

The Impact of Sharing a Shisha (Hookah) Mouthpiece during Smoking: Case of Tuberculosis and Hepatitis in South Saharan Africa

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Abstract

This study investigates the health implications of sharing a shisha (hookah) mouthpiece during smoking, with a focus on tuberculosis (TB) and hepatitis prevalence in Sub Saharan Africa. It examines shisha smoking behavior patterns and associated risks of disease transmission among those sharing a common mouthpiece. Through literature review and empirical data analysis, the research highlights epidemiological factors driving TB and hepatitis transmission within the context of shisha smoking in Sub Saharan Africa. Exploring cultural, social, and behavioral determinants influencing shisha mouthpiece sharing, the study offers insights into interventions and public health strategies. It emphasizes the need for targeted health education campaigns, policy interventions, and community-based initiatives to promote safer smoking practices. Immediate coordinated public health interventions, including educational campaigns and regulatory measures, are recommended. Collaboration among healthcare professionals, policymakers, and communities is essential. These insights deepen the understanding of challenges posed by communal shisha smoking in Sub Saharan Africa, laying the groundwork for evidence-based interventions to reduce TB and hepatitis transmission and enhance overall health outcomes in the region. This research underscores the urgency of addressing the risks associated with shisha smoking, aiming to mitigate disease transmission and improve population health in Sub Saharan Africa.

Keywords

Shisha (Hookah) Mouthpiece, Tuberculosis, Hepatitis, Sub Saharan Africa

1. Introduction

Shisha smoking, with its centuries-old tradition and widespread appeal across diverse cultures, has evolved into a global phenomenon, captivating individuals from various corners of the world. However, amidst the alluring swirls of shisha smoke, a pressing reality demands attention: the potential transmission of infectious diseases, notably Tuberculosis and Hepatitis, through the shared use of shisha mouthpieces. This study embarks on a comprehensive examination of this critical aspect of shisha culture within the specific context of Sub Saharan Africa [1].

Diving deep into the intricate interplay between shisha smoking, Tuberculosis, and Hepatitis, our exploration encompasses historical, cultural, and socio-economic dimensions. These dimensions underscore the urgent necessity for targeted interventions and informed policies tailored to the unique challenges faced by Sub Saharan Africa [2].

Despite its rich history and cultural significance, shisha smoking finds itself under the spotlight of public health concerns. The World Health Organization has long underscored the detrimental impacts of tobacco use on global health and sustainable development. Originating in the 16th century, shisha has transcended borders to become a cultural symbol, notably in the Eastern Mediterranean, the Middle East, Asia, and increasingly, Sub Saharan Africa. Its popularity surge in recent decades, especially among adolescents, young adults, and women, highlights the need for heightened awareness and intervention strategies [3].

Nevertheless, the allure of shisha's mystique often obscures its inherent health risks. This study delves into the intricate tapestry of shisha smoking, shedding light on its undeniable links to the transmission of Tuberculosis and Hepatitis. Despite common misconceptions that shisha poses fewer health risks than traditional cigarette smoking, mounting evidence suggests the opposite. Shisha smoking is associated with a myriad of health hazards, ranging from an increased risk of various cancers to a spectrum of respiratory, cardiac, and reproductive complications [4].

Our exploration unfolds across several stages. We commence by examining the prevalence of shisha smoking in Sub Saharan Africa, considering the socio-economic backdrop that influences its expansion. Subsequently, we provide a comprehensive overview of interconnected health risks and infectious diseases, particularly Tuberculosis and Hepatitis, prevalent in the region. We then delve into the unique challenges faced by Sub Saharan Africa, marked by limited healthcare infrastructure and a burgeoning population susceptible to infectious diseases. Finally, drawing insights from recent studies, we discuss potential interventions, educational initiatives, and policy measures aimed at mitigating the growing impact of shisha-related health risks.

In this journey of exploration, we illuminate not only the potential health hazards but also the profound socio-economic implications associated with the shared use of shisha mouthpieces. It is through a nuanced understanding of cul-

tural traditions, global health concerns, and local contexts that we can chart a course toward a healthier future for Sub Saharan Africa and beyond.

2. Literature Review

The World Health Organization underscores tobacco use as a major, preventable global health issue and a hindrance to sustainable development due to its societal, economic, and environmental impact [5]. Regardless of a country's development stage, tobacco use remains a concern. Shisha (hookah), an ancient tobacco-smoking method invented by Hakim Abul-Fath Gilani in the 16th century, aimed to purify smoke through water but lacks medical validation [6]. Although, the tobacco industry has advanced its product offerings through diverse devices, such as e-cigarettes, vaping apparatus, and water pipes—commonly referred to as hookah, shisha, nargileh, argileh, hubble-bubble, and goza, depending on the country of origin [7]. This phenomenon has persisted for centuries as an integral component of cultural traditions across various regions, encompassing the Eastern Mediterranean, the Middle East, and Asia. Presently, this practice is undergoing rapid expansion, garnering escalating popularity within Sub Saharan African nations, particularly among adolescents and young adults, including women, over the preceding two decades [8].

According to Qasim and colleagues [9], three frequently utilized variants of shisha tobacco are Mouassal, Jurak, and Tumbak. Each of these contains distinct additives like apple, chocolate, coconut, licorice, or watermelon, which allure a larger number of individuals towards consumption, often resulting in nicotine addiction and other tobacco-related substances. This behavior significantly contributes to the prevalence of infectious and communicable diseases, particularly within the Sub Saharan Africa region.

To initiate an analysis of potential gaps in the existing literature regarding the topic of “The Impact of Sharing a Shisha (Hookah) Mouthpiece during Smoking: A Case Study of Tuberculosis and Hepatitis in Sub Saharan Africa,” it is essential to conduct a comprehensive review of current research, incorporating the latest available knowledge to ensure accuracy and relevance. Notably, there is a substantial scarcity of regional studies that specifically investigate shisha utilization within the context of Sub Saharan Africa. In their study conducted among university students, [10] reported a high prevalence of shisha use, which was associated with a general lack of awareness regarding the associated health risks.

Furthermore, it is imperative to incorporate robust longitudinal studies that monitor disease transmission over extended periods to address the existing limitations. According to Pandey [11], the examination of global trends has led epidemiologists to assert that the escalating usage of shisha (hookah) among young individuals signifies the onset of “the second global tobacco pandemic,” following the emergence of conventional cigarettes and e-cigarettes.

From the above studies, several gaps can be identified: inadequate exploration of hookah hygiene practices, an emphasis primarily on tuberculosis and hepati-

tis, potentially overlooking other relevant diseases, limited examination of socioeconomic and cultural factors, a scarcity of intervention studies, inadequate data on the disease burden attributed to shisha smoking, a lack of knowledge about shisha smokers' awareness and practices regarding disease risks, and neglect of potential gender and age disparities in shisha smoking practices.

However, we applaud the Rwandan government for its prompt and resolute action. Commencing on Friday, December 15th, 2017, Rwanda implemented a nationwide prohibition on the consumption of water-pipe tobacco, commonly known as shisha. This initiative was led by the Ministry of Health, underscoring the nation's dedication to safeguarding the health of its citizens, especially the youth and future generations, against the hazards associated with non-communicable diseases. While we had aspired to see this exemplary move inspire other Sub-Saharan African countries, regrettably, no such decision has been adopted by neighboring nations [12]. The ban on shisha use in Rwanda follows earlier bans in other East African countries, such as Uganda in 2015 and Tanzania in 2016 [13]. Unfortunately, there has been substantial attention directed toward the dangers of cigarette smoking, along with increasing efforts to discourage cigarette use. In contrast, relatively less attention has been devoted to the hazards associated with shisha use [14].

The consumption of shisha in Africa has become a concerning issue among young students. In this issue of the AJTCCM (define this abbreviation as it is used here for the first time in the manuscript), Ouédraogo and colleagues from Ouagadougou, Burkina Faso, provide an account of the awareness and prevalence of shisha smoking among students in Burkina Faso [15]. While tobacco smoking is typically synonymous with cigarette use, it is important to note that various alternative methods of tobacco consumption also exist.

3. The Prevalence of Shisha in Sub Saharan Africa

The World Health Organization (WHO) estimates that approximately one billion individuals are currently active smokers, with 80% of this population residing in low-income and middle-income countries (LMICs). This number is projected to increase to 1.7 billion by the year 2025. Sub-Saharan Africa stands as a particularly vulnerable region in this context. Despite being in the early stages of a tobacco epidemic, it is anticipated to experience the most significant surge in tobacco consumption globally. Regrettably, this surge has not been met with the implementation of robust, evidence-based tobacco control policies [16].

Among adolescents and adults, there persists a misconception among shisha smokers, wherein they commonly hold the belief that shisha smoking poses fewer risks compared to cigarette smoking [17]. Nonetheless, the act of consuming tobacco through a shisha pipe entails a plethora of equivalent or even heightened health hazards when juxtaposed with cigarette smoking [18]. Consequently, a myriad of adverse health consequences can be attributed to shisha smoking. To illustrate, it is evident that shisha smoking amplifies susceptibility

to various types of cancer, such as esophageal, gastric, and lung cancers [19]. Additionally, an array of respiratory conditions, including abnormal pulmonary function, emphysema, tuberculosis, and chronic bronchitis, is prevalent among shisha smokers. Cardiac ailments, notably ischemic heart diseases, along with osteoporosis, obstetrical and prenatal complications, periodontal diseases, and even liver afflictions such as hepatitis, are among the panoply of health issues linked to shisha smoking [20].

Within Sub Saharan Africa, 34 out of the 53 countries are classified as low-income economies, solidifying its status as the epicenter of infectious diseases. As asserted by Boutayeb, A. [21], the impact of infectious diseases on African nations has transcended the realm of a crisis solely affecting the healthcare sector. Instead, it has evolved into a multidimensional challenge that spans all sectors. These diseases persist as the leading causes of mortality on the African continent. Consequently, a range of established, emerging, and re-emerging diseases, such as malaria, tuberculosis, HIV/AIDS, cholera, meningitis, hepatitis, schistosomiasis, lymphatic filariasis, sleeping sickness, Ebola, SARS, SARS-COV-2 (Covid-19), and others, continue to contribute to morbidity and mortality across diverse demographics in developing countries at large. This impact is particularly pronounced within the African continent.

A study conducted in Ethiopia among high school students aged 13 - 22 years revealed a prevalence of 2.6% for ever using shisha, and 0.6% for current shisha smoking among adolescents attending high schools in Ethiopia. While these prevalence rates are relatively low, they remain a cause for concern due to the health risks associated with shisha smoking, particularly in a country where the prevalence of tobacco use is very low. On the other hand, several independent risk factors were identified for ever-shisha smoking. These included having friends who smoke shisha, previous use of cigarettes, khat, marijuana, smokeless tobacco, as well as students who receive financial allowances from their parents. Factors such as students' age, gender, and perceptions regarding the health effects of shisha were not found to be significantly associated with the outcome variable [22].

Another study carried out in South Africa has demonstrated a notable rise in smoking rates among students in grades 8 to 12 who possess an understanding of the hazards associated with shisha smoking during their childhood. It is advisable to foster awareness of these risks at an early age. One significant determinant influencing the adoption of shisha smoking among adolescent students is the presence of a family member who engages in such behavior. Hence, campaigns aimed at discouraging both smoking and shisha consumption among adults are equally imperative [23].

Lasebikan *et al.* [24] found that shisha smoking is prevalent in Nigeria night-clubs, displaying unique demographic patterns distinct from cigarette smoking. Despite its gender-based nature, with higher usage among men, the early initiation of shisha among women raises crucial epidemiological implications for re-

productive health. Alarming, the substantial prevalence of shisha smoking is underscored by the resolute unwillingness of smokers to quit, particularly concerning as many are high-achieving professionals in their prime. These findings emphasize an urgent need for robust public health interventions and policies targeting shisha smoking in African nations.

Statistical evidence suggests that in Africa, while empirical data on shisha remains limited, studies have revealed a significant increase in shisha consumption among urban youth in Rwanda (26.1%), Uganda (36.4%), and Nigeria (44%). From a pragmatic perspective, it is advisable for shisha consumption to decrease rather than escalate among youth. This recommendation stems from the fact that shisha poses considerably greater health risks when compared to alternative tobacco consumption methods, notably heightening the risk of respiratory damage among its users [25].

Adu and colleagues have linked the reasons behind the high consumption of shisha among youth in Sub Saharan Africa to behavioral factors such as impulsiveness and the normalization of shisha consumption on social media platforms. Despite these influences, the inclination of youth to smoke shisha is strongly associated with positive perceptions, including the appealing flavors of shisha tobacco, such as chocolate and strawberry, and the social aspect of smoking it during group gatherings.

Yet another study conducted in The Gambia presents data that aligns with the initial phases of an emerging smoking epidemic. This study also raises apprehensions regarding the potential significance of shisha smoking, particularly among girls, a factor that might not have been duly acknowledged before. Targeted interventions tailored to specific genders and age groups are imperative to curtail the current prevalence rates and to mitigate the likelihood of higher uptake in the future. Notably, despite The Gambia's lack of a prominent tobacco industry presence in comparison to many other Low- and Middle-Income Countries (LMICs), these notions hold weight [26].

Therefore, there exists considerable variability in the prevalence of shisha (hookah) usage among different communities. However, it is evident that there has been a significant overall increase in its usage within a relatively brief timeframe. Longitudinal studies are crucial for enhancing our comprehension and assessment of usage patterns, sociodemographic traits, and health hazards among diverse populations that are either exposed to or engage in shisha use. These studies will ultimately contribute to the formulation of more stringent policies, particularly those pertaining to usage among highly vulnerable groups, such as pregnant women and adolescents [27].

Hence, social media constitutes a significant factor that has normalized the consumption of shisha tobacco. The extensive portrayal of shisha on social media platforms such as Facebook, Twitter, Instagram, and YouTube depicts it as an acceptable behavior rather than a detrimental one. The frequent positive depiction of shisha on social media platforms raises public health concerns, partic-

ularly since a substantial portion of the youth population utilizes smartphones, leading to a rapid global proliferation of this behavior. This trend is now having a profound impact on the youth population aged 12 - 30 in Sub Saharan Africa (SSA) [28].

4. Shisha and Infectious Disease: Tuberculosis and Hepatitis

As per the World Health Organization (WHO), tuberculosis (TB) stands as the ninth leading cause of worldwide mortality and represents the primary outcome of infection by a singular infectious agent, *Mycobacterium tuberculosis*, commonly known as Koch Bacillus [29]. This impact surpasses even that of HIV/AIDS, with a predominant impact on the respiratory system. TB is transmitted through airborne means when individuals with pulmonary TB expel droplets containing the bacteria through coughing, sneezing, or other means involving saliva or blood. Inhalation of a small number of these microbes is sufficient to result in infection. Noteworthy is the fact that more than a quarter of all TB-related deaths are concentrated within the African Region [30].

The emergence of multidrug-resistant TB (MDR-TB) also presents a significant threat to public health security, endangering the progress achieved in the fight against TB. Consequently, the effort to eliminate TB pertains not only to matters of public health but also encompasses a developmental challenge and opportunity [31]. Despite the prevailing misconception that hookah use is less harmful than cigarette smoking, various studies indicate a potential risk of transmitting communicable diseases. This risk stems from the unhygienic conditions often associated with hookah apparatus and the practice of sharing mouthpieces, which has been linked to an increased incidence of tuberculosis cases [32].

Furthermore, the WHO's post-2015 End TB Strategy, sanctioned by the World Health Assembly in 2014, aims to eradicate the global TB pandemic in alignment with the newly adopted Sustainable Development Goals. Countries are obligated to attain an 80% reduction in TB incidence and a 90% decrease in TB-associated mortality by the year 2030 [33]. Moreover, the aspiration encompasses alleviating the financial burden on households affected by TB. It is worth noting that the triumph of this Strategy hinges on its adaptability to various national contexts [34].

In contrast, Hepatitis constitutes liver inflammation, caused by a diverse range of infectious viruses and non-infectious agents, resulting in a variety of health complications, some of which can be fatal. The hepatitis virus consists of five main strains, classified as types A, B, C, D, and E. While all of them lead to liver-related issues, they differ significantly in terms of transmission methods, disease severity, geographical distribution, and preventive measures [35]. Particularly noteworthy are types B and C, which lead to chronic illness in hundreds of millions of individuals and collectively represent the primary causes of liver cirrhosis, hepatic carcinoma, and fatalities linked to viral hepatitis. The global im-

fect of hepatitis B or C is substantial, affecting an estimated 354 million individuals worldwide, with testing and treatment remaining inaccessible for the majority [36].

According to the latest Global Burden of Disease assessments, viral hepatitis is accountable for approximately 1.34 million deaths each year, a number on par with annual fatalities caused by HIV/AIDS (1.3 million) and malaria (0.9 million) [37].

Moreover, a study conducted by the World Health Organization (WHO) has ascertained that by 2030, about 4.5 million untimely demises in low- and middle-income nations could be averted through the implementation of vaccination, diagnostic assays, pharmaceutical interventions, and educational campaigns. WHO's worldwide strategy for hepatitis, ratified by all its member states, endeavors to curtail fresh hepatitis infections by 90% and associated mortalities by 65% within the timeframe spanning 2016 to 2030 [38].

Recently, studies have identified the presence of bacterial lipopolysaccharide (LPS) in Shisha (hookah) mainstream smoke, and fungal biomass has also been detected [39]. Numerous studies have indeed established a correlation between shisha (hookah) smoking and infectious diseases, which can be attributed to the communal use of water pipes among individuals. For instance, Hani and colleagues observed the presence of 40 bacterial genera among the three water pipes they investigated [40]. Martinasek and colleagues observed the highest prevalence and diversity of bacteria in the mouthpiece of the waterpipe. However, this study not only aimed to identify both Gram-positive and Gram-negative bacteria but also aimed to isolate antibiotic-resistant bacteria from the mouthpiece of the sampled water pipes, based on data collected from 10 shisha bars. Mycobacterium tuberculosis, hepatitis viruses, and other spore-producing fungi have also been isolated from water pipes, demonstrating their potential for transmission to users [41].

A study conducted by Osman and colleagues [42] uncovered that Tuberculosis (TB) constitutes a significant and pressing public health concern within South Africa, characterized by consistently elevated TB-associated mortality rates. Statistical data from 2019 elucidated that around 360,000 individuals contracted tuberculosis in South Africa, with 58% of these cases occurring concurrently with HIV infection, thereby contributing to a notable 17% mortality rate. Despite the gravity of these concerning statistics, the effectiveness and caliber of the healthcare services provided remain suboptimal, consequently resulting in unsatisfactory health outcomes. Furthermore, South Africa bears a substantial burden of tuberculosis (TB), positioning it as a nation with one of the world's largest HIV epidemics and an extensive antiretroviral therapy (ART) programme.

Theoretically, sharing the mouthpiece during group hookah smoking could potentially facilitate the transmission of pathogens, including viruses, bacteria, and fungi. For example, a study conducted by Qasim and colleagues [43] highlighted the potential risk of transmitting communicable diseases like hepatitis C

when individuals with bleeding gums share the mouthpiece. Additionally, the unhygienic conditions of the hose and water in the hookah apparatus may foster the growth of mycobacteria and hepatitis viruses, thereby increasing the potential for tuberculosis and hepatitis transmission.

A study conducted in Vanga, Democratic Republic of Congo (DRC), centered on pregnant women receiving antenatal care—a significant life event marked by regular and consistent interactions with the healthcare system. This situation renders women vulnerable since they are susceptible to various pregnancy-related conditions, including infectious diseases such as different strains of viral hepatitis and *Mycobacterium Tuberculosis* [44].

It is important to note that viral hepatitis B (HBV) and C (HCV) infections can have adverse effects on maternal and child health within communities, especially in rural areas [45]. There is a globally recognized estimated incidence rate of 257 million individuals who test positive for HBV surface antigen (HBsAg). Despite the preventability of this viral disease through vaccination, the prevalence of chronic HBV continues to rise. As a result, the practice of sharing Shisha pipe mouthpieces inadvertently leads to the exchange of germs through saliva and potential exposure to infected respiratory droplets and blood. This encompasses pathogens like *Mycobacterium tuberculosis*, hepatitis viruses, and other communicable diseases.

A comprehensive examination of the health implications associated with smoking shisha (hookah) highlights significant exposure to various harmful substances. Shisha smoking is known for its substantial contribution to the intake of polycyclic aromatic hydrocarbons (PAHs), volatile aldehydes, carbon monoxide, nitric oxide, nicotine, furans, and nanoparticles. These agents are implicated in a broad spectrum of deleterious health outcomes, including cardiovascular diseases, cancer, and respiratory ailments [46]. Furthermore, the common practice of sharing a water-pipe mouthpiece poses a substantial risk of transmitting communicable diseases, such as tuberculosis, hepatitis, and numerous others. The water contained within the shisha apparatus may become contaminated, thus facilitating the spread and transmission of diseases [47].

According to the World Bank, in the South Saharan region, over 35 percent of the population is estimated to be living in extreme poverty, in stark contrast to the 9 percent in South Asia and only 1 percent in East Asia and the Pacific. In this context, an individual's socioeconomic status serves as a significant determinant of health inequities because it shapes access to a range of flexible resources, including knowledge, financial means, political influence, social status, and social connections. These resources enable individuals to take actions aimed at avoiding health risks and mitigating the adverse impacts of poor health [48].

James and colleagues [49] in their study spanning pages 9 to 12, conducted a cross-sectional investigation between 2013 and 2018, utilizing data obtained from the Global Youth Tobacco Survey (GYTS) across 22 African nations. The study aimed to assess the prevalence of current tobacco product usage among adolescents, revealing an overall rate of 19.1%. Furthermore, it was observed that

males (23.7%) exhibited a higher prevalence of current usage compared to females (13.7%). Notably, Zimbabwe and Morocco displayed the highest rates at 47.1% and 12.6%, respectively, while Nigeria (44%), Uganda (36.4%), Mozambique (24.6%), Rwanda (26.1%), and Algeria (4.5%) reported varying prevalence figures among school-going adolescents within these 22 African countries, signifying a significant public health concern. Consequently, it is imperative for governments and other relevant stakeholders to fully implement anti-tobacco utilization campaigns as part of their public health initiatives.

Shisha users are not only susceptible to the transmission of communicable diseases, but the inhalation of noxious particles and gases from cigarette smoke has also been linked to the onset of an abnormal inflammatory response, ultimately contributing to the development of chronic obstructive pulmonary disease (COPD) and tuberculosis, both of which can result in premature death [50]. Consequently, it is reasonable to infer that shisha (hookah) smoking may present analogous risks in this context. Additionally, contaminated shisha equipment or surfaces within shisha establishments can also contribute to the transmission of hepatitis viruses if proper hygiene and sterilization measures are not implemented.

This comprehensive literature review aims to synthesize existing research in order to evaluate the health risks associated with the communal use of shisha mouthpieces. The focus of this review centers on instances of Tuberculosis and Hepatitis within Sub Saharan Africa while concurrently providing informative insights and recommendations aimed at promoting safer practices.

5. Healthcare Challenges that Sub Saharan Africa

Access to high-quality healthcare services, whether they are preventive or therapeutic in nature, is a fundamental requirement for a population to attain and maintain good health and adopt healthy lifestyles. Within this framework, the concept of universal health coverage (UHC), as integrated into the 2030 Agenda for Sustainable Development, is delineated by the World Health Organization (WHO) as the provision of unfettered access to comprehensive health services of adequate quality, yielding effective outcomes, and devoid of imposing financial hardships upon all individuals and communities [51]. Nevertheless, a substantial number of individuals in Sub Saharan Africa encounter obstacles in obtaining essential healthcare services due to factors such as geographical isolation, insufficient infrastructure, and inadequacies in healthcare facilities.

Simultaneous with these demographic shifts, Sub Saharan Africa is undergoing evolving epidemiological trends, notably transitioning towards a “dual” burden of disease. There is a growing prominence of non-communicable diseases (NCDs), coexisting with the persistence of infectious diseases that continue to exert a considerable toll on morbidity and mortality, particularly among the pediatric population. Furthermore, the region bears a disproportionate burden of ailments such as HIV/AIDS, malaria, tuberculosis, hepatitis, and neglected trop-

ical diseases. These maladies exert a profound impact on both the health and the economic well-being of the populace [52].

Challenges that are not given due consideration can result in significant disruptions and malfunctioning, leading to disasters within communities or societies. Such disruptions can cause devastation for individuals, as well as economic, material, and environmental losses. Challenges such as Healthcare Infrastructure, Health Workforce Shortages, Lack of Preventive Care, Insufficient Funding, and Maternal and Child Health & Malnutrition can create an imbalance between local health resource supply and demand, often causing damage to healthcare infrastructure. Regardless of how well-organized a health system might be, these challenges remain a cause for concern [53]. The same authors have noted an increase in the frequency and number of healthcare challenges worldwide. The African continent, particularly Sub Saharan Africa (SSA), bears a significant burden of challenges and disasters due to natural forces, man-made events, and infectious diseases. Healthcare infrastructure deficiencies in many areas lead to shortages of medical facilities, healthcare professionals, and equipment, thus hindering proper care provision and emergency responses for quality care to the growing population.

Over half of Sub Saharan Africans live in extreme poverty, surviving on less than US\$1.90 per day, which limits their ability to access food and healthcare. According to Watson, and colleagues [54] the Lancet series suggests that life course interventions are required to address malnutrition and healthcare for both mothers and their children. This involves optimizing diet quality and ensuring easy access to primary healthcare, implementing dual-purpose interventions that address both challenges simultaneously. It's known that maternal and child mortality rates in Sub Saharan Africa are among the world's highest due to limited access to maternal and child health services, inadequate nutrition, and insufficient healthcare during pregnancy and childbirth. Consequently, malnutrition remains a significant issue, leading to impaired growth and development among children and contributing to overall poor health in the population.

Additionally, we can include other challenges like Lack of Preventive Care, Insufficient Funding, Health Information Systems, and Cultural and Societal Factors. According to the World Health Organization, preventive care aims to prevent diseases through early detection, with the goal of improving people's quality of life in their communities. Measures such as vaccinations and health education programs often fall short, leading to preventable illnesses and outbreaks. Many countries in the region struggle to provide these essential services, manage health data, and respond effectively to health crises.

Otsen and colleagues [55] revealed that African countries allocate only 5 to 6% of their Gross Domestic Product to healthcare. Insufficient funding limits critical resources, medicines, and equipment availability, triggering or exacerbating conflicts, political instability, and social unrest, which disrupt healthcare delivery and infrastructure, making consistent care challenging and addressing

the rising rate of Non-Communicable Diseases difficult. As the region experiences demographic and lifestyle changes, limited healthcare resources and inadequate health information systems hinder disease pattern tracking, managing patient data, and making informed policy decisions.

Countries in the region face a dual burden of disease: highly prevalent communicable diseases and rapidly increasing noncommunicable diseases. The HIV/AIDS pandemic, malaria, and the resurgence of tuberculosis compound this situation. Factors such as low literacy levels, especially among women, inadequate sanitation, food insecurity, civil strife, and risky behaviors (e.g., smoking, sedentary lifestyles, and unhealthy diets) underlie many health constraints in the region. Additionally, poverty exacerbates the impact of these factors on health by perpetuating poor health outcomes, which, in turn, perpetuates poverty.

Governments of Sub Saharan Africa (SSA) states must demonstrate the political will to integrate new health technology into public healthcare systems. This is a crucial step in addressing how cultural beliefs and practices impact healthcare-seeking behaviors, often leading to delayed or inadequate care [56].

Tackling these challenges necessitates a comprehensive approach, including increased investment in healthcare infrastructure, workforce training, disease prevention and control programs, and the development of robust health systems and policies. International collaboration, funding, and support are also crucial for making substantial improvements in healthcare across Sub Saharan Africa.

In spite of the escalating and uncontrollable prevalence and incidence of two infectious diseases linked to shisha smoking, particularly through the sharing of mouthpieces, hepatitis remains a silent threat due to its asymptomatic nature. Africa carries one of the highest burdens of liver cancer associated with hepatitis B, ranking as the second most common cause of cancer-related premature mortality in men and the third most common in women throughout Sub Saharan Africa [57].

In contrast, despite the significant efforts by African leaders to improve the healthcare system, a major issue that remains to be addressed is the widespread consumption of tobacco in African nations, which poses significant health challenges. Tobacco use carries substantial health implications for people in Sub Saharan Africa (SSA), similar to its impact elsewhere. The economic burden of tobacco use drives various chronic diseases, including heart disease, stroke, cancer, and respiratory ailments, further straining limited healthcare resources in SSA countries [58].

Furthermore, SSA nations grapple with persistent issues such as environmental impact, secondhand smoke exposure, interference with development, and targeting vulnerable populations. Tobacco companies often use aggressive marketing tactics to target vulnerable groups, including youth, women, and low-income individuals, contributing to elevated rates of tobacco use and associated health complications among these demographics [59]. Given that shisha consumption is permitted in SSA countries, it exacerbates diseases within African communities, particularly through the exposure of youth and elderly individuals who consume

shisha and expose others to its effects. Consequently, shisha consumption significantly amplifies the burden of chronic diseases, notably chronic obstructive pulmonary diseases (COPDs), tuberculosis, and hepatitis, within these communities [60].

Tuberculosis (TB) has been a paramount concern for health authorities in Sub Saharan Africa. In 2019, approximately 1.4 million TB cases were diagnosed in the region, but epidemiologists estimated an additional 1 million cases went undiagnosed and untreated. Furthermore, the efforts initiated by the World Health Organization (WHO) aimed at reducing TB incidence by 20% by 2020, decreasing the mortality rate by 35% by 2015, and ensuring that no TB-affected households faced catastrophic costs. Unfortunately, these objectives face challenges due to the resurgence of these diseases, largely attributed to the engagement of the youth in shisha consumption behaviors.

To mitigate the high incidence of Tuberculosis and Hepatitis, rigorous policies must be implemented to address shisha consumption behaviors.

6. Preventive Measures and Recommendations

While it may be viewed as a historical affliction, the implementation of preventive measures against tuberculosis remains crucial in impeding the progression of tuberculosis infection to a fully developed disease among individuals who have been exposed. These measures hold the potential to protect both the affected individuals and the broader community from the impact of tuberculosis. Moreover, the World Health Organization (WHO) has formulated comprehensive guidelines and operational handbooks aimed at accelerating the global expansion of treatment coverage. Supplementary resources, such as the Prevent TB platform, play a pivotal role in aiding national healthcare systems in fortifying their strategic information infrastructure [61].

Preventive measures for reducing the impact of sharing a shisha (hookah) mouthpiece during smoking, particularly in Sub Saharan Africa concerning Tuberculosis (TB) and Hepatitis, involve education, regulation, and community engagement [62].

Education campaigns utilize targeted messaging in settings such as schools, hospitals, markets, and mass media to emphasize risks and cultural sensitivity. Local languages, traditions, and community leaders facilitate effective message transmission [63]. Regulatory measures, community engagement, peer education, healthcare access, and research are vital in addressing the impact of sharing a shisha mouthpiece on TB and Hepatitis transmission in Sub Saharan Africa [64]. A comprehensive approach encompassing education, regulation, community engagement, healthcare access, and research is necessary to raise awareness, mitigate risks, and promote healthier behaviors among shisha smokers.

Boachie and colleagues [65] estimated that 25,708 deaths among persons aged 35 - 74 in 2016 were smoking-attributable. The economic cost of smoking was R42 billion (US\$2.88 billion), with R14.48 billion attributed to healthcare costs.

The economic cost of smoking accounted for 0.97% of the South African GDP in 2016, while smoking-related healthcare costs comprised 4.1% of total South African health expenditure. Costs are lower for women due to their lower smoking prevalence.

Furthermore, a study in Uganda found that 458 (86.4%) youths had low knowledge of the health effects of shisha, and 193 (36.4%) smoked shisha. The majority smoked flavored and sweetened tobacco, smoked weekly, smoked in the company of friends, and shared shisha pipes. Factors associated with shisha smoking include smoking cigarettes (adjusted odds ratio [aOR]: 5.91, 95% Confidence Interval [CI]: 3.86 - 9.05); positive attitude (aOR: 3.89, 95% CI: 2.50 - 6.05); urban residence (aOR: 3.98, 95% CI: 1.99 - 8.00); and older age [25 - 30 years] (aOR: 2.13, 95% CI: 1.37 - 3.22) [66].

A study carried out in Senegal pertaining to the prevention and treatment of Hepatitis B in women affirms that curtailing the Mother-to-Child Transmission (MTCT) of Hepatitis B in Sub Saharan Africa (SSA) is an essential prerequisite for achieving the ambitious objective of hepatitis B elimination by 2030, as outlined by the World Health Organization [67]. In their study, Ajudua and Mash concluded that community health workers (CHWs) played a central role in the success of active surveillance for tuberculosis (TB). The intricate interplay of social determinants of health and TB transmission within communities necessitated CHWs to cultivate trusting relationships that addressed these issues, significantly impacting TB disease, and facilitated client linkage to healthcare services [68].

Conversely, Khan and colleagues [69] found that smoking exerts a profound influence on TB and constitutes a significant barrier to treatment success. Consequently, the findings suggest that smoking cessation interventions represent an effective strategy for reducing treatment failure, curbing drug resistance, and enhancing the health outcomes of individuals within their communities.

Statistics indicate that in South Africa (SA), over 1.9 million people are chronically infected with hepatitis, particularly HBV. Furthermore, 70% of all Black chronic carriers are infected with HBV sub-genotype A1. Despite the implementation of an infant immunization program in 1995 and the availability of effective treatment for chronic hepatitis infection, the virus continues to pose a significant burden on public health in South Africa. Additionally, advancements in hepatitis research have contributed to a better understanding of HBV epidemiology and management challenges in the South African context [70]. To mitigate the potential transmission risks of both tuberculosis and hepatitis resulting from the shared use of shisha mouthpieces, it is imperative to consider a range of preventive measures and adhere to the recommended guidelines.

1) Education and Awareness: Raise awareness among shisha users regarding the potential risks associated with sharing mouthpieces and the modes of transmission of TB and hepatitis. Distribute informative materials and conduct health education sessions at shisha cafés.

2) Promotion of Individual Mouthpieces: Promote the use of individual disposable mouthpieces for each shisha smoker. Shisha cafes should provide disposable mouthpieces that are replaced after every customer.

3) Regular Cleaning and Sanitization: Ensure thorough cleaning and sanitization of shisha equipment, including mouthpieces, hoses, and bowls, after each use to mitigate the risk of disease transmission.

4) Regulation and Enforcement: Enforce regulations and guidelines for shisha cafés to adhere to hygiene practices, including the use of individual mouthpieces and regular cleaning procedures. Government authorities should oversee the enforcement of these regulations to ensure compliance.

5) Access to Healthcare: Improve accessibility to healthcare services for the early detection and treatment of TB and hepatitis. Provide screening services in high-risk areas and offer affordable or cost-free treatment options.

7. Conclusions

In conclusion, our study sheds light on the significant health risks associated with sharing a shisha (hookah) mouthpiece, particularly in the context of South Saharan Africa where tuberculosis and hepatitis pose considerable public health challenges. Through meticulous analysis, we have uncovered compelling evidence linking the sharing of shisha mouthpieces to the transmission of these infectious diseases, highlighting the urgency for targeted interventions and awareness campaigns. Our findings underscore the need for comprehensive public health strategies aimed at mitigating the spread of tuberculosis and hepatitis through shisha smoking practices. Implementing stringent regulations, promoting hygiene practices, and educating individuals about the risks associated with sharing mouthpieces are imperative steps toward curbing disease transmission in this vulnerable population.

Furthermore, our study underscores the importance of culturally sensitive interventions that consider the social dynamics and norms surrounding shisha smoking in South Saharan Africa. By engaging with local communities and leveraging existing networks, health authorities can foster meaningful behavior change and promote safer smoking practices.

Therefore, our research not only deepens our understanding of the health implications of sharing shisha mouthpieces but also underscores the pressing need for targeted interventions to safeguard public health in South Saharan Africa. As we move forward, collaborative efforts between policymakers, healthcare professionals, and communities are essential to effectively address the intersection of shisha smoking, infectious diseases, and public health in this region.

8. Recommendations for Further Research

The investigation into the capacity and readiness of health systems in South Saharan Africa to diagnose, treat, and prevent tuberculosis and hepatitis among shisha-smoking populations requires a multi-faceted approach. Our findings

have revealed several gaps in our understanding of public involvement in research, necessitating further investigation. Realist evaluation presents an opportunity to extend and rigorously test the theoretical framework we have developed in this study.

Health System Analysis: Investigate the capacity and readiness of health systems in South Saharan Africa to diagnose, treat, and prevent tuberculosis and hepatitis among shisha-smoking populations. Assess healthcare infrastructure, resource allocation, and healthcare provider training needs to improve access to quality care.

Infectious Disease Transmission: A comprehensive inquiry into the transmission dynamics of infectious diseases through the communal use of hookah mouthpieces.

Genomic Analysis: Explore the genetic variations of tuberculosis and hepatitis strains prevalent in shisha-smoking communities to understand patterns of transmission and potential drug resistance, informing targeted treatment and prevention strategies.

Microbiological Analysis: A systematic analysis of microbial contamination on shisha mouthpieces, alongside the assessment of the efficacy of various cleaning methods.

Behavioral Research: Conduct in-depth behavioral research to understand the socio-cultural factors influencing the sharing of shisha mouthpieces in South Saharan Africa. Investigate attitudes, beliefs, and social norms surrounding shisha smoking to develop culturally tailored interventions.

Economic Evaluation: Conduct economic evaluations to assess the cost-effectiveness of interventions targeting the prevention of tuberculosis and hepatitis transmission through shisha smoking. Explore the potential savings in healthcare expenditures and productivity gains associated with reducing disease burden.

Educational Interventions: An evaluation of the impact of awareness-raising campaigns aimed at elucidating the associated health risks of mouthpiece sharing.

Cultural and Social Factors: An examination of the influence of cultural norms and social factors on the practice of mouthpiece sharing.

Chemical Analysis: A comprehensive assessment of alterations in the chemical composition of shisha smoke when mouthpieces are shared.

Policy and Regulation: An evaluation of the effectiveness of policies and regulations designed to curtail the practice of mouthpiece sharing.

Alternatives and Harm Reduction: An exploration of the feasibility and effectiveness of harm reduction strategies, such as disposable mouthpieces.

Cross-Cultural Comparisons: Compare shisha-smoking practices and their health implications across different regions and populations to identify common trends and unique contextual factors. Exchange knowledge and best practices to inform global efforts to address the public health challenges associated with shisha smoking.

Youth and Vulnerable Populations: A focused inquiry into the prevalence and consequences of mouthpiece sharing among youth and vulnerable demographic groups.

Health Promotion Campaigns: A comprehensive assessment of the impact of public health campaigns designed to raise awareness of the hazards associated with communal shisha mouthpiece usage.

Longitudinal Studies: Conduct longitudinal studies to assess the long-term health outcomes of individuals who frequently share shisha mouthpieces, particularly focusing on the incidence and prevalence of tuberculosis and hepatitis in South Saharan Africa.

Intervention Studies: Design and implement intervention studies to evaluate the effectiveness of various strategies aimed at reducing the sharing of shisha mouthpieces and preventing the transmission of tuberculosis and hepatitis. Assess the impact of regulatory measures, educational campaigns, and community engagement initiatives on behavior change and disease incidence.

Multidisciplinary Approaches: Foster collaboration between researchers, healthcare professionals, policymakers, community leaders, and other stakeholders to leverage diverse perspectives and expertise in addressing the complex interplay of social, cultural, economic, and environmental factors influencing shisha smoking and infectious disease transmission.

Hence, further research in these areas is essential for advancing our understanding of the impact of sharing shisha mouthpieces on the transmission of tuberculosis and hepatitis in South Saharan Africa. By addressing key knowledge gaps and implementing evidence-based interventions, we can work towards improving public health outcomes and reducing the burden of infectious diseases in shisha-smoking communities.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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