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Chronic Diseases and Their Impact on Public Health

Muqrin Ghazi Al-Osimi[1], Faris Majed Al-Muqati[2], Wael Ayad Ayed Alotaibi[3], Bandar Saad Dhawahi Alotaibi[3], Sultan Mohammed Aqeel Alotaibi[3], Jarah Fawaz Mehmas Alosaimi[3], Arif Mukhlid Rasheed Alghannami[3], Sultan Eid Abdul Rahman Al-Osaimi Al-Otaibi[3], Muath Abdulrahman M Alkuwaiz[4], Mohammed Bijad A Alotaibi[5]

1Epidemiology Technician, Medical Clinic, Al-Dawadmi Prison, Saudi Arabia.
2Epidemiology Technician, East Dawadmi Primary Health Care Center, Saudi Arabia.
3Technician-public health ,Al-Dawadmi Hospital, Saudi Arabia.
4Technician-public health, Ad Diriyah Hospital, Saudi Arabia.
5Technician-public Health, Ruwaidah Alard General Hospital, Saudi Arabia.

Abstract
Background: One of the main causes of death and disability in the globe is chronic illness, which includes diabetes, cancer, heart disease, and respiratory conditions. The World Health Organization (WHO) estimates that 71% of fatalities worldwide each year are caused by these illnesses. Several factors, including aging populations, bad lifestyles, and socioeconomic inequality, contribute to the incidence of chronic diseases. Due to lost productivity and long-term treatment expenses, they significantly strain economies and healthcare systems. Creating successful management and preventive plans requires an understanding of their effects.
Aim: This study/article's goal is to investigate how chronic diseases affect public health, considering their prevalence, risk factors, and related social and economic issues. To lessen their impact on people, communities, and healthcare systems, it also looks for preventive, early identification, and management techniques.
Conclusion: Globally, chronic illnesses represent a significant and expanding public health concern. Their high frequency and related expenses underscore the pressing need for all-encompassing approaches to deal with their underlying causes and enhance treatment. It is crucial to take preventive actions like encouraging healthy lifestyles, expanding access to healthcare, and putting community-based treatments into practice. To ensure a better future for all populations, policymakers and stakeholders must work together to prioritize managing and preventing chronic diseases.
Keywords: Chronic diseases, public health, Disease burden, Prevention strategies, and Healthcare systems.

Introduction:

Non-communicable diseases (NCDs), sometimes known as chronic diseases, are long-lasting ailments that frequently advance slowly and are a major worldwide health concern. These include diabetes, cancer, heart disease, and chronic respiratory conditions, which collectively cause over 70% of deaths worldwide each year, according to the World Health Organization (WHO). Rapid urbanization, changes in lifestyle, and demographic shifts like aging populations have all contributed to the incidence of these illnesses.[1]

In addition to their effects on individuals, chronic illnesses put a burden on healthcare systems, impede economic growth, and worsen health disparities, especially in low- and middle-income nations. Many of these disorders are preventable or controllable via early detection, public health measures, and persistent legislative efforts, despite their substantial impact.[2]

Millions of people's quality of life is greatly impacted by chronic diseases, sometimes referred to as non-communicable diseases (NCDs), which are a major cause of death and morbidity globally. Heart disease, diabetes, cancer, and chronic respiratory diseases are among the ailments that develop gradually and last for long periods of time. Chronic diseases are not contagious like infectious diseases, yet they are heavily impacted by environmental, genetic, and behavioral factors.[3]

Because chronic diseases have significant economic and social ramifications in addition to placing a heavy load on healthcare systems, their increasing incidence poses a serious challenge to public health. The aging of the world's population, sedentary lifestyles, bad eating habits, and rapid urbanization all contribute to the rising prevalence of these illnesses. A thorough grasp of the underlying causes, preventative measures, and efficient management techniques are necessary to address this problem.[4]

A major worldwide health concern of the twenty-first century is chronic diseases, which include problems including diabetes, cancer, cardiovascular disease, and chronic respiratory disorders. According to the World Health Organization, these non-communicable diseases (NCDs) are the leading cause of death globally, with almost 41 million people dying from them each year. Chronic illnesses have a substantial impact on economic development, productivity, and quality of life in addition to mortality rates.[5]

The change in lifestyle brought about by urbanization and globalization is one of the main causes of chronic diseases. Tobacco usage, excessive alcohol use, poor eating habits, and sedentary behavior have all been identified as significant risk factors. The prevalence of these disorders is further increased by genetic predispositions, environmental variables, and the aging of the world's population. For example, urban settings frequently encourage unhealthy habits like a dependence on fast food and a lack of opportunity for physical activity.[6]

Chronic illnesses have a crippling financial cost. They make up a sizable amount of healthcare spending, especially in wealthy nations where the price of chronic illness treatment, medicine, and long-term care is very high. Individuals and families frequently incur catastrophic losses as a result of these disorders, especially in low- and middle-income countries where healthcare systems may be less prepared to manage them.[7]

Despite the difficulties, public health initiatives can help largely avoid chronic diseases. Reducing the prevalence of disease has been demonstrated to be possible through early screening programs, health education campaigns encouraging healthy lifestyles, and legislative actions like limiting tobacco use or charging sugar-filled beverages. Addressing health inequalities that frequently increase the burden of chronic diseases also requires community involvement and fair access to healthcare.[8]

However, prevention alone is not enough to manage chronic diseases. To improve results, treatment innovations like tailored medicine and technology developments like telemedicine are essential. Furthermore, improving healthcare systems to offer patient-centered, integrated care can greatly enhance the quality of life for people with long-term illnesses.[9]

To sum up, chronic illnesses present a complex public health issue that necessitates a multipronged approach. Governments and stakeholders may lessen the effect of these diseases by putting prevention first, encouraging international cooperation, and making investments in healthcare infrastructure. In addition to saving lives, a concentrated effort to combat chronic illnesses will improve economic stability and overall well-being.[10]

This article examines the complex relationship between chronic illnesses and public health, highlighting the necessity of cooperation between communities, governments, and healthcare providers to lessen the consequences of these conditions and advance better societies.

Communicable and non-communicable diseases differ in their causes, modes of transmission, prevention, and treatment. Here's a breakdown of the key differences:[11]

Aspect	Communicable Diseases	Non-Communicable Diseases
Definition	Diseases caused by infectious agents such as bacteria, viruses, fungi, or parasites.	Diseases not caused by infectious agents; result from genetic, environmental, or lifestyle factors.

Cause	Caused by pathogens (e.g., viruses, bacteria, fungi).	Caused by non-infectious factors like genetics, lifestyle, or environment.
Mode of Transmission	Spread from person to person, animal to person, or through the environment (e.g., air, water, food, or vectors).	Not transmissible between individuals.
Examples	Tuberculosis, influenza, HIV/AIDS, malaria, and COVID-19.	Diabetes, cancer, heart disease, asthma, and osteoporosis.
Prevention	-Vaccination -Hygiene practices -Safe food and water - Quarantine measures	- Healthy diet - Regular exercise - Avoidance of tobacco and alcohol - Regular health checkups
Treatment	Often treated with antibiotics, antivirals, antifungals, or antiparasitic drugs.	Managed with medications, lifestyle changes, or surgery, but often cannot be fully cured.
Onset	Often acute and develops rapidly.	Usually chronic and develops gradually over time.
Duration	Typically short-term, although some can become chronic.	Typically, long-term and persistent.

Global Burden of Chronic Diseases

Prevalence and mortality rates worldwide.

The prevalence and mortality rates of communicable and non-communicable diseases contribute to global health issues in diverse ways. Particularly in low- and middle-income countries (LMICs), infectious diseases caused by bacteria, viruses, and parasites continue to be a serious health concern. These illnesses, which include HIV/AIDS, malaria, tuberculosis, and respiratory infections like pneumonia, are more common in areas with inadequate sanitation, little access to healthcare, and high levels of poverty. With an anticipated 7.8 million deaths worldwide in 2019, communicable diseases were responsible for about 14% of all fatalities. Vulnerable groups, including elderly people and children under five, are disproportionately affected by these illnesses. Infectious illness effect and global dissemination have also been shown by outbreaks such as the COVID-19 pandemic.[12]

However, non-communicable diseases (NCDs) are now the world's largest cause of death, accounting for around 74% of all deaths, or 41 million each year. In both affluent and developing countries, NCDs—which include diabetes, cancer, respiratory conditions, and cardiovascular diseases—are common. The biggest cause of death is cardiovascular disease, which is followed by diabetes, cancer, and chronic respiratory conditions. Because of aging populations, urbanization, and changes in lifestyle, the burden of NCDs is growing in LMICs as well as high-income nations. Even though communicable diseases still account for a large portion of deaths, non-communicable diseases are becoming more and more prevalent and deadly, which is why public health initiatives around the world are primarily focused on them.[13]

- **Regional disparities and the impact on low- and middle-income countries**

Particularly for low- and middle-income countries (LMICs), regional differences in the frequency of communicable and non-communicable diseases (NCDs) have important ramifications. Due to issues including poor sanitation, a lack of proper healthcare infrastructure, and restricted access to clean water and vaccines, infectious illnesses continue to pose the greatest threat to public health in many LMICs. For instance, sub-Saharan Africa, some regions of Asia,

and Latin America still have high prevalence rates of infectious diseases like HIV/AIDS, malaria, and tuberculosis. In addition, outbreaks of illnesses like cholera and Ebola plague these areas, severely taxing already overburdened healthcare facilities. Effective disease control and preventive efforts are hampered by a lack of funding, medical staff, and public health infrastructure, even though communicable diseases are frequently avoidable or treated with the right healthcare treatments.[14]

However, in LMICs, non-communicable diseases (NCDs) are increasing, primarily because of urbanization, changing lifestyles, and demographic changes, such as an aging population. The twin burden of disease, in which NCDs and communicable diseases both contribute to morbidity and mortality, is becoming more and more prevalent in these nations. Healthcare systems that are already struggling due to infectious disease outbreaks are being overtaken by the rising incidence of diseases including cancer, diabetes, and heart disease across Southeast Asia, Latin America, and some parts of the Middle East. The increase in NCDs in these areas is a result of risk factors such cigarette smoking, poor diets, sedentary lifestyles, and rising obesity rates.[15]

These differences have a significant influence. People in LMICs frequently suffer from avoidable illnesses and have higher mortality rates due to the restricted ability to treat both communicable diseases and noncommunicable diseases. The financial burden is also substantial since managing and preventing infectious diseases continues to be expensive, and the expense of treating chronic illnesses like diabetes and heart disease puts a pressure on public health resources. Economic development is further hampered by the prevalence of NCDs in LMICs, which also leads to longer-term health issues like disability and decreased worker productivity.[16]

High-income nations (HICs) on the other hand have stronger healthcare systems, easier access to medical technology, and more funding for illness prevention, all of which contribute to reduce the prevalence of NCDs and communicable illnesses. But even among HICs, the incidence of NCDs has created a growing health crisis, with a greater emphasis on preventative treatment and managing chronic diseases.[17]

The need for customized public health strategies in LMICs to address the combined burden of infectious and non-communicable diseases is generally highlighted by geographical inequalities. Health education must be promoted, healthcare infrastructure must be strengthened, access to healthcare services must be improved, and socioeconomic determinants of health like poverty, nutrition, and access to clean water and sanitation must be addressed.[18]

Risk Factors for Chronic Diseases

Conditions or habits that raise the chance of long-term health issues like cancer, diabetes, cardiovascular disease, and chronic respiratory disorders are known as risk factors for chronic diseases. Both controllable and non-modifiable risk factors are possible. A poor diet, a lack of exercise, tobacco use, excessive alcohol use, obesity, high blood pressure, high cholesterol, and long-term stress are all modifiable risk factors. Obesity and an increased risk of heart disease, type 2 diabetes, and cancer can result from a poor diet that is low in nutrients and high in processed foods.[19]

Smoking and excessive alcohol use are key causes of cancer, heart disease, and respiratory disorders, while sedentary lifestyles and physical inactivity lead to obesity and other chronic problems. Obesity raises the risk for several chronic diseases and is frequently associated with poor diet and inactivity. Significant risk factors for heart disease and stroke include high blood pressure and high cholesterol, and long-term stress can make health problems worse by encouraging unhealthy coping mechanisms like smoking or overeating.[20]

Risk factors that cannot be changed include exposure to the environment, age, gender, genetics, and ethnicity. People are more susceptible to chronic illnesses as they get older because their bodies are less able to sustain their health. Certain diseases, including osteoporosis in women and heart disease in men, are more common in particular genders. Because genetic factors influence illness susceptibility, a family history of chronic diseases can also raise the probability of having similar disorders.[21]

Racial and ethnic differences also come into play since certain groups are more susceptible to diseases including cancer, diabetes, and high blood pressure. Lastly, chronic diseases may arise because of exposure to pollutants, environmental toxins, or dangerous materials in specific jobs. Many modifiable risk factors, such eating a nutritious diet, exercising frequently, abstaining from tobacco and excessive alcohol use, and managing stress, can be addressed by lifestyle changes, but non-modifiable factors cannot be changed. By doing these steps, you can lower your risk of developing chronic illnesses and enhance your general health.[22]

Impact on Public Health Systems

Global public health systems are significantly impacted by the growing prevalence of chronic illnesses, particularly in low- and middle-income (LMIC) nations. Long-term treatment and care are frequently needed for chronic illnesses like cancer, diabetes, and cardiovascular diseases, which puts a heavy burden on the healthcare system's financial, human, and infrastructure resources. The rising incidence of chronic diseases merely adds to the strain that infectious diseases and other health issues already place on public health systems in many LMICs.[23]

Chronic disease management necessitates ongoing medical care, which includes frequent checkups with the doctor, prescription drugs, diagnostic testing, and occasionally surgery or long-term treatment. All of these entail a large financial outlay for healthcare services. As a result, public health systems struggle to provide fair access to care, particularly for underserved groups that might not have easy access to medical facilities, qualified staff, or necessary prescription drugs.[24]

Furthermore, because the expenses of treating and caring for chronic illnesses can take funds away from preventative measures and other essential healthcare requirements, they also contribute to an increasing economic burden. Many people fall into poverty because of the high cost of managing chronic diseases, which also raises their out-of-pocket expenses, particularly in environments with limited resources. The increasing number of persons with chronic illnesses who are unable to work due to illness exacerbates this economic strain, resulting in lower productivity and increased social and economic inequality.[25]

Furthermore, health systems are under more pressure to offer age-appropriate care and services due to the rising incidence of chronic diseases in aging populations. To reduce the long-term strain on healthcare systems and enhance population health outcomes, public health initiatives must concentrate on prevention, early diagnosis, and lifestyle modifications in addition to treating chronic diseases. To address the underlying causes of chronic diseases and increase the resilience of the health system, effective management of these conditions necessitates a thorough, coordinated strategy that includes improved resource allocation, policy changes, and more public health education.[26]

Preventive strategy

To delay the emergence of conditions including cancer, diabetes, heart disease, and chronic respiratory disorders, preventive measures for chronic diseases concentrate on lowering risk factors and encouraging better lives. These tactics can be applied to both modifiable and non-modifiable risk factors at the individual, group, and societal levels.[27]

The first step in prevention at the individual level is to promote healthy habits. This entails encouraging regular exercise, eating a diet full of fruits, vegetables, good grains, and lean meats,

and cutting back on processed foods, sweets, and bad fats. Campaigns to reduce alcohol intake and smoking cessation programs are also essential for preventing chronic illnesses. Further lowering the risk of diseases like diabetes, heart disease, and hypertension can be achieved by educating people about the value of stress management practices like mindfulness, relaxation, and seeking mental health support. Timely intervention and halting the progression of disease depend on routine health screenings and early identification of risk factors like diabetes, high blood pressure, and high cholesterol.[28]

Public health initiatives can encourage healthy habits at the local level by reaching out to the media, educational institutions, employers, and community organizations. Sedentary lifestyles can be decreased with the aid of corporate wellness initiatives or programs that promote physical exercise, including cycling or walking. Campaigns for public health education regarding the risks of smoking, binge drinking, and eating poorly are also crucial for increasing awareness and changing social norms. Communities' general health and the risk of chronic diseases can be enhanced by having access to safer places for physical activity, healthier dietary options, and reasonably priced healthcare services.[29]

Governments and legislators have the power to enact laws that promote healthier surroundings on a social level. These could include prohibitions on tobacco advertising, charges on sugary drinks, or rules to lessen the promotion of unhealthy foods and drinks. Physical activity can be promoted by urban planning that places a high priority on walkable neighborhoods, park accessibility, and public transportation. The prevention of respiratory illnesses and other chronic ailments can also be aided by legislation aimed at lowering air pollution and workplace dangers. With an emphasis on universal health coverage that offers access to screenings, immunizations, and reasonably priced treatment, healthcare systems can be reinforced to prioritize preventive and risk factor management.[30]

Furthermore, lowering gaps in the prevalence of chronic diseases, especially in low- and middle-income nations, requires international efforts to address the social determinants of health, such as poverty, education, and access to clean water. The burden of chronic diseases on both individuals and healthcare systems can be considerably decreased by implementing a multifaceted strategy that incorporates interventions at the individual, community, and society levels.[31]

Conclusion

In conclusion, both modifiable and non-modifiable risk factors contribute to the rise in chronic diseases, which poses a serious challenge to global public health systems. In addition to causing high rates of death and morbidity, these illnesses can severely tax healthcare resources, particularly in low- and middle-income nations where infectious diseases may already be putting a strain on health systems. To lessen this cost and enhance public health outcomes, preventive measures are crucial. In order to lower the risk of chronic diseases, it is essential to promote healthy lifestyle choices, such as regular exercise, a balanced diet, quitting smoking, and moderate alcohol consumption. Meanwhile, establishing settings that promote disease prevention at the community and societal levels is largely dependent on public health policies that consider environmental, social, and economic aspects. Effective risk factor management and chronic disease prevention can be further strengthened by early detection, access to high-quality healthcare, and public health education. To lessen the effects of chronic diseases, enhance quality of life, and guarantee more sustainable health systems in the future, a thorough and cooperative strategy including people, communities, healthcare professionals, and legislators is ultimately required.

References

[1] Piovani D, Nikolopoulos GK, Bonovas S. Non-Communicable Diseases: The Invisible Epidemic. J Clin Med. 2022 Oct 8;11(19):5939. doi: 10.3390/jcm11195939. PMID: 36233805; PMCID: PMC9572583.

[2] Mazzucca S, Arredondo EM, Hoelscher DM, Haire-Joshu D, Tabak RG, Kumanyika SK, Brownson RC. Expanding Implementation Research to Prevent Chronic Diseases in Community Settings. Annu Rev Public Health. 2021 Apr 1;42:135-158. doi: 10.1146/annurev-publhealth-090419-102547. Epub 2021 Jan 19. PMID: 33467924; PMCID: PMC9152846.

[3] Anderson E, Durstine JL. Physical activity, exercise, and chronic diseases: A brief review. Sports Med Health Sci. 2019 Sep 10;1(1):3-10. doi: 10.1016/j.smhs.2019.08.006. PMID: 35782456; PMCID: PMC9219321.

[4] Sun X, Li X. Editorial: Aging and chronic disease: public health challenge and education reform. Front Public Health. 2023 May 9;11:1175898. doi: 10.3389/fpubh.2023.1175898. PMID: 37228734; PMCID: PMC10203579.

[5] Budreviciute A, Damiati S, Sabir DK, Onder K, Schuller-Goetzburg P, Plakys G, Katileviciute A, Khoja S, Kodzius R. Management and Prevention Strategies for Non-communicable Diseases (NCDs) and Their Risk Factors. Front Public Health. 2020 Nov 26;8:574111. doi: 10.3389/fpubh.2020.574111. PMID: 33324597; PMCID: PMC7726193.

[6] Munawir Alhejely MM, Shibli KY, Hamed Almalki WA, Felemban GMB, Alluhaybi HS, Majrashi BM, Bakhsh BY. Influence of Lifestyle Changes on Cardiovascular Diseases in Saudi Arabia: A Systematic Literature Review. Cureus. 2023 Jun 7;15(6):e40075. doi: 10.7759/cureus.40075. PMID: 37425506; PMCID: PMC10326797.

[7] Holman HR. The Relation of the Chronic Disease Epidemic to the Health Care Crisis. ACR Open Rheumatol. 2020 Mar;2(3):167-173. doi: 10.1002/acr2.11114. Epub 2020 Feb 19. PMID: 32073759; PMCID: PMC7077778.

[8] Haldane V, Chuah FLH, Srivastava A, Singh SR, Koh GCH, Seng CK, Legido-Quigley H. Community participation in health services development, implementation, and evaluation: A systematic review of empowerment, health, community, and process outcomes. PLoS One. 2019 May 10;14(5):e0216112. doi: 10.1371/journal.pone.0216112. PMID: 31075120; PMCID: PMC6510456.

[9] Flessa S, Huebner C. Innovations in Health Care-A Conceptual Framework. Int J Environ Res Public Health. 2021 Sep 24;18(19):10026. doi: 10.3390/ijerph181910026. PMID: 34639328; PMCID: PMC8508443.

[10] Grady PA, Gough LL. Self-management: a comprehensive approach to management of chronic conditions. Am J Public Health. 2014 Aug;104(8):e25-31. doi: 10.2105/AJPH.2014.302041. Epub 2014 Jun 12. PMID: 24922170; PMCID: PMC4103232.

[11] Edemekong PF, Huang B. Epidemiology of Prevention of Communicable Diseases. [Updated 2022 Oct 24]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK470303/

[12] Australian Institute of Health and Welfare (2024) Infectious and communicable diseases, AIHW, Australian Government, accessed 27 November 2024.

[13] Ramesh S, Kosalram K. The burden of non-communicable diseases: A scoping review focus on the context of India. J Educ Health Promot. 2023 Feb 28;12:41. doi: 10.4103/jehp.jehp_1113_22. PMID: 37113407; PMCID: PMC10127498.

[14] Ndubuisi NE. Noncommunicable Diseases Prevention In Low- and Middle-Income Countries: An Overview of Health in All Policies (HiAP). Inquiry. 2021 Jan-Dec;58:46958020927885. doi: 10.1177/0046958020927885. PMID: 34420412; PMCID: PMC8385577.

[15] Hambleton IR, Caixeta R, Jeyaseelan SM, Luciani S, Hennis AJM. The rising burden of non-communicable diseases in the Americas and the impact of population aging: a secondary analysis of available data. Lancet Reg Health Am. 2023 Mar 31;21:100483. doi: 10.1016/j.lana.2023.100483. PMID: 37065858; PMCID: PMC10090658.

[16] Miranda JJ, Kinra S, Casas JP, Davey Smith G, Ebrahim S. Non-communicable diseases in low- and middle-income countries: context, determinants and health policy. Trop Med Int Health. 2008 Oct;13(10):1225-34. doi: 10.1111/j.1365-3156.2008.02116.x. PMID: 18937743; PMCID: PMC2687091.

[17] Peng W, Zhang L, Wen F, Tang X, Zeng L, Chen J, Galea G, Wen D, Wang Y. Trends and disparities in non-communicable diseases in the Western Pacific region. Lancet Reg Health West Pac. 2023 Dec 1;43:100938. doi: 10.1016/j.lanwpc.2023.100938. PMID: 38456093; PMCID: PMC10920054.

[18] Abubakar I, Dalglish SL, Angell B, Sanuade O, Abimbola S, Adamu AL, Adetifa IMO, Colbourn T, Ogunlesi AO, Onwujekwe O, Owoaje ET, Okeke IN, Adeyemo A, Aliyu G, Aliyu

MH, Aliyu SH, Ameh EA, Archibong B, Ezeh A, Gadanya MA, Ihekweazu C, Ihekweazu V, Iliyasu Z, Kwaku Chiroma A, Mabayoje DA, Nasir Sambo M, Obaro S, Yinka-Ogunleye A, Okonofua F, Oni T, Onyimadu O, Pate MA, Salako BL, Shuaib F, Tsiga-Ahmed F, Zanna FH. The Lancet Nigeria Commission: investing in health and the future of the nation. Lancet. 2022 Mar 19;399(10330):1155-1200. doi: 10.1016/S0140-6736(21)02488-0. Epub 2022 Mar 15. PMID: 35303470; PMCID: PMC8943278.

[19] Masoudkabir F, Mohammadifard N, Mani A, Ignaszewski A, Davis MK, Vaseghi G, Mansourian M, Franco C, Gotay C, Sarrafzadegan N. Shared Lifestyle-Related Risk Factors of Cardiovascular Disease and Cancer: Evidence for Joint Prevention. ScientificWorldJournal. 2023 Jul 22;2023:2404806. doi: 10.1155/2023/2404806. PMID: 37520844; PMCID: PMC10386903.

[20] Ng R, Sutradhar R, Yao Z, Wodchis WP, Rosella LC. Smoking, drinking, diet and physical activity-modifiable lifestyle risk factors and their associations with age to first chronic disease. Int J Epidemiol. 2020 Feb 1;49(1):113-130. doi: 10.1093/ije/dyz078. PMID: 31329872; PMCID: PMC7124486.

[21] Sözen T, Özışık L, Başaran NÇ. An overview and management of osteoporosis. Eur J Rheumatol. 2017 Mar;4(1):46-56. doi: 10.5152/eurjrheum.2016.048. Epub 2016 Dec 30. PMID: 28293453; PMCID: PMC5335887.

[22] Bhatnagar A. Environmental Determinants of Cardiovascular Disease. Circ Res. 2017 Jul 7;121(2):162-180. doi: 10.1161/CIRCRESAHA.117.306458. PMID: 28684622; PMCID: PMC5777598.

[23] Yeates K, Lohfeld L, Sleeth J, Morales F, Rajkotia Y, Ogedegbe O. A Global Perspective on Cardiovascular Disease in Vulnerable Populations. Can J Cardiol. 2015 Sep;31(9):1081-93. doi: 10.1016/j.cjca.2015.06.035. Epub 2015 Jul 13. PMID: 26321432; PMCID: PMC4787293.

[24] Zhao S, Du R, He Y, He X, Jiang Y, Zhang X. Elements of chronic disease management service system: an empirical study from large hospitals in China. Sci Rep. 2022 Apr 5;12(1):5693. doi: 10.1038/s41598-022-09784-8. PMID: 35383275; PMCID: PMC8982312.

[25] Ryan Crowley, Hilary Daniel, Thomas G. Cooney, et al; for the Health and Public Policy Committee of the American College of Physicians . Envisioning a Better U.S. Health Care System for All: Coverage and Cost of Care. Ann Intern Med.2020;172:S7-S32. [Epub 21 January 2020]. doi:10.7326/M19-2415

[26] Jones CH, Dolsten M. Healthcare on the brink: navigating the challenges of an aging society in the United States. NPJ Aging. 2024 Apr 6;10(1):22. doi: 10.1038/s41514-024-00148-2. Erratum

in: NPJ Aging. 2024 May 10;10(1):25. doi: 10.1038/s41514-024-00153-5. PMID: 38582901; PMCID: PMC10998868.

[27] Wu Y, Ding Y, Tanaka Y, Zhang W. Risk factors contributing to type 2 diabetes and recent advances in the treatment and prevention. Int J Med Sci. 2014 Sep 6;11(11):1185-200. doi: 10.7150/ijms.10001. PMID: 25249787; PMCID: PMC4166864.

[28] Le Goff D, Aerts N, Odorico M, Guillou-Landreat M, Perraud G, Bastiaens H, Musinguzi G, Le Reste JY, Barais M. Practical dietary interventions to prevent cardiovascular disease suitable for implementation in primary care: an ADAPTE-guided systematic review of international clinical guidelines. Int J Behav Nutr Phys Act. 2023 Jul 28;20(1):93. doi: 10.1186/s12966-023-01463-9. PMID: 37507692; PMCID: PMC10385931.

[29] Baker PR, Francis DP, Soares J, Weightman AL, Foster C. Community wide interventions for increasing physical activity. Cochrane Database Syst Rev. 2015 Jan 5;1(1):CD008366. doi: 10.1002/14651858.CD008366.pub3. PMID: 25556970; PMCID: PMC9508615.

[30] Taillie LS, Busey E, Stoltze FM, Dillman Carpentier FR. Governmental policies to reduce unhealthy food marketing to children. Nutr Rev. 2019 Nov 1;77(11):787-816. doi: 10.1093/nutrit/nuz021. PMID: 31329232; PMCID: PMC7528677.

[31] Quinn SC, Kumar S. Health inequalities and infectious disease epidemics: a challenge for global health security. Biosecur Bioterror. 2014 Sep-Oct;12(5):263-73. doi: 10.1089/bsp.2014.0032. PMID: 25254915; PMCID: PMC4170985.