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Socioeconomic and demographic disparities in the impact of digestive diseases in the middle East and North Africa (MENA) region

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Abstract

Introduction Digestive diseases (DD) pose a significant global health burden, with the Middle East and North Africa (MENA) region providing a unique landscape to study the impact of socioeconomic disparities on DD incidence and outcomes. This study examines the burden of DD in the MENA region, focusing on socioeconomic influences.

Methods We utilized data from the Global Burden of Disease (GBD) dataset from 1990 to 2021, analyzing trends in incidence, mortality, and disability-adjusted life years (DALYs) for DD. Percentage changes and estimated annual percentage changes (EAPCs) were calculated for age-standardized rates, and correlations were assessed between disease metrics and socio-demographic indices, including the Socio-demographic Index (SDI), Human Development Index (HDI), and Gender Inequality Index (GII).

Results Between 1990 and 2021, the total incidence of DD rose by 129.8%, from 19.7 million to 45.4 million cases. Age-standardized mortality and DALY rates decreased by 48.3% and 44.7%, respectively. Strong correlations were observed between age-standardized incidence rates (ASIR) and SDI ($r=0.90$), HDI ($r=0.88$), and GII ($r=-0.86$). EAPCs for incidence, deaths, and DALYs were 0.79, -2.29, and −1.88, respectively.

Conclusion Despite a reduction in mortality and DALY rates, the persistently high incidence rates of DD in the MENA region underscores ongoing public health challenges. Socioeconomic factors strongly influence disease burden, highlighting the need for targeted interventions to address disparities and improve digestive disease outcomes across the region.

Keywords Digestive diseases, MENA region, Socioeconomic disparities, Incidence trends, Public health

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Introduction

Digestive diseases (DD) present a significant global health concern, contributing to considerable morbidity, mortality, and economic burden. These diseases encompass a wide range of conditions affecting the gastrointestinal (GI) tract, liver, pancreas, and gallbladder, significantly impact individuals' quality of life and place a heavy burden on healthcare systems [1, 2]. According to the global burden of disease (GBD) 2020 report, digestive diseases rank among the top causes of disability-adjusted life years (DALYs) globally, highlighting the urgent need to address these conditions [3, 4]. Additionally, the Pan American Health Organization (PAHO) reports that digestive diseases, including conditions like peptic ulcers, cirrhosis, and inflammatory bowel disease, result in high levels of premature mortality, especially in low- and middle-income countries [5].

Over the past few decades, the Middle East and North Africa (MENA) regions have faced significant healthcare challenges due to political conflicts, social unrest, and economic instability. These issues have strained healthcare systems, making it difficult to collect reliable health data and manage chronic conditions like digestive disease [6–8]. Additionally, deficiencies in health information systems and data management hinder effective public health policymaking, as many MENA countries struggle with limited data availability and accessibility [9–12]. This lack of robust data complicates the response to health crises and the implementation of effective healthcare reforms. Existing literature on digestive diseases in the MENA region is limited, often focusing on other health outcomes or relying on small-scale surveys and patient-based studies [13].

Despite these challenges, some countries in the region, such as Saudi Arabia and the UAE, have made substantial investments in their healthcare systems. Saudi Arabia's Vision 2030 initiative has led to significant advancements in medical technology and hospital expansion, aiming to improve overall healthcare quality [14]. Similarly, the UAE has notable growth in this sector and substantial enhancements in healthcare facilities [15]. These contrasting developments make the MENA region a unique area for studying the impacts of healthcare investments on managing chronic conditions like digestive diseases.

Given these challenges, our study aims to examine the burden of digestive diseases across the MENA region by analyzing long-term trends and their association with socioeconomic factors. By investigating how variations in disease burden relate to broader demographic and economic conditions, we seek to provide insights that can inform targeted public health interventions and policy decisions aimed at reducing health inequities and improving outcomes in the region.

Methods

Data source

This study leverages data from the 2021 Global GBD study, an extensive database maintained by the Institute for Health Metrics and Evaluation (IHME) at the University of Washington, which assesses mortality and disability caused by a range of diseases, injuries, and risk factors worldwide. The GBD study incorporates data from diverse sources such as censuses, household surveys, disease registries, health service data, and vital statistics, providing a comprehensive view of health indicators like deaths, incidence, prevalence, years of life lost (YLLs), years lived with disability (YLDs), and disability-adjusted life years (DALYs) across 371 diseases and 88 risk factors. This dataset spans 204 countries and territories, covering both genders from 1990 to 2021, thus enabling temporal comparisons [16, 17]. In regions where data availability and accessibility can be challenging, the GBD framework addresses these gaps by using advanced statistical modeling techniques, such as Bayesian meta-regression and data synthesis methods, to generate reliable estimates. These methods allow for the integration of multiple data sources while accounting for inconsistencies and missing data [16].

Digestive diseases in this study were classified according to GBD definitions, with specific case definitions aligned with ICD-10 standards, as detailed in Supplement Table 1. The analysis includes cirrhosis and other chronic liver diseases, upper digestive system diseases (peptic ulcer disease, gastritis and duodenitis, gastroesophageal reflux disease), gallbladder and biliary diseases, inguinal, femoral, and abdominal hernias, inflammatory bowel disease, pancreatitis, appendicitis, paralytic ileus and intestinal obstruction, vascular intestinal disorders, and other digestive diseases [18].

Measures

This analysis covers incidence, mortality, and DALY trends for digestive diseases in the MENA region from 1990 to 2021, using the Global Health Data Exchange (GHDx) query tool [18]. Incidence was defined as the number of new cases within a specified period, expressed as raw counts and age-standardized rates per 100,000 individuals. Mortality data, derived from vital records and surveys, are also presented in raw counts and age-standardized rates per 100,000. DALYs, representing the total of YLLs and YLDs, are provided in both raw counts and age-standardized rates per 100,000.

Geographical location

This study covers 21 countries within the MENA region as categorized by the GBD dataset: Afghanistan, Algeria, Bahrain, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestine, Qatar, Saudi Arabia,

Sudan, Syria, Tunisia, Turkey, the United Arab Emirates, and Yemen.

Sociodemographic measures

To account for socioeconomic diversity within the MENA region, we analyzed data across various sociodemographic indices. The Socio-Demographic Index (SDI) combines income, education, and fertility rates to measure development levels [19]. The SDI values used in this study were obtained directly from the GBD dataset, where they are pre-calculated based on standardized methodology developed by IHME [19]. Additionally, the HDI assesses health, education, and living standards [20], while the GII highlights disparities in reproductive health, empowerment, and economic participation, shedding light on gender-related health barriers [20].

Statistical analysis

The GBD study employs advanced methodologies like the Cause of Death Ensemble model (CODEm), spatiotemporal Gaussian process regression (ST-GPR), and DisMod-MR for initial data processing. We accessed this processed data through the GBD website for further analysis.

Our analysis included presenting incident cases, DALYs, deaths, age-standardized incidence rates (ASIR), age-standardized DALYs rate, and age-standardized death rates of each cause, with 95% confidence intervals (CIs). We calculated the annual proportion of incident cases and deaths by etiology, location, and year. The percentage changes in these metrics from 1990 to 2021 were computed for each digestive disease, as detailed in Supplemental Tables 2–4, using the formula:

$$Percent\ change = \frac{measures\ in\ 2021 - measures\ in\ 1990}{measures\ in\ 1990} x\ 100\%$$

Additionally, we determined the Estimated Annual Percentage Changes (EAPCs) in age-standardized rates, including 95% confidence intervals (CIs), using a regression line fitted to the natural logarithm of the rates against calendar years; $y = \alpha + \beta x + \varepsilon$, where $y = \ln(\text{Measure})$, and $x =$ calendar year. The EAPC was calculated as: $100 \times (\exp(\beta) - 1)$. The natural logarithm transformation was applied to stabilize variance and account for exponential trends in disease burden metrics. A log-linear model was selected as it allows for a proportional interpretation of trends over time. Statistical significance was determined using the 95% CI of the EAPC. A trend was classified as significantly increasing or decreasing if the 95% CI did not include zero.

Correlations between age-standardized incidence, age-standardized DALYs, and age-standardized mortality in 2021 with SDI, HDI, and GII were evaluated using Pearson correlation analyses. All analyses as well as graphical illustrations were conducted using R programming version 4.3.3. A *P*-value of < 0.05 was considered statistically significant.

Results

Trends in incidence

From 1990 to 2021, the raw number of incident cases rose from 9,322,555 (9,226,040–9,419,071) to 21,460,265 (21,240,265–21,680,265) for males, showing an increase of 130.2% as shown in Supplement Table 2. The raw incidence rate for females increased from 10,419,425 (10,316,042–10,522,809) to 23,909,617 (23,680,512–24,138,722), showing a 129.5% rise. In addition, the ASIR per 100,000 individuals showed an increase by 23.5%, from 4,928.6 (4,846.63–5,013.26) to 6,088.22 (5,915.55–6,276.92) for males, and females increased by 26.1%, from 5,707.43 (5,610.00–5,807.43) to 7,195.58 (6,987.60–7,421.87) as shown in Fig. 1A.

For cirrhosis and other chronic liver diseases, the ASIR per 100,000 individuals increased by 18.5% for males and by 23.3% for females. Upper digestive system diseases showed a significant increase in raw incidence cases, more than doubling for both genders. The ASIR had a slight increase of 0.2% for males, and of 0.9% for females. Gallbladder and biliary diseases' ASIR decreased by 4.8% for males and 4.0% for females. For pancreatitis, ASIR decreased by 2.9% for males and 2.9% for females. For hernias, the ASIR decreased by 16.1% for males and 7.8% for females.

The incidence rate per 100,000 of specific diseases varied by age group as shown in Fig. 2. The peak incidence rate of cirrhosis and other chronic liver diseases was highest among individuals aged 20–24 years for both males and females. Gastroesophageal reflux disease also peaked in the 70–74 years age group, while inflammatory bowel disease showed its highest incidence in the 55–59 years age group in males and in the 45–49 years age group for females.

Kuwait reported the highest ASIR in 2021 at 8,028.26 (7,147.84–9,160.50) and Afghanistan exhibited the lowest ASIR, with 4,949.94 (3,818.46–7,072.40) per 100,000 individuals. The overall ASIR EAPC for the region stands at 0.79, (CI: 0.74 to 0.84). Among the countries, Iran exhibits the highest increase, with an EAPC of 1.46 (CI: 1.31–1.61) as shown in Fig. 3A. The smallest increase is observed in Sudan with an EAPC of 0.28 (CI: 0.23–0.33). In contrast, Afghanistan shows a slight decrease in incidence rates, with an EAPC of -0.12 (CI: -0.25 to 0.01). The correlation between ASIR, DALYs, deaths with each of the indices (SDI, HDI and GII) in 2021 was examined in Fig. 4. ASIR and SDI had a strong positive correlation with a Pearson's r of 0.90 (p-value < 0.001) (Fig. 4A). ASIR and HDI also demonstrated a strong positive correlation with Pearson's r of 0.86 (p-value < 0.001) (Fig. 4B).

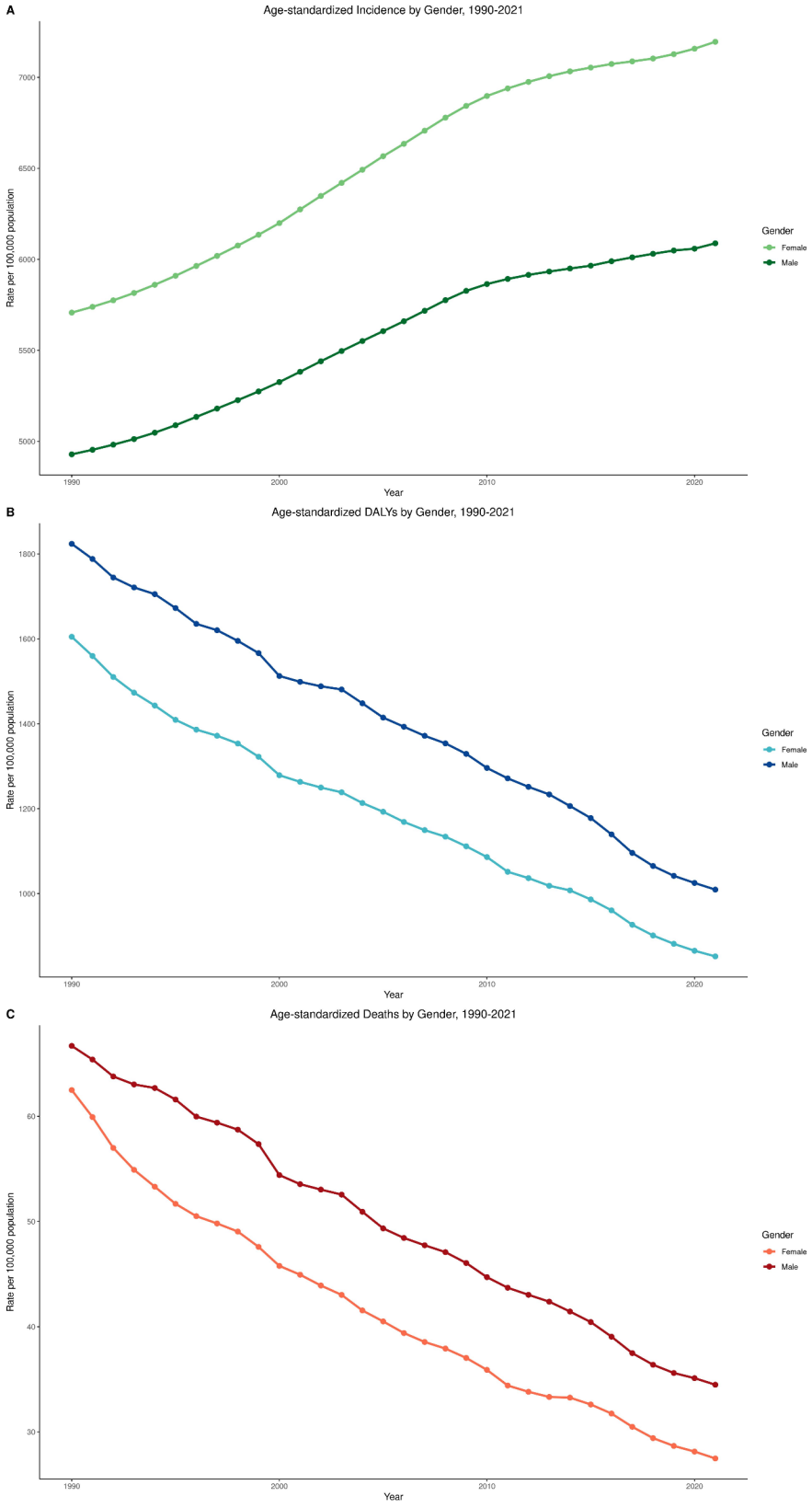

Fig. 1 Trends in age-standardized rates by gender, 1990–2021

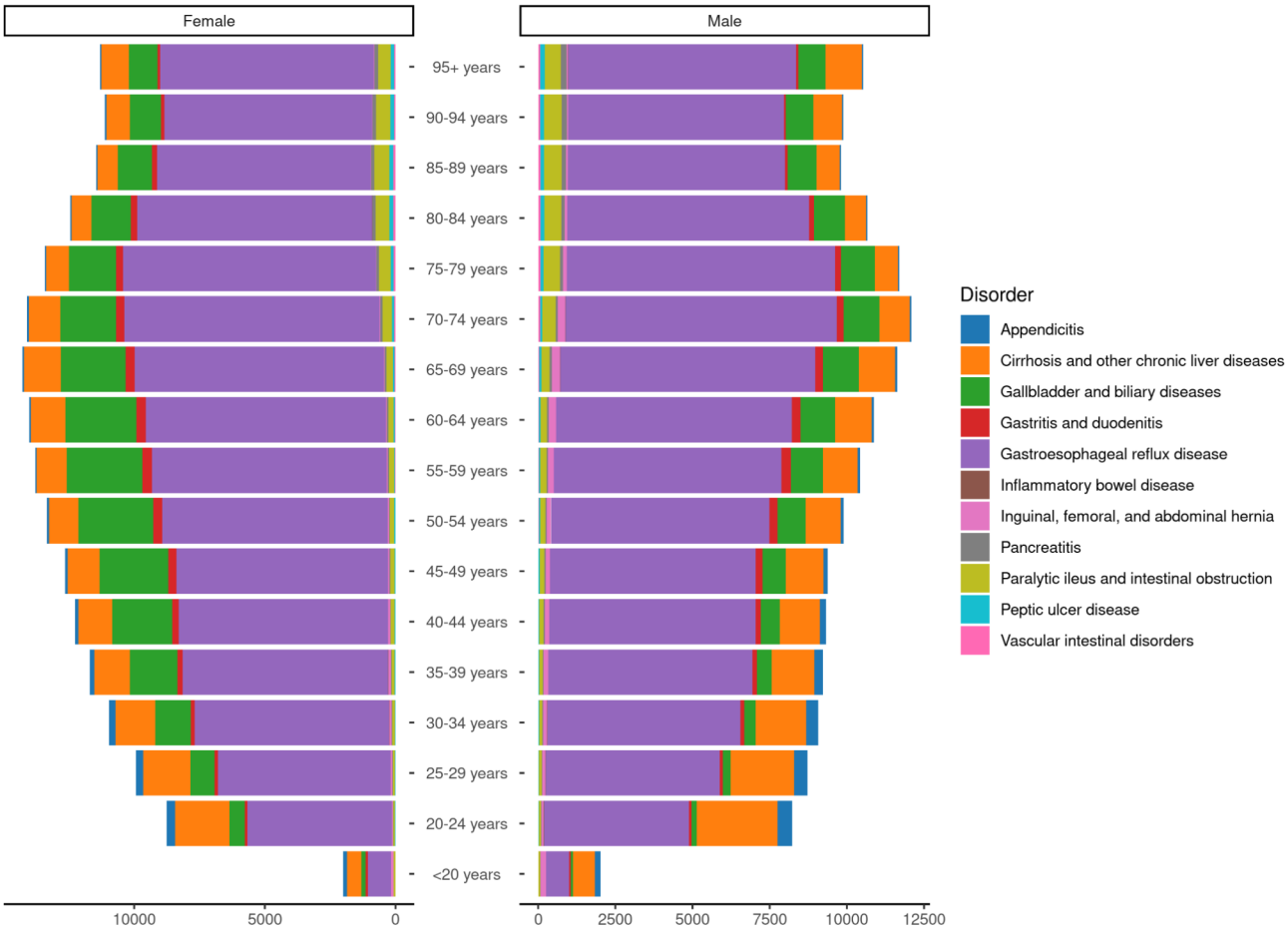

Fig. 2 Incidence rates in 2021 attributable to risk factors across different age groups, males vs. females

Additionally, ASIR and GII showed a strong negative correlation with Pearson's r of -0.86 (p-value < 0.001) (Fig. 4C). Further details on the distribution of digestive diseases by country can be found in Supplementary Fig. 1.

Trends in DALYs

From 1990 to 2021, the total number of DALYs for all digestive diseases increased significantly from 3,641,292 (3,215,442–4,054,462) in 1990 to 4,764,470 (4,113,388–5,568,946) in 2021, showing a 30.8% increase as shown in Supplement Table 3. Despite these increases in raw DALY count, the age-standardized DALY rate per 100,000 individuals for these diseases decreased by 45.7%, from 1,719.63 (1,523.66–1,934.52) to 932.98 (813.63–1,078.52) per 100,000 individuals for both genders as shown in Fig. 1B.

For Cirrhosis and other chronic liver diseases, the age-standardized DALY rate showed a decline for males of 44.7%, and of 46.9% for females. Upper digestive system diseases showed a significant reduction in age-standardized DALY rates; for males, the rate decreased by 47.6%, while for females, the rate dropped by 17.3% decrease. Gallbladder and biliary diseases age-standardized DALYs rate in males decreased by 18.5%, and in females by 15.0%. Pancreatitis also experienced a decrease in males by 8.3%, and in females by 15.0%. Lastly, hernias decreased by 32.7% in males and by 32.9% in females.

In 2021, Egypt reported the highest age-standardized DALY rate in 2021 at 2,400.44 (1,993.79 to 2,857.72). In contrast, Kuwait exhibited the lowest rate, with 441.91 (365.32 to 543.50) per 100,000 individuals. The EAPC in DALY across MENA region reveals a consistent decline across all countries as shown in Fig. 3B. The overall EAPC for the MENA region was −1.88 (CI: -1.93 to -1.82). Among the countries, Bahrain exhibits the most substantial decrease in DALYs, with an EAPC of -2.62 (CI: -2.90 to -2.34). The smallest decrease is observed in United Arab Emirates with an EAPC of -0.37 (CI: -0.74 to -0.01). Age-standardized DALY revealed a negative correlation with SDI in 2021 with Pearson's r of -0.48 (p-value 0.029) (Fig. 4D). In contrast, age-standardized DALYs and both HDI and GII had no significant association with a p-value of 0.178, and 0.346, respectively as shown in Fig. 4E and F. Further details on the distribution of digestive diseases by country can be found in Supplementary Fig. 2.

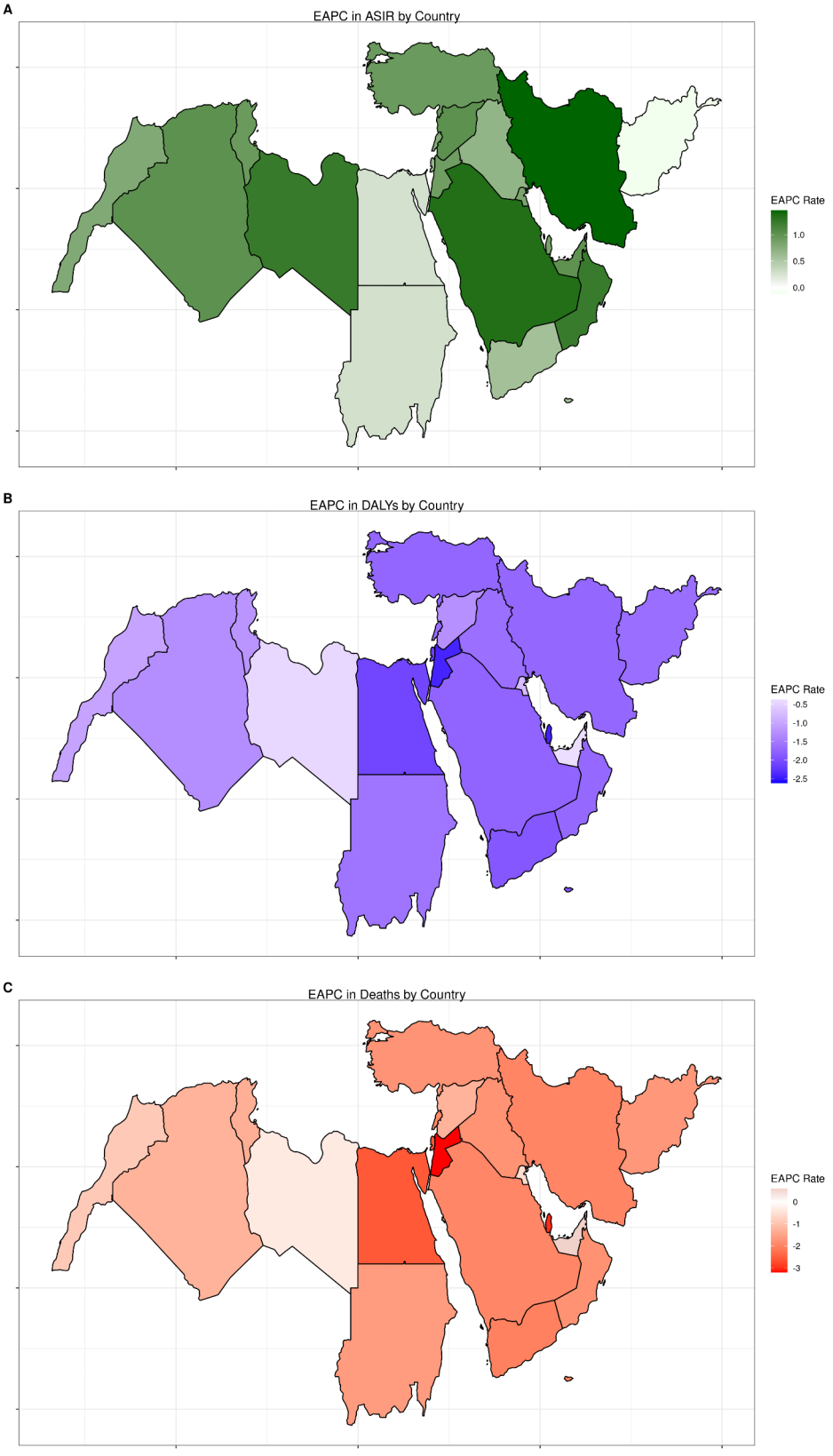

Fig. 3 Estimated annual percentage change in age-standardized incidence, DALY, and death rates by country in the mena region

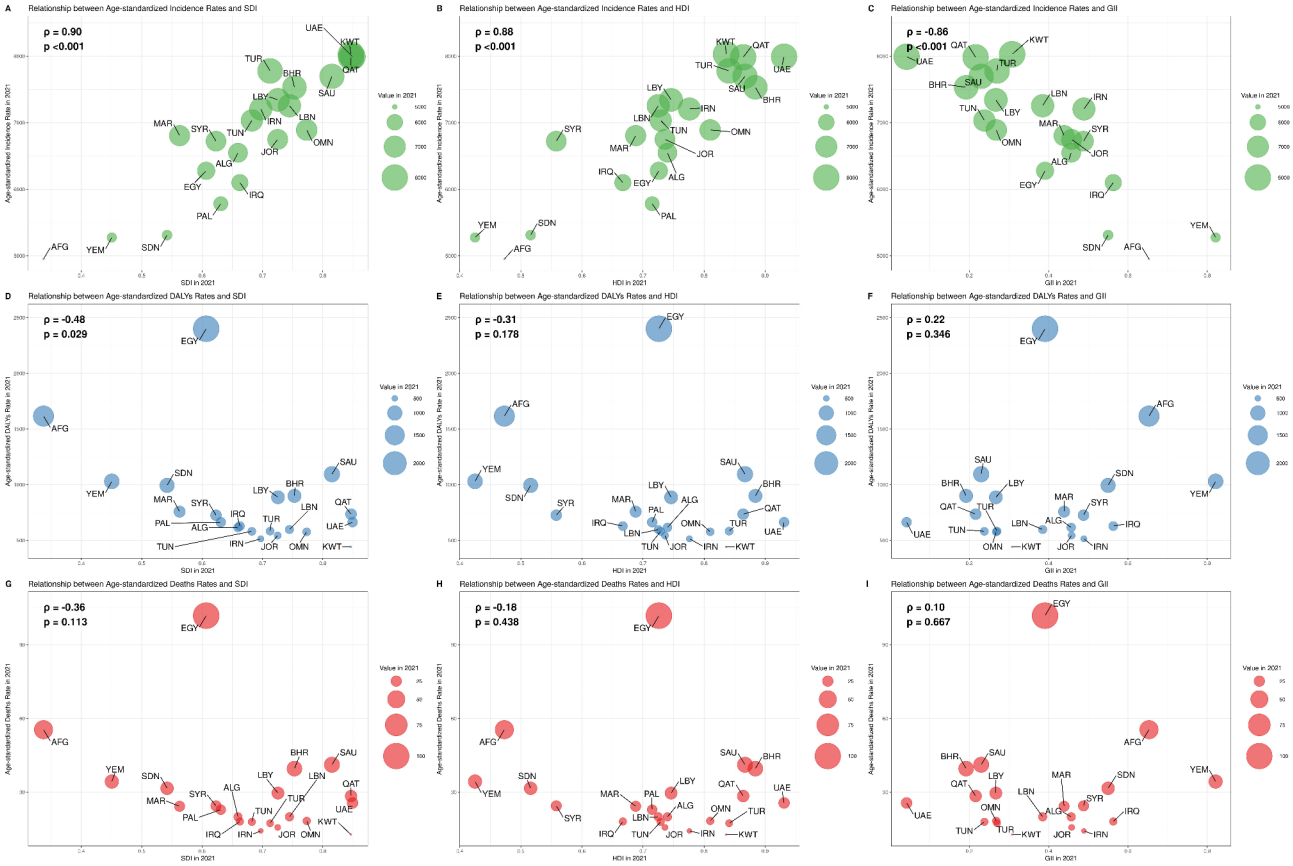

Fig. 4 Relationships between age-standardized incidence, DALY, and death rates with socioeconomic indicators in 2021

Trends in deaths

As shown in in Supplement Table 4, the total number of deaths attributed to all digestive diseases from 1990 to 2021 rose significantly for both genders from 99,738 (88,407 – 113,320) in 1990 to 129,006 (113,108–148,493) in 2021, a 29.3% increase. However, the age-standardized death rate per 100,000 individuals decreased by 52.1%, from 64.84 (56.72–75.51) in 1990 to 31.07 (27.38–35.44) in 2021 as shown in Fig. 1C.

For cirrhosis and other chronic liver diseases, the age-standardized death rate declined for both genders. For males, the rate decreased by 48.1%, while females witness a 60.6% decrease. Upper digestive system diseases showed a decrease of 68.3% for males and 59.2% for females. Gallbladder and biliary disease age-standardized death rates decreased by 23.6% for males and 20.5% for females, pancreatitis by 6.4% for males and 7.1% for females, and hernias by 56.1% for males and for 44.8% females.

In 2021, Egypt reported the highest death rate at 101.84 (84.23 to 121.96), on the other end, Kuwait exhibited the lowest death rate, with 12.74 (10.25 to 15.52). The EAPC in death rates across MENA region reveals a general decline as shown in Fig. 3C. The overall EAPC for the region is -2.29, (CI: -2.32 to -2.25). Among the countries in the region. Jordan exhibits the most substantial decrease in death rates, with an EAPC of -3.20 (CI: -3.53 to -2.86). On the other hand, United Arab Emirates is the only country showing a positive EAPC of 0.60 (CI: 0.02 to 1.19). The correlation analysis for deaths as shown in Fig. 4G and H, and 4I did not show any significant correlation between age-standardized death rates in 2021 and SDI, HDI and GII with a *p*-value of 0.113, 0.438, and 0.667 respectively. Further details on the distribution of digestive diseases by country can be found in Supplementary Fig. 3.

Discussion

Our study aimed to investigate the burden and disparities of GI diseases in the MENA region using the 2021 GBD dataset, representing the first comprehensive epidemiological effort to analyze these disparities using the 2021 data. Our results showed that while the ASIR of GI diseases increased by 24.7% from 1990 to 2021, there has been a notable decline in both age-standardized DALYs and death rates of 45.7% and 52.1%, respectively. The leading cause of incident cases was gastroesophageal reflux disease, while the most common cause of DALYs and deaths was cirrhosis and other chronic liver diseases. The ASIR of DD varied by country and was strongly

correlating with sociodemographic indices including the SDI, HDI, and GII.

Healthcare systems in the MENA region encounter numerous complex challenges, including demographic shifts, budget constraints, and the difficulties of training and recruiting healthcare workers, which have often led to a focus on curative treatment over preventive care [21]. Many countries are faced with limited public funds for healthcare due to economic pressure, which leads to under-funded healthcare facilities, limited access to advanced medical technologies and restrictions on public health initiatives [22]. The structure of healthcare systems across MENA varies widely, ranging from publicly funded universal healthcare models to predominantly private or out-of-pocket payment systems. These differences contribute to disparities in access to timely and quality diagnosis and treatment, with financial constraints, insurance coverage gaps, and limited healthcare infrastructure in certain regions acting as key barriers to equitable care [21]. While many countries continue to grapple with substantial healthcare challenges, including regional conflicts, others, such as Saudi Arabia and the United Arab Emirates, have emerged as leaders in the field. These nations are increasingly investing in clinical trials, research, genomics, and precision medicine, aiming to advance personalized medical care and improve health outcomes [23]. Meanwhile, countries like Iran, Egypt, and Bahrain have made significant strides in health outcomes by efficiently utilizing their resources [21]. Jordan, for example, allocates 9% of its Gross Domestic Product (GDP) to healthcare, enhancing health outcomes and establishing itself as a recognized destination for medical tourism [24, 25]. However, many other countries in the region face significant challenges due to political instability, ongoing conflicts, and economic hardships. These challenges have placed immense pressure on healthcare systems, leading to compromised infrastructure, critical shortages of medical supplies, and a scarcity of trained healthcare professionals. Consequently, the focus in these regions has shifted predominantly to emergency care and crisis management, often at the expense of preventive care and the treatment of chronic diseases [21]. Regional instability may have impacted public health initiatives, potentially contributing to disparities in healthcare access and outcomes. Our results show a strong association between SDI variations and disease incidence, emphasizing the role of socioeconomic factors in shaping health disparities across the region.

Our results also demonstrated a strong association between the GII and the incidence rate of digestive diseases across individual countries. Countries with higher GII, reflecting greater gender inequality, tended to have higher incidence rates of digestive diseases. With increasing GII, women often face significant barriers to accessing essential reproductive health services. Limited patient autonomy in medical decision making, common in these contexts, could lead to delays in diagnosing and treating gastrointestinal conditions, and contributing to worse patient outcomes [26, 27]. Additionally, elevated GII is associated with lower educational attainment among women, contributing to reduced health literacy, which further increases the incidence of these diseases [28]. These interconnected factors significantly amplify the burden of digestive diseases as well as exacerbate existing disparities in health outcomes across the region. This highlights the critical need for more equitable healthcare access, targeted policies that promote gender equity, and a comprehensive strategy to promote health education and reduce these disparities.

While our findings highlight a persistent rise in incidence, improvements in overall DALYs and mortality suggest progress in managing disease outcomes. Previous trends (from 1990 to 2010) reported by Sepanlou et al. are similar, noting improvements in both DALYs and mortality rates in gastrointestinal and liver diseases [29]. Alsakarneh et al. also report decreased morality rates and DALYs among patients with IBD in the MENA region between 1990 and 2019 [30]. Similarly, Al Ta'ani et al. report an overall decrease in age-standardized death rates as well as DALYs among patients with cirrhosis and other chronic liver diseases in the MENA region between 1990 and 2021 [31]. The implementation of more effective public health interventions and healthcare infrastructure in certain regions may have contributed to these improved outcomes [21]. As a result, despite the persistent challenges, these advancements are making a meaningful impact on the burden of digestive diseases in the MENA region: investments aiming at improving healthcare infrastructure, diagnostic tools and preventive healthcare are beginning to translate into better patient outcomes. However, these advancements have not been sufficient to curb the steady rise in incidence, highlighting ongoing challenges in disease prevention and risk reduction. While our study examines long-term trends over three decades, it is important to acknowledge that the COVID-19 pandemic may have influenced digestive disease outcomes, particularly through disruptions in healthcare access, delayed diagnoses, and increased mortality in vulnerable populations.

Public health implications

The National Institute of Health (NIH) is actively engaged in understanding the social determinants of health that significantly impact digestive diseases. It funds various research efforts aimed at identifying health disparities, establishing partnerships with leaders across the field to facilitate collaborative efforts to mitigate and

overcome healthcare disparities and improve overall health outcomes [32]. Similar initiatives are needed in the MENA region, tailored to the area's unique needs. Priority should be given to implement interventions that focus on limiting the communicable digestive diseases like hepatitis and diarrhea, given that those diseases were ranked in top 5 digestive diseases leading to death in the region [29]. This could be achieved by enhancing awareness and screening through multiple comprehensive public campaigns, while also reducing the treatment costs through strategic partnerships with the government and pharmaceutical companies for better compliance and longitudinal care [33, 34]. Some efforts are currently in place: the World Health Organization's Eastern Mediterranean Regional Office (EMRO) emphasizes the need for comprehensive strategies to address non-communicable diseases, including digestive diseases, by improving healthcare access and reducing inequalities [4].

Collaborative partnerships within the MENA region could also prove instrumental in addressing public health challenges. By pooling resources, sharing healthcare innovations, and adopting successful healthcare models, MENA countries could collectively strengthen their healthcare systems, especially in regions facing economic or political instability. These partnerships could enable cross-border training programs for healthcare workers, joint research initiatives to address common health burdens, and coordinated public health campaigns targeting high-prevalence diseases across multiple countries.

Moreover, it is crucial to assess and understand the nutritional landscape in the MENA region. Understanding eating habits and ensuring food security is essential to the efforts to reduce malnutrition. More emphasis is needed on enriching the agricultural sector and developing long term plans that improve food storage and distribution as well [35]. Furthermore, improving the infrastructure of health care system is paramount in tackling DD challenges, by developing better screening and diagnostic tests availability when needed. Advocating for these interventions will reflect on better health outcomes and will decrease the financial burden of DD as well given their increased annual cost burden [36, 37]. A focus on enhancing food security and promoting balanced diets through public health campaigns could address underlying risk factors contributing to digestive diseases. Programs that promote healthy eating habits, enriched agricultural practices, and better food distribution systems would support preventive healthcare measures and lessen the strain on healthcare systems. Long-term, these nutrition-centered strategies could reduce disease incidence and help lower healthcare expenditures related to digestive diseases.

Establishing a comprehensive data infrastructure for digestive diseases across the MENA region would support effective public health planning and resource allocation. Regional or national digestive disease registries could track disease patterns, monitor healthcare access, and identify high-risk populations, guiding tailored interventions. This data-driven approach would allow policymakers to make informed decisions and support precision medicine initiatives suited to MENA's demographic and socioeconomic landscape, ultimately improving patient outcomes and optimizing resource use. Additionally, efforts to reduce gender inequality should be integrated into public health strategies, ensuring equitable access to healthcare and resources for women, which could contribute to improved digestive disease outcomes across the region.

Future directions

Despite the decreased DALYs and mortality rates, ASIR continues to rise and is corelated to all 3 indices: SDI, HDI, and GII. This highlights the disparities within the MENA region. To effectively address these issues, country-specific interventions are essential, tailored to the unique available resources, economic conditions and political stability of each nation. Looking ahead, there is significant potential for advanced interventions in the field of personalized medicine, which can enhance our understanding of population characteristics. Advocating for the establishment of nationwide digestive disease registries is crucial as these registries compile vital information such as the social determinants of health. This data can guide future research initiatives that aim to analyze the characteristics and needs of the population, leading to improved management strategies, more efficient use of available resources and improved patient outcomes.

Conclusion(s)

This study reveals significant disparities in the impact of digestive diseases in the MENA region, highlighting the importance of socio-demographic, human development and gender inequality indices. Despite an overall reduction in DALYs and mortality rates, the increase in ASIR of digestive diseases indicates ongoing challenges in the region that require targeted interventions. The correlation between sociodemographic indices and disease incidence emphasizes the need for tailored healthcare strategies that address the specific needs of each country. However, these findings highlight the critical need for enhancing public health initiatives, improving healthcare infrastructure and promoting health education to mitigate the burden of digestive diseases. Ultimately, addressing the disparities in healthcare access and prioritizing investment in preventative care are essential for foresting equitable health systems and building a future where the burden of these conditions is significantly reduced in the region.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12939-025-02448-9.

Supplementary Material 1

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Author contributions
(A=Study Design, B=Data collection, C=Statistical analysis, D=Data interpretation, E=Manuscript preparation, F=Literature search, G=Manuscript review). Omar Al Ta'ani: ABCDEFG. Yazan Al-Ajlouni: ADEFG. Chloe Lahoud: AEFG. Sharifeh Almasaid: AEFG. Yahya Alhalalmeh: AEFG. Zaid Oweis: AEFG. Pojsakorn Danpanichkul: EFG. Ali Baidoun: EFG. Saqr Alsakarneh: EFG. Dushyant Singh Dahiya: EFG. Basile Njei: ADEFG.

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Data availability
The data supporting this study's findings come from the GBD study, available on the Institute for Health Metrics and Evaluation website. The GBD offers comprehensive health data worldwide, including mortality, morbidity, and risk factor estimates for various diseases and conditions.The dataset can be accessed by visiting the IHME GBD Data Tool at https://vizhub.healthdata.org/gbd-compare/#. This interactive tool allows for the exploration of health trends at global, regional, and country levels. The dataset is openly accessible under IHME's terms, supporting its use for research and policy analysis.

Declarations

Ethics approval and consent to participate
Given that we utilized publicly accessible data, no IRB or individual consent was needed.

Consent for publication
Given that we utilize publicly accessible data, individual consent for publication is not required.

Competing interests
The authors declare no competing interests.

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