urban planning and culturally grounded approaches can foster healthier lifestyles, particularly in rapidly urbanizing areas. Continued investment in longitudinal research is essential to validate these findings and guide tailored, evidence-based strategies for equitable health outcomes across diverse populations.

CONCLUSION

This regional and country-level analysis across AES and AWC countries reinforces the connection between diabetes prevalence and multiple socioeconomic factors, highlighting the need for tailored, context-specific public health strategies. Countries demonstrating reductions in diabetes prevalence typically featured higher educational attainment, slower urban population growth, increased health expenditure, and expanded internet use, as illustrated by Botswana's integrated approach. In contrast, rising prevalence rates were observed in countries with declining labor force participation and reduced health expenditure. Among the five socioeconomic indicators examined, differences in urban population growth and internet use showed significant correlations with differences in diabetes prevalence. These results identify urban population growth and internet use as the indicators most strongly related to diabetes prevalence in the study countries. Addressing diabetes prevalence effectively requires multifaceted, context-sensitive approaches that reflect the complex socioeconomic landscape shaping health trends.

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CONFLICT OF INTEREST

The authors declare that there are no competing interests related to this work.

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AUTHORS' CONTRIBUTIONS

All authors contributed to the conceptualization of the study, manuscript writing, and the review and revision of the final manuscript.

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Supplementary Table: Exploratory Pearson correlations between differences in diabetes prevalence and differences in socioeconomic indicators (illustrative only, small sample size)

Socioeconomic Indicator	r (correlation with differences in diabetes prevalence)	p-value
Education attainment	- 0.045	0.916
Labor force participation	- 0.411	0.312
Urban population growth	0.920	0.001
Current health expenditure (% of GDP)	- 0.381	0.351
Internet use	- 0.925	0.001

N = 8 countries; r = Pearson correlation coefficient; p-values indicate statistical significance. The indicators presented in this table correspond to diabetes prevalence and the five socioeconomic indicators described in the Methods section, where differences are defined either as change from 2011 to 2021 (for indicators with two time points) or as cross-country variation in 2021 (for indicators with one time point).