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The prevalence and management of hypertension and type 2 diabetes mellitus as non-communicable diseases in Cambodia: A critical review

Review Article

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Abstract: Non-communicable diseases (NCDs) such as hypertension (HTN) and type 2 diabetes mellitus (T2DM) are dramatically increasing in low-middle-income countries (LMICs), including Cambodia. Major NCDs, including T2DM and HTN, are becoming more common in Cambodia as a result of the country's rapid economic development and changing demographics. The management and prevention of T2DM and HTN diseases is the highest priority in reducing the morbidity and mortality rate of ischaemic heart disease and stroke. This review article highlights the current trends of HTN and T2DM diseases in Cambodia and also provides essential information on how to manage and prevent those two diseases among Cambodia's people. We discuss the challenges and opportunities for Cambodia to improve its healthcare system. To conclude, we advocate for a multi-sectoral approach involving the improvement of healthcare infrastructure at the health center level, health education, and effective policies to reduce their burden.

1. Introduction

Every country worldwide is facing an increasing spread of non-communicable diseases (NCDs), particularly in low-middle-income countries (LMICs), which account for about 77% of the 31.4 million total deaths annually (World Health Organization [WHO], 2023a). Cambodia, a developing country in Southeast Asia, aims to transition to an upper-middle-income country (UMIC) by 2030. The incidence of major NCDs, like hypertension and diabetes, has increased in Cambodia as a result of the country's rapid economic development and demographic changes.

To improve life expectancy at birth from 59.4 years in 2000 to 70 years in 2020 (World Bank, n.d.) and 70.74 years in 2024 (Macrotrends, n.d.), the government has focused on health education and public health services. According to Kulikov et al. (2019), NCDs account for 64% of all deaths in Cambodia, with the population having a 23% probability of dying between the ages of 30 and 70 from one of the four main NCDs: cardiovascular disease (CVD), diabetes, chronic respiratory disease, and cancer. The WHO reported that this issue is caused by experiences during early life and widespread occurrences of overweight and obesity, tobacco use, air pollution, low levels of physical activity, and high levels of salt intake, which disproportionately affect populations living in the world's poorest countries (WHO, 2023a). Addressing NCDs is crucial for economic reasons, as prompt and efficient preventive actions can yield significant cost benefits and mitigate their negative impact on Cambodia's economic production.

The WHO report also indicates that hypertension and diabetes contribute to ischaemic heart disease and stroke, ranking fourth among the leading causes of high morbidity and mortality rates (World Bank, 2022). However, awareness and care towards hypertension (HTN) and type 2 diabetes mellitus (T2DM)

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are generally lower among residents of rural, semi-urban, and urban areas compared to the people who live in the city (Wagner et al., 2018). This could be due to easier access to healthcare services in the city. Moreover, developing a control and management system for HTN and T2DM is crucial for reducing the morbidity and mortality rates of ischaemic heart disease and stroke (Hernandez et al., 2021). The Royal Government of Cambodia's strong political commitment towards achieving Universal Health Coverage (UHC) provides the Ministry of Health (MoH) with an opportunity to improve health service delivery (WHO, 2016). To ensure service availability for T2DM and HTN patients, the MoH and donor organisations have introduced a multitude of primary health care (PHC) interventions. Those include: the establishment of NCD clinics at the referral hospitals (RHs); the introduction of the World Health Organization Package of Essential Non-Communicable Disease Interventions (WHO PEN) programme in health centres (HCs); and the expansion and integration of MoPoTsyo's community-based peer educator network (Chham et al., 2022). Expanding access to healthcare services for T2DM and HTN through the implementation of comprehensive health intervention programs is a critical step towards achieving UHC for NCDs in Cambodia. However, this effort faces significant challenges within the healthcare system, including weak governance, limited financial resources, and a notable shortage of human resources (Jacobs et al., 2016).

The delivery of T2DM and HTN services at the PHC and community levels is particularly hindered by the scarcity of qualified personnel. These NCDs require a multifaceted approach to management, encompassing lifelong healthcare support, early detection of cases, promotion of psychosocial well-being, encouragement of self-management, and provision of medical assistance (Beaglehole et al., 2008). Although management of HTN and T2DM has been initiated in Cambodia, gaps exist, suggesting the need for further improvements. This review article highlights current trends of HTN and T2DM in Cambodia and provides essential information on managing and preventing these conditions among the Cambodian population.

2. The prevalence and risk factors for hypertension and diabetes in Cambodia

HTN and T2DM are significant global public health concerns. These two diseases are major risk factors for cardiovascular diseases, accounting for approximately 31% (17.9 million) of all deaths worldwide annually (WHO, n.d.a). In Cambodia, the prevalence of HTN and T2DM among adults aged 30–79 years has been a persistent issue, largely due to a lack of awareness about these conditions (Te et al., 2023; WHO, 2018; Ramachandran et al., 2014). The prevalence of T2DM and HTN has seen a dramatic increase in recent years. In 2010, the rates were 2.9% and 11.2% among the population aged 25–64, respectively, which rose to 9.6% and 14.2% among those aged 18–69 by 2019 (Ministry of Health, 2019) and up to 23.5% among adults aged 40–69 in 2016 (Chham et al., 2023). By 2020, the prevalence had further increased to 35.2% for HTN and 37.2% for T2DM among adults aged 40 and older, with 34.7% having both T2DM and HTN (Chham et al., 2023; Chhim et al., 2023).

A study by Wagner et al. (2018) revealed that the highest rate of undiagnosed T2DM was in rural areas (67%), followed by semi-urban (55%), and urban areas (51%), among Cambodian people. The increased rates of smoking and alcohol use were identified as the primary factors contributing to the higher prevalence of T2DM and HTN in rural areas (Wagner et al., 2018). Given the significant rise in the incidence of these two NCDs, there are several factors contributing to the increasing prevalence of HTN and T2DM, which are described below, including alcohol consumption, unhealthy diet and digestion risk factors, and physical inactivity (Elliott et al., 2022; Kulikov et al., 2019; Lee et al., 2012; Ministry of Health, 2019; Te et al., 2023; WHO, 2023b; WHO, 2018).

2.1. Alcohol consumption

According to the WHO's Global Status Report on Alcohol and Health (2018), each Cambodian male and female consumes over one liter of spirits per week, equating to 21 liters of pure alcohol annually. However, the study estimates that men consume approximately three times as much alcohol (27 liters) as women do (10 liters) per capita in 2018. In Cambodia, associations between alcohol consumption and tobacco use were observed; men or women who smoked were twice as likely to consume alcohol as well. Among those aged 15–19, 27% of females and 42% of males were identified as currently drinking, with 10% engaging in strong episodic drinking (Kulikov et al., 2019).

Recently, Cambodia has implemented fiscal measures to reduce the cost of alcohol, aligning with WHO-recommended policy strategies to combat harmful alcohol use (Te et al., 2023; WHO, 2018). In 2014, the excise duty on alcoholic beverages increased from 10% to 20%, and by 2016, it rose to 25%. Despite these taxation hikes on alcohol production, consumption rates remain high in Cambodia (Kulikov et al., 2019). This could be attributed to the absence of laws prohibiting the wholesale sale of alcohol or banning its sponsorship, promotion, and advertising. While heavy alcohol use is associated with various types of cancer, pancreatitis, epilepsy, diabetes, cirrhosis, ischemic heart disease, stroke, and other cardiovascular and circulatory disorders (Kulikov et al., 2019), there's a significant link between alcohol abuse and NCDs (Kulikov et al., 2019; WHO, 2018). However, there's a considerable underestimation of the benefits of reducing alcohol consumption for economic growth and Cambodia's goal to become an UMIC by 2030.

2.2. Unhealthy diet and digestion risk factors

The risk of a cardiovascular event is greatly increased by high levels of metabolic variables, including blood pressure, body mass index, and blood cholesterol levels. According to the 2016 STEPS survey, 19.2% of adults in Cambodia are overweight (16.9% of women and 22.0% of men), and 3% are obese (Kulikov et al., 2019). Among adults over the age of 18, 9.6% had elevated blood glucose levels, and 45% had elevated total cholesterol levels. Due to consumption of meals high in *trans*- and saturated fatty acids, as well as salt, elevated blood pressure was prevalent in 14.2% of cases (Kulikov et al., 2019; WHO, 2023b).

Salt intake is often indicative of unhealthy diets, especially when considering policy actions and data modeling (Hyseni et al., 2017). In Cambodia, sodium consumption is high. The WHO-recommends consuming no more than 5 grams of salt per day. However, the average daily intake for Cambodian adults exceeds this, reaching up to 8.5 grams (approximately 9.2 grams for men and 7.6 grams for women) (WHO, 2023b). The risk of ischemic heart disease, stroke, and other cardiovascular and circulatory disorders increases with unhealthy diets, with stomach cancer being one of these NCDs. High salt intake accounts for 28.2% of cardiovascular fatalities (Chan et al., 2021; WHO, 2023b).

2.3. Physical inactivity

Physical inactivity is the main factor contributing to diabetes globally. However, the 2016 STEPS survey revealed that while 8% of Cambodian individuals between the ages of 18 and 69 engaged in adequate physical activity (Kulikov et al., 2019), the majority did not reach the WHO's recommended weekly allowance of 150 minutes of moderate-to-intense physical activity (WHO, 2022c). Men (5.5%) had a lower percentage than women (11%) (Kulikov et al., 2019). Women between the ages of 18 and 29

were the least active, with only 18.2% meeting the recommended levels. Employment accounted for 76.6% of all physical activity, transportation for 17.8%, and recreation for 5.6% (Kulikov et al., 2019).

According to Lee et al. (2012), metabolic disorders linked to physical inactivity include T2DM, coronary heart disease, and malignancies of the breast and colon. Regular exercise often reduces the risk of diabetes, ischemic heart disease, stroke, breast cancer, and colon cancer (Kulikov et al., 2019; Lee et al., 2012). In Cambodia, there is a strong political commitment to promoting physical activity, as evidenced by the establishment of public outdoor areas. Furthermore, the school community—which consists of instructors, parents, and food vendors—emphasizes the advantages of maintaining a nutritious diet and being physically active for one's health (Ministry of Health, 2019).

3. Management and treatment of hypertension and diabetes

HTN management in patients with T2DM is essential for reducing the risk of both microvascular and macrovascular complications of diabetes. Numerous studies have been done on the ideal medications to take and blood pressure targets for diabetic people. According to the previous report by Levesque et al. (2013), it is essential to understand how antihypertensive medications work, their common side effects, and how to use them in a mixture to obtain the targeted pressure. However, only 2/4 of Cambodians with T2DM hadn't been diagnosed (Te et al., 2023). Moreover, in the other reports by Chham et al. (2023) and Chhim et al. (2023), only one-third of the total population achieved a complete continuum of care and good health outcomes from these two NCDs. Those studies also indicated that most of the patients tend to visit private clinics rather than public hospitals when they are heavily ill with their diseases (Chham et al., 2023; Chhim et al., 2023; Te et al., 2023). It's very important for people to have a basic knowledge of HTN and T2DM care in order to prevent serious conditions. Below are the main key factors that contributed to effectively managing and treating HTN and T2DM accordingly.

3.1. Long-life threatening of hypertension and diabetes

HTN in diabetic patients is particularly challenging and significantly increases the risk of end-stage renal disease, coronary artery disease, stroke, peripheral vascular disease, and diabetic retinopathy (Elliott et al., 2000). Importantly, treating HTN in diabetic patients is essential because controlling blood glucose alone is insufficient to optimally reduce the incidence of diabetes-related mortality and myocardial infarction. Additionally, drug therapy is recommended for any HTN, T2DM, or diabetic patient with a blood pressure higher than 130/85 mm/Hg. Factors associated with poor blood pressure (BP) control include male sex, low income, and medication non-adherence, as identified in the Reasons for Geographic and Racial Differences in Stroke (REGARDS) cohort study (McClellan et al., 2006). Therefore, often two or more antihypertensive drugs are required to adequately control blood pressure levels in diabetics, along with lifestyle changes.

3.1.1. Lifestyle intervention

A healthy lifestyle and its impact on HTN treatment have been well demonstrated in the Dietary Approaches to Stop Hypertension (DASH) study. Lifestyle advice includes several interventions: weight loss through reducing daily caloric intake, restricting sodium to less than 2.3 g/day, increased consumption of fruits, vegetables, and whole grains (8–10 servings/day), and low-fat dairy products (2–3 servings/day), avoiding excessive alcohol consumption (no more than two drinks/day for men and no more than one drink/day for women) (Sacks et al., 2001), smoking cessation (Young et al., 2016), and regular exercise, such as aerobic physical activity like brisk walking for about 30 minutes, 3–5 times per

week (James et al., 2014). A change in lifestyle can be beneficial for glycemic control and the management of dyslipidemia as well. It should be recommended for all patients with even mildly elevated blood pressure, although there is insufficient evidence to confirm its effect on reducing cardiovascular events. Diabetic patients with HTN who will benefit most from lifestyle changes are those with systolic blood pressure (SBP) > 120 mmHg or diastolic blood pressure (DBP) > 80 mmHg. For other diabetes patients with SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg, a healthy lifestyle should be combined with pharmacological antihypertensive treatment (Berra et al., 2020; Young et al., 2016).

3.1.2. Pharmacological treatment

Patients with HTN, T2DM, or diabetes with HTN will need medication to control and prevent the development of complications. A combination of two or more drugs appears inevitable, as many diabetic patients exhibit resistant HTN. Such combinations synergistically lower BP and can result in fewer side effects. Moreover, taking multiple drugs in a single pill enhances adherence, leading to better BP control and cost-effectiveness (Bangalore et al., 2007). The choice between monotherapy and combination therapy for antihypertensive treatment in diabetic patients hinges on HTN severity. For patients with BP between 140/90 mmHg and 159/99 mmHg, monotherapy is generally recommended. However, for those with BP ≥ 160/100 mmHg, initial combination therapy with two antihypertensive drugs is advised (De Boer et al., 2017). Studies show that diabetic patients with average BP above 160/100 mmHg treated with a combination achieve BP targets more often than those on monotherapy (Bakris et al., 2003; Feldman et al., 2009). Angiotensin-converting enzyme (ACE) inhibitors, or angiotensin receptor blockers (ARBs), are preferred for initial or early HTN treatment in diabetic patients with albuminuria due to their kidney-protective effects (Ahmad et al., 2023). They can prevent microalbuminuria or slow diabetic nephropathy progression. Due to the lack of clear superiority of ACE inhibitors or ARBs in preventing CVD, the combination of those two drugs is not recommended for diabetic patients. Thiazide diuretics, either alone or in combination with ACE inhibitors or ARBs, can benefit HTN management in diabetics, but caution is needed for potential side effects like hypokalemia, hyperglycemia, and hyperuricemia. Loop diuretics are preferred for those with an estimated glomerular filtration rate < 30 mL/min/1.73 m^2 (Barzilay et al., 2004; Hansson et al., 2000).

Calcium channel blockers (CCBs) are ideal as second- or third-line agents for HTN treatment in diabetics, particularly when combined with RAS blockers. In a trial focusing on cardiovascular event prevention in patients with systolic hypertension, a combination of ACE inhibitors, benazepril and CCB amlodipine, showed lower morbidity and mortality rates than benazepril combined with the thiazide-like diuretic hydrochlorothiazide. While CCBs are generally well-tolerated, common side effects include headache, peripheral edema, and flushing. Beta-blockers are not first-line antihypertensive agents except for heart failure or post-myocardial infarction patients due to their impact on insulin sensitivity and potential diabetes deregulation. Nebivolol, a selective beta-1-blocker, may be an option for diabetic patients pending further trials (Hillebrand et al., 2009). Reduced hypoglycemia perception in beta-blocker users limits their use to strictly indicated cases.

3.2. Healthcare system and improvement for hypertensive and diabetes patients in Cambodia

The incidence of NCDs is increasing in Cambodia, which is presently experiencing an epidemiological shift. Considering a population of about 17 million and an annual health expenditure of 122 USD per capita in 2021 (WHO, n.d.b). The healthcare system in Cambodia faces significant challenges in providing high-quality care for chronic diseases, including T2DM and HTN. These demanding situations consist

of geographical barriers, limited knowledge and skills among healthcare providers, and insufficient medication resources (Nang et al., 2019). To deal with these problems, a comprehensive and multipronged approach is needed, regarding collaboration between the government, external funding agencies, the private sector, and communities (Nang et al., 2019). Integrated healthcare, which includes behavioral interventions and using a Health Risk Assessment (HRA), is recommended to improve the high-quality and effects of care for these conditions (O'Donnell et al., 2020). Health care reform efforts, inclusive of the development of a public health service system, have been proven to enhance equity, quality, efficiency, and social accountability within the care of T2DM and HTN patients in other settings. However, the overall performance of current social health protection schemes in rural Cambodia in providing access to treatment for these conditions is mixed, with disease-specific interventions showing better results (Bigdeli et al., 2016).

The government, particularly the Ministry of Health, may need to consider expanding the capability of healthcare services at the health center level, including qualified staff, medication availability, various disease diagnoses such as HTN and T2DM, and other NCDs that can provide effective treatment and easier conditions for people in rural or urban areas (Nang et al., 2019). To cope with this huge development and improvement, other related organizations and stakeholders also need to be involved.

4. Prevention of hypertension and diabetes

There is currently no way to prevent type 1 diabetes mellitus. On the other hand, there are numerous efficient methods for preventing T2DM and HTN in order to avoid complications and early mortality. These policies and practices help everyone stay healthy, regardless of whether they have diabetes. Some daily activities include exercising regularly, eating healthily, avoiding smoking, limiting alcohol consumption, and controlling BP and lipids. The best way to manage T2DM is to get it diagnosed and treated as early as possible. If diabetes is not properly managed, your health will suffer. Access to basic diagnostics, such as blood glucose testing, should be available in PHC settings to help people get the information they need to care for themselves. Patients will need periodic specialist evaluations or treatment for complications. Regardless of the type of diabetes a person has, there are cost-effective interventions that can improve patient outcomes. These interventions include controlling blood glucose through a combination of diet, physical activity, and medication if necessary; controlling BP and lipids to reduce the risk of CVD and other complications; and regular examinations for damage to the eyes, kidneys, and feet to facilitate early treatment (WHO, 2022a; WHO, 2022b).

The Cambodian government has unveiled a six-step strategy to tackle NCDs effectively. First, it seeks to raise public awareness about the costs of NCDs and the benefits of cost-effective interventions, targeting the younger population through economic growth and health improvement advocacy. Second, there's a focus on strengthening tobacco control by enforcing laws, increasing tobacco taxes, and banning public smoking and advertising, supported by UN-backed evidence. Third, comprehensive salt reduction policies are proposed, including targets for salt in foods, sodium content labeling, and banning *trans*-fats, coupled with public education. Fourth, physical activity is promoted via awareness campaigns and health-focused urban planning, featuring events like "fun runs" and improved infrastructure. Fifth, health taxes are proposed, targeting tobacco, alcohol, and sugary drinks to both reduce consumption and fund NCD prevention. Lastly, national coordination is emphasized, fostering collaboration among ministries, NGOs, and civil society to achieve unified NCD prevention aligned with sustainable development goals (Kulikov et al., 2019).

However, according to the context of Cambodia, the government should focus on promoting and advertising information regarding HTN and T2DM control and prevention through official social media, TV, radio, and street banners. Setting up a strategy plan for encouraging people to check up on their health regularly. Also expanded the capacity of the healthcare system, which provides easy access and effective treatment services to patients accordingly.

5. Challenges and opportunities

The Cambodian government has confronted a few demanding situations in order to improve the quality of the healthcare system. Firstly, healthcare infrastructure: Cambodia's healthcare system faces demanding situations in terms of infrastructure, human capital, and funding. Strengthening primary healthcare offerings and integrating NCD management into primary care can improve the early detection and control of HTN and T2DM (Chham et al., 2023). Secondly, health education and awareness: there is a need for comprehensive health education and consciousness packages targeting the general population, especially older adults. Promoting a healthy life, early detection, and regular health check up and monitoring can help lessen the burden of HTN and T2DM as preventive care strategies (Steinman et al., 2020; Te et al., 2023). Thirdly, policy and governance: effective policies and governance are important for addressing the NCD burden in Cambodia. Policy interventions, which include taxation on dangerous foods, subsidies for wholesome ingredients, and regulations on tobacco and alcohol products, can make a contribution to the prevention and manipulation of HTN and T2DM (Kulikov et al., 2019). All the factors raised above have been considered because of the lack of information and education on the dangers and effects of high blood pressure and diabetes conditions. Nevertheless, continuous initiatives by the government, non-governmental organizations, and international partners seek to raise public awareness, promote preventive care (screening), and increase access to quality care.

6. Conclusion

Overall, HTN and T2DM are significant public health demanding situations in Cambodia, with increasing prevalence rates and related morbidity and mortality. Addressing those NCDs requires a multi-sectoral approach regarding healthcare structures, communities, and policymakers. Strengthening healthcare infrastructure, improving health education and consciousness, and implementing effective policies are crucial steps towards reducing the burden of HTN and T2DM in Cambodia.

Author contributions

Sorn, V. conceptualizations, wrote and edited the manuscript; Eat, S., Chhon, Y., and Muk, L. wrote, and reviewed the manuscript. All authors contributed to the article and approved the submitted version.

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Conflicts of interest

The authors declare no competing interests.

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