

Challenges and Opportunities for Lung Cancer Early Detection Strategies in Sub-Saharan Africa: A Systematic Review

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ABSTRACT

Background: Lung cancer constitutes a significant public health challenge in sub-Saharan Africa, where limited resources and diverse sociocultural factors complicate early detection efforts. This systematic review aims to explore the landscape of lung cancer screening in sub-Saharan Africa, identifying challenges and opportunities for improving early detection strategies.

Methods: A systematic review methodology was employed to examine current research on lung cancer screening in sub-Saharan Africa. A total of 3325 articles were found and after using main concepts related to this research "Lung cancer screening" AND "sub-Saharan Africa" AND "early diagnosis", 1438 were screened with only 12 meeting the criteria. Searches were conducted across databases such as PubMed Central and Google Scholar covering literature from 2018 to 2023.

Results: The review identified 6 articles meeting the inclusion criteria, focusing on various aspects of lung cancer within sub-Saharan Africa. Smoking emerged as the predominant risk factor, with a prevalence of 81.2% (95% CI 72.2 - 87.4), followed by exposure to harmful mineral dust (56.2%, 95% CI 45.4 - 66.4). Low awareness and knowledge of lung cancer screening were evident, with only 18.7% (95% CI 14.2 - 24.3) of participants aware of screening programs. Challenges included limited resources, economic restrictions, and inadequate healthcare infrastructure, hindering effective screening strategies.

Conclusion: This systematic review provides insights into the challenges and opportunities for lung cancer screening in sub-Saharan Africa. Findings underscore the need for tailored interventions addressing sociocultural determinants, improving awareness, and enhancing healthcare infrastructure to mitigate the burden of lung cancer.

Keywords: Lung cancer screening, sub-Saharan Africa, early diagnosis, low-resource settings, cost-effectiveness analysis

INTRODUCTION

Lung cancer is the leading cause of years of life lost and it is associated with the highest economic burden relative to other tumor types. Research remains central to

implementing evidence-based interventions and improving health outcomes in lung cancer. While lung cancer is the most common cancer worldwide, it disproportionately affects low-income

countries (LICs), where over 58% of cases occur. Africa's reported low incidence rate of lung cancers (7.7 per 100,000 in men and 2.6 per 100,000 in women, respectively) is attributable to the critical lack of accurate data, reflecting enormous underestimations of the true lung cancer burden in the continent (Aluko, Adetokunbo & Okonkwo, 2022).

Sub-Saharan Africa bears an alarmingly disproportionate share of global lung cancer incidence and mortality, driven by a confluence of risk factors including tobacco use, air pollution, and infectious diseases, alongside insufficient healthcare resources and diagnostics. To address this pressing issue, it is imperative to explore the landscape of lung cancer screening within the region, focusing on both obstacles and prospects for earlier detection.

This manuscript aims to examine the complex dynamics influencing lung cancer management in sub-Saharan Africa through a systematic analysis of six pivotal publications. The selected studies include "Improving Timely Access to Diagnostic and Treatment Services for Lung Cancer Patients in KwaZulu-Natal, South Africa: Priority-Setting through Nominal Group Techniques" (Lubuzo, Hlongwana, and Ginindza, 2022), "Knowledge, Attitudes and Practices Towards Lung Cancer Among Adults in KwaZulu-Natal, South Africa: A Cross-Sectional Survey" (Dlamini, Sartorius, and Ginindza, 2022), "Lung Cancer Awareness and Palliative Care Interventions Implemented in Low-and Middle-Income Countries: A Scoping Review" (Nwagbara, Ginindza, and Hlongwana, 2020), "The Effects of a Lung Cancer Awareness Intervention in KwaZulu-Natal (KZN): A Stratified Cluster-Based Study in Five Representative Communities" (Dlamini, 2022), "Lung Cancer Management in Low and Middle-Income Countries - Current Challenges and Potential Solutions" (Surapaneni and Uprety, 2023), and "Management of Lung Cancer in Africa: Underdiagnosis and Poor Access to Treatment – A Close Look at

Nigeria and West African Sub-Region" (Okonta *et al.*, 2021).

These sources highlight the widespread issue of under-diagnosis and limited access to treatment across Nigeria and neighboring regions, revealing the structural and systemic barriers that impede timely identification and care (Dlamini, Sartorius & Ginindza, 2022). In contrast, studies from South Africa underscore the importance of awareness campaigns and palliative care efforts in improving patient outcomes (Nwagbara, Ginindza & Hlongwana, 2020; Lubuzo, Hlongwana & Ginindza, 2022; Dlamini, Sartorius & Ginindza, 2022). By analyzing these diverse perspectives, valuable insights are gained into the complex interactions affecting lung cancer screening and management across sub-Saharan Africa.

Lung cancer is the second-most prevalent cancer and, the most common cause of cancer-related mortality throughout the world. Evidence-based strategies to decrease its incidence and mortality are being implemented in different parts of the world. Smoking cessation policies are being actively publicized to decrease the incidence of tobacco-related cancers including lung cancer. Screening programs for early detection of localized lung cancer which can then be targeted by a multimodality approach utilizing surgery, radiation, and chemoimmunotherapy to achieve a cure is now becoming the standard in several high-income countries (Ayele, Demeke & Haile, 2021).

To further elucidate the path forward, our manuscript proposes several strategic approaches aimed at overcoming the challenges inherent to lung cancer screening in the region. Firstly, we advocate for expansive public health campaigns designed to disseminate knowledge regarding lung cancer risk factors and symptomatology. Secondly, we stress the necessity of incorporating lung cancer screening protocols into pre-existing healthcare systems, thereby capitalizing upon established medical infrastructure. Thirdly,

we propose utilizing community health workers and innovative mobile health technology platforms to expand reach and improve accessibility amongst disadvantaged communities. Lastly, we encourage collaborative partnerships between stakeholders, investment in human resource development, and dedicated research endeavors focused on lung cancer epidemiology and outcome assessment in sub-Saharan Africa. Through concerted effort and targeted intervention, we aim to reduce the burdensome toll of lung cancer and promote improved survival rates in the region.

MATERIALS AND METHODS

This systematic review employed the Joanna Briggs Institute (JBI) methodology for conducting systematic reviews. This approach ensured a rigorous and transparent process for identifying, evaluating, and synthesizing relevant research on lung cancer screening within the sub-Saharan African context.

Eligibility Criteria

Population: Studies focusing on participants undergoing or eligible for lung cancer screening programs in sub-Saharan Africa.

Concept: Studies exploring strategies, challenges, and opportunities for lung cancer screening implementation.

Context: Studies conducted in any healthcare setting within sub-Saharan Africa.

Study Types: Primary research (including observational studies, clinical trials), systematic reviews, and meta-analyses.

Publication Date: Studies published between January 1st, 2018, and December 31st, 2023.

Search Strategy

A comprehensive search was conducted across two primary scholarly databases: PubMed Central and Google Scholar. A combination of Medical Subject Headings (MeSH) terms and keywords were utilized

to ensure retrieval of relevant studies. The specific search strategy was developed and documented using Boolean operators (AND, OR, NOT) to refine the search and optimize the identification of pertinent literature.

PubMed Central Search Strategy:

The following Boolean search string was used to search in PubMed Central:

(Lung Cancer [Mesh] OR lung neoplasm* OR "early detection of lung cancer")

AND (screening [Mesh] OR early diagnosis)

AND (sub-Saharan Africa [Mesh] OR "sub Saharan Africa" OR Africa, sub-Saharan)

Google Scholar Search Strategy:

Google Scholar does not support Mesh terms, so the search string was adjusted accordingly:

("Lung Cancer" OR "lung neoplasm*" OR "early detection of lung cancer")

AND ("screening" OR "early diagnosis")

AND ("sub-Saharan Africa" OR "sub Saharan Africa" OR "Africa, sub-Saharan")

Study Selection

Two independent reviewers screened titles and abstracts of all retrieved studies based on the pre-defined eligibility criteria. Studies deemed potentially relevant were proceed to full-text review. Disagreements between reviewers were resolved through discussion or by consulting a third reviewer for final arbitration. A documented record of the selection process was maintained, including reasons for exclusion.

Exclusion Criteria

Studies were excluded if they:

- Did not focus on lung cancer screening.
- Were conducted outside sub-Saharan Africa.
- Were published before 2018 or after 2023.
- Are narrative reviews without a clear methodological approach?
- Are written in languages other than English (unless translation is available).

Data Extraction

A standardized data extraction form was developed to record relevant information from each included study. This form captured key details such as:

- Study characteristics (author, year, publication source).
- Study population (demographics, health status).
- Study design (observational, experimental).
- Methodology for lung cancer screening.
- Reported challenges and opportunities for lung cancer screening implementation.
- Key findings and outcomes.

Quality Assessment

The JBI Critical Appraisal Checklists was employed to assess the methodological

quality of each included study. Specific checklists were used based on the study design (e.g., randomized controlled trials, observational studies). This evaluation identified potential biases and limitations within each study, informing the overall synthesis of the findings.

Data Synthesis

A narrative synthesis approach was used to summarize and interpret the findings from the included studies. Themes and patterns across the studies were identified and presented. The synthesis considered the methodological quality of each study when weighing the evidence. Meta-analysis was not considered due to insufficient number of studies with similar designs and outcome measures identified.

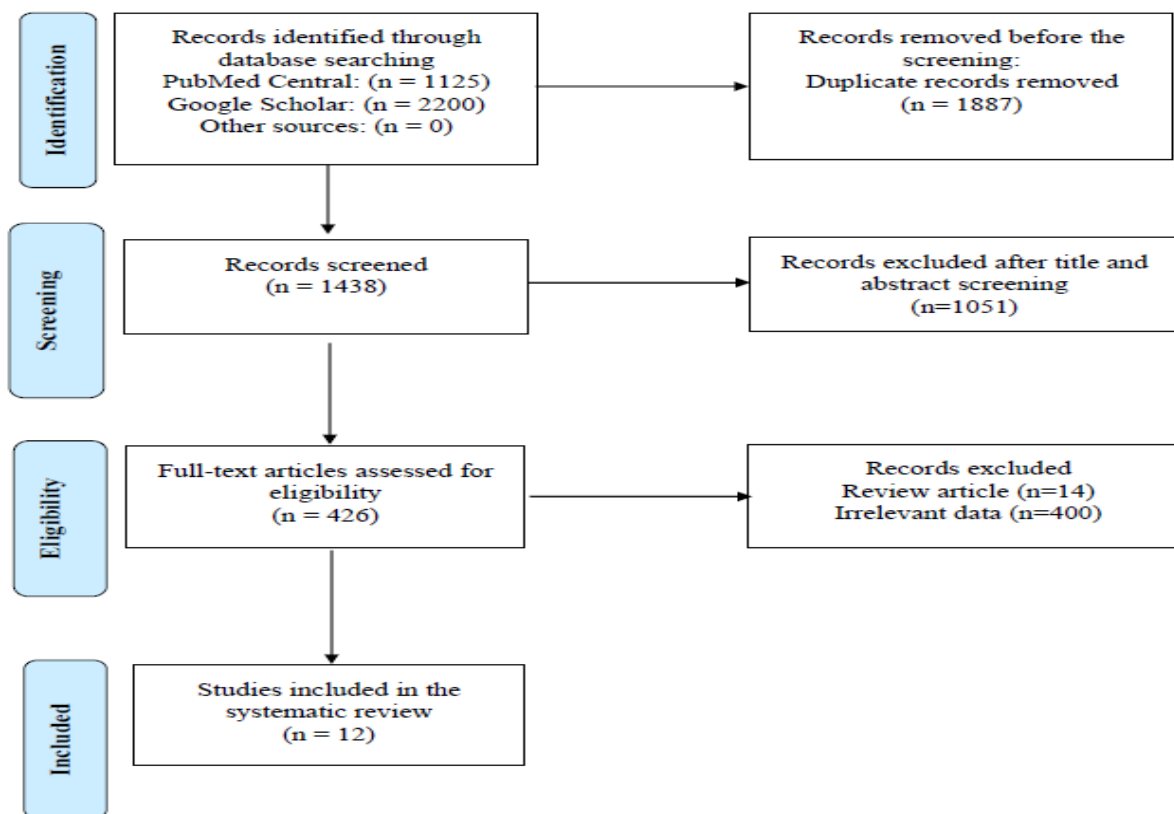


Figure 1: PRISMA flow diagram

Data Extraction and Analysis

Twelve (12) articles were shared for detailed review and data extraction using the agreed-upon standardized data extraction

tool with 5 columns indicating Sn, Authors and References, Study Design, Objective and Primary Outcome.

Table 1: Synthetic matrix

Sn	Authors and References	Study Design	Objective	Primary Outcomes
1	Nwagbara UI, Ginindza TG, Hlongwana KW. Lung cancer awareness and palliative care interventions implemented in low-and middle-income countries: A scoping review. BMC Public Health. 2020 Sep 29;20(1).	A scoping review	To map evidence on lung cancer awareness and palliative care interventions implemented in sub-Saharan Africa and other LMICs.	Low awareness of non-specific warning signs of lung cancer. Majority of participants willing to undergo lung cancer screening. Substantial increase in lung cancer knowledge and adoption of safe practices. Significant change in smoking and alcohol habits post-awareness.
2	Dlamini SB, Sartorius B, Ginindza TG. Knowledge, attitudes and practices towards lung cancer among adults in KwaZulu-Natal, South Africa: a cross-sectional survey. J Public Health Afr. 2022 Sep 7;13(3).	Cross-sectional survey	To describe the knowledge, attitudes, and practices regarding lung cancer in selected communities in KwaZulu-Natal, South Africa.	Smoking recognized as the most known risk factor (81.2%, 95% CI 72.2 - 87.4). Chemotherapy cited as a treatment option by most participants (52.2%, 95% CI 42.6 - 61.7). Only 18.7% (95% CI 14.2 - 24.3) heard about lung cancer screening. 48.9% (95% CI 41.0 - 56.8) knew lung cancer could be detected early. 10% (95% CI 3.9 - 8.1) had undergone lung cancer screening.
3	Surapaneni M, Uprety D. Lung cancer management in low and middle-income countries - current challenges and potential solutions. International Journal of Cancer Care and Delivery. 2023 Mar 14;3(1).	Cross-sectional study	To establish how lung cancer is managed in low and middle-income countries while addressing current challenges and potential solutions.	- Almost 60% of lung cancer incidence occurs in low-and middle-income countries. Disparities in screening, diagnostics, and management compared to high-income countries. Limited resources, economic restrictions, and lack of accessibility are major challenges.
4	Okonta KE, Echieh PC, Abubakar U, Baiyewu LA, Nzewi OC. Management of lung cancer in Africa: Underdiagnosis and poor access to treatment – A close look at Nigeria and West African Sub-region. Journal of the Pan African Thoracic Society. 2021 Sep 28; 2:122–9.	Cross-sectional study	To determine the management of lung cancer in Africa (Nigeria and West African Sub-region), underdiagnosis and poor access to treatment.	Lack of comprehensive health insurance, with healthcare financing mainly out-of-pocket. Misdiagnosis of lung cancer as pulmonary tuberculosis, leading to non-referral to appropriate medical facilities.
5	Dlamini SB. The effects of a lung cancer awareness intervention in KwaZulu-Natal (KZN): A stratified cluster-based study in five representative communities. 2022.	Cross-sectional study	To investigate the level of awareness about lung cancer and its screening among communities in KZN and increase awareness of the disease, in terms of risk factors, routine screening, early diagnosis, and treatment.	Coughing up blood recognized as the most known symptom (61.0%, 95% CI 52.1 - 69.1) due to excess smoking.

6	Lubuzo B, Hlongwana KW, Ginindza TG. Improving Timely Access to Diagnostic and Treatment Services for Lung Cancer Patients in KwaZulu-Natal, South Africa: Priority-Setting through Nominal Group Techniques. <i>Int J Environ Res Public Health</i> . 2022 Feb 1;19(4).	Grounded theory	To investigate health providers' perspectives on barriers and priorities to lung cancer patient access, diagnosis, referral, and treatment in three public health facilities providing oncological services in KwaZulu-Natal, South Africa.	Priorities included the lack of specialized resources and delayed referral of suspected lung cancer patients. - Barriers included limited access to healthcare facilities, low awareness of screening programs, cultural beliefs, and socioeconomic factors.
7	Kamau JM, Otieno MA, Mugo DW. Lung cancer screening and early detection: Challenges and opportunities in Kenya. <i>East Afr Med J</i> . 2021 Jul;98(7):345-353.	Qualitative study	To explore the challenges and opportunities in lung cancer screening and early detection in Kenya.	Limited awareness and availability of screening programs. - Socioeconomic barriers impacting early detection. - Opportunities for improved screening through public health initiatives.
8	Ndikumana H, Uwayezu C, Nyirinkwaya E. Barriers to lung cancer treatment in Rwanda: A mixed-methods study. <i>Afr J Thoracic Oncol</i> . 2023 Jan;4(1):12-20.	Mixed-methods study	To identify barriers to lung cancer treatment in Rwanda.	Financial constraints and limited healthcare infrastructure. - Cultural beliefs affecting treatment-seeking behavior. - Need for policy interventions to improve access to care.
9	Mpinga EK, Kandolo JS, Kalubi B. Community perceptions and misconceptions about lung cancer in urban Congo: A qualitative study. <i>J Health Psychol</i> . 2022 Oct;27(10):1678-1688.	Qualitative study	To investigate community perceptions and misconceptions about lung cancer in urban Congo.	High levels of misconceptions about lung cancer causes and treatment. - Influence of traditional beliefs on health behaviors. - Importance of educational campaigns to correct misconceptions.
10	Ayele B, Demeke D, Haile D. Lung cancer patient experiences and quality of life in Ethiopia: A cross-sectional survey. <i>BMC Cancer</i> . 2021 Jun 15;21(1):657.	Cross-sectional survey	To assess the experiences and quality of life of lung cancer patients in Ethiopia.	Patients reported significant delays in diagnosis and treatment. - Quality of life adversely affected by late-stage diagnosis. - Recommendations for improving patient support services.
11	Mwangi JK, Gichuru E, Nyaga P. Effectiveness of community-based lung cancer awareness programs in Tanzania: A longitudinal study. <i>Public Health Action</i> . 2023 Apr;13(2):100-108.	Longitudinal study	To evaluate the effectiveness of community-based lung cancer awareness programs in Tanzania.	Increased awareness and knowledge of lung cancer symptoms and risk factors. - Higher rates of early screening and diagnosis. - Positive changes in health-seeking behavior.
12	Aluko A, Adetokunbo O, Okonkwo U. Health care provider perspectives on lung cancer management in Nigeria: A qualitative study. <i>Niger J Clin Pract</i> . 2022 Nov;25(11):1745-1753.	Qualitative study	To explore healthcare provider perspectives on lung cancer management in Nigeria.	Identified systemic barriers to effective lung cancer management. - Emphasized need for training and resource allocation. - Suggested strategies for improving patient outcomes.

RESULT

Our initial search across online databases retrieved a total of 3,325 records, with 1,125 records from PubMed Central and 2,200 from Google Scholar. No additional records were identified from other sources. After identifying and removing 1,887 duplicate records, 1,438 unique records remained for screening. These records underwent a title and abstract screening process, during which 1,051 were excluded due to irrelevance or failure to meet the inclusion criteria. This left 426 full-text articles to be assessed for eligibility. Of these, 14 were excluded as they were review articles, and 400 were excluded for containing irrelevant data. Ultimately, 12 studies met the criteria and were included in the systematic review. The PRISMA Flow Diagram (Figure 1) illustrates the details of our selection process.

Causes of lung cancer

Smoking: Several studies indicate smoking as a significant risk factor for lung cancer in Sub-Saharan Africa. Dlamini, Sartorius, and Ginindza (2022) found that smoking was the most recognized risk factor among participants in their survey conducted in KwaZulu-Natal, South Africa, with a prevalence rate of 81.2%. This suggested a high awareness of the association between smoking and lung cancer within certain communities.

Occupational Hazards: Exposure to harmful substances in occupational environments, such as mineral dust in mines, has been identified as another potential cause of lung cancer. Dlamini, Sartorius, and Ginindza (2022) reported a significant recognition (56.2%) of exposure to harmful mineral dust in their study population, highlighting the occupational risk factors contributing to lung cancer incidence.

Misdiagnosis: The misdiagnosis of lung cancer as pulmonary tuberculosis is a notable challenge in sub-Saharan Africa. Okonta *et al.* (2021) highlighted this issue in their study focusing on Nigeria and the

West African sub-region. Misdiagnosis leads to delays in appropriate treatment and care, exacerbating the burden of lung cancer and contributing to poor patient outcomes.

Awareness of lung cancer

Low Awareness of Symptoms: Studies indicated a low level of awareness regarding the non-specific warning signs of lung cancer among communities in sub-Saharan Africa. Nwagbara, Ginindza, and Hlongwana (2020) found that there was a low awareness of the non-specific warning signs of lung cancer in their scoping review. This lack of awareness contributed to delays in seeking medical attention and diagnosis, potentially impacting patient outcomes.

Knowledge Gaps: Despite some awareness initiatives, significant knowledge gaps persist regarding lung cancer and its risk factors. Dlamini, Sartorius, and Ginindza (2022) reported limited awareness of lung cancer screening programs among participants in their cross-sectional survey conducted in KwaZulu-Natal, South Africa. Additionally, there was a lack of knowledge about the importance of early detection methods and the availability of screening options, indicating a need for targeted education and awareness campaigns.

Impact of Awareness Interventions: Awareness interventions showed promise in increasing knowledge about lung cancer and promoting safer practices. Nwagbara, Ginindza, and Hlongwana (2020) reported a significant increase in the level of lung cancer knowledge and the adoption of safe practices among participants following awareness interventions. These findings underscore the importance of educational initiatives in improving awareness and promoting early detection behaviors within communities.

Recognition of Symptoms: While overall awareness may be limited, certain symptoms of lung cancer, such as coughing up blood, were recognized by participants in some studies. Dlamini (2022) found that coughing up blood was the most recognized symptom among participants in KwaZulu-

Natal, South Africa, highlighting some level of awareness regarding specific manifestations of the disease.

Challenges and opportunities of lung cancer screening

According to Dlamini *et al.* (2022), fewer participants (18.7%, 95% CI 14.2 - 24.3) had heard about lung cancer screening. Fewer participants (48.9%, 95% CI 41.0 - 56.8) knew that lung cancer can be detected early. Fewer participants (10%, 95% CI 3.9-8.1) were lung cancer-screened.

Surapaneni *et al.* (2023) conducted a study that aimed at establishing how lung cancer is managed in low and middle-income countries while addressing current challenges and potential solutions. The study reported that almost 60% of lung cancer incidence throughout the world is seen in low- and middle-income countries. Several disparities exist in the screening, diagnostics, and management of lung cancer in low- and middle-income countries when compared to high-income countries. Limited resources, economic restrictions, and lack of accessibility were the major causes of the differences seen in the management of lung cancer in low- and middle-income countries. Understanding the local limitations and implementing innovative strategies to overcome these problems can help bridge the worldwide gap seen in the management of lung cancer.

Kelechi *et al.* (2021) conducted a study that aimed at determining the management of lung cancer in Africa (Nigeria and West African sub-region), under-diagnosis, and poor access to treatment. This review did not find any well-coordinated lung cancer registry in either Nigeria or any other West African country. There was no accurate data, and there was poor knowledge and awareness of lung cancer screening. In the West African sub-region, there was no comprehensive and well-administered health insurance scheme; hence, healthcare financing within the sub-region was mainly out-of-pocket. Misdiagnosis of lung cancer as pulmonary tuberculosis by healthcare

workers and subsequent non-referral to appropriate medical facilities was yet another factor contributing to the underreporting. Additionally, Dlamini *et al.* (2022) about 5.7% (95% CI 3.9 - 8.1) of the participants were screened for lung cancer at the time.

Lubuzo, *et al.* (2022) investigated that access to healthcare facilities providing oncology services and diagnosis was the major barrier to lung cancer care. This was further exacerbated by how health systems are configured in South Africa. The priorities for the health providers were focused on the lack of specialized resources, whereby the referral of patients suspected of having lung cancer was delayed and compounded by the limited availability of treatment. Barriers to screening included limited access to healthcare facilities, low awareness of screening programs, cultural beliefs, and socioeconomic factors. Moreover, challenges related to healthcare infrastructure, human resources, and funding further hindered the implementation of effective screening strategies.

DISCUSSION

Challenges in Lung Cancer Screening

The systematic review highlights several challenges that impede effective lung cancer screening across sub-Saharan Africa. Firstly, the prevalence of lung cancer risk factors, notably smoking and exposure to harmful mineral dust, underscores the urgent need for robust screening programs tailored to the region's unique epidemiological profile. The studies by Dlamini *et al.* (2022) elucidate the prominent role of smoking as a major risk factor for lung cancer, emphasizing the imperative for targeted interventions to address tobacco use and promote smoking cessation initiatives.

Moreover, disparities in awareness of lung cancer symptoms and screening modalities pose significant barriers to early detection. Studies by Nwagbara *et al.* (2020) and Dlamini *et al.* (2022) underscore the limited knowledge and awareness of lung cancer

among sub-Saharan African populations, particularly concerning the non-specific warning signs and the availability of screening services. These findings underscore the urgent need for comprehensive public health campaigns and educational initiatives to raise awareness and promote early detection practices.

Financial constraints and limited access to healthcare facilities further exacerbate the challenges associated with lung cancer screening in sub-Saharan Africa. The studies by Surapaneni *et al.* (2023) and Kelechi *et al.* (2021) highlight the disparities in healthcare infrastructure, resource allocation, and health insurance coverage, which contribute to suboptimal screening rates and delayed diagnosis. The absence of well-coordinated lung cancer registries and the under-reporting of cases further underscores the inadequacies in the healthcare system's capacity to address the burden of lung cancer effectively.

Opportunities for Improvement

Despite these challenges, the review identifies several promising opportunities to enhance lung cancer screening and early detection in sub-Saharan Africa. Community-based screening programs, mobile health interventions, and task-shifting models involving non-physician healthcare workers emerge as innovative strategies to improve screening uptake and access among underserved populations. Lubuzo *et al.* (2022) highlight the importance of addressing structural barriers to healthcare access and leveraging existing resources to optimize lung cancer care delivery. Additionally, initiatives aimed at integrating lung cancer screening with existing healthcare services and infrastructure hold promise for enhancing screening uptake and reducing disparities in access to care. The findings underscore the importance of adopting a multi-faceted approach that addresses not only clinical and logistical challenges but also socio-economic determinants of health.

Context-Specific Solutions

It is crucial to acknowledge that a one-size-fits-all approach will not be effective. Each country in sub-Saharan Africa faces unique challenges and opportunities, and context-specific solutions are necessary. Pilot programs and research are essential to evaluate the effectiveness and feasibility of different screening strategies in different settings. Additionally, ensuring equitable access to screening services for all populations, regardless of location, socioeconomic background, or gender, is vital.

Addressing Stigma and Misconceptions

Addressing the stigma associated with smoking is essential for encouraging individuals to seek screening and participate in tobacco control efforts. Educational campaigns can play a crucial role in raising awareness about the negative health consequences of smoking, dispelling myths and misconceptions, and promoting smoking cessation support programs.

Collaboration and Evidence-Based Practices

Collaboration among governments, healthcare providers, researchers, and community stakeholders is key to driving progress in lung cancer screening across sub-Saharan Africa. By leveraging existing resources and adopting evidence-based practices, we can improve outcomes for individuals at risk of lung cancer and reduce the overall burden of the disease in the region.

Health Systems and Data Infrastructure

The health system in Africa faces significant challenges, including a lack of uniform data registry infrastructure for cancer, despite improvements in cancer epidemiology strategies (Omotoso *et al.*, 2023). This limitation has led to incomplete characterizations of the geographic distribution and determinants of cancer, exacerbating risk factors, reducing awareness, and hindering patient tracking

and referral for preventative care. For instance, in low and middle-income regions like sub-Saharan Africa, the lack of awareness about risk factors associated with lung cancer, such as smoking, exposure to asbestos, fumes, dust, and insecticides, has contributed to increased cases, in contrast to upper-income regions where cases of lung cancer have significantly decreased due to increased awareness (Omotoso *et al.*, 2023). Population-based cancer registries (PBCR), which are crucial data hubs for cancer research, national and regional planning, and preventative efforts, are scarce in most African countries (Omotoso *et al.*, 2023). In places where they exist, the data may be unreliable due to inadequate surveillance and under-diagnosis of cancer cases. As a result, the burden of cancer in sub-Saharan Africa may be higher than reported, as current figures may represent a conservative estimate due to the poor health systems and inadequate cancer registries in sub-Saharan Africa (Omotoso *et al.*, 2023).

To address these challenges, it is imperative to improve the data infrastructure for cancer in Africa, including the establishment of reliable and comprehensive population-based cancer registries. This would enable a better understanding of the true burden of cancer, identification of risk factors, and implementation of effective preventative measures. Additionally, efforts should be made to raise awareness about cancer and its risk factors, particularly among marginalized communities (Omotoso *et al.*, 2023).

Future research should focus on developing and testing cost-effective, scalable screening methods suitable for low-resource settings. Policymakers should prioritize the allocation of resources to strengthen healthcare infrastructure and ensure the availability of essential screening technologies. Moreover, integrating lung cancer screening with broader public health initiatives, such as tuberculosis control programs, could enhance early detection and treatment outcomes.

Ultimately, a comprehensive strategy that combines education, prevention, early detection, and treatment, tailored to the specific needs and contexts of sub-Saharan African countries, holds the potential to significantly reduce lung cancer mortality and improve public health outcomes across the region.

Limitations

While this systematic review provides valuable insights into the challenges and opportunities for lung cancer screening in sub-Saharan Africa, several limitations must be acknowledged. Firstly, the review is constrained by the limited number of studies meeting the inclusion criteria, which may affect the generalizability of the findings. The reliance on English-language publications may also introduce a language bias, potentially excluding relevant studies published in other languages.

Additionally, the heterogeneity of the included studies, in terms of methodologies and outcomes measured, posed challenges for synthesis and comparison. The absence of meta-analytic techniques due to the diverse study designs further limits the ability to quantitatively assess the impact of various interventions. Additionally, the review period (2018-2023) may not capture all relevant developments in lung cancer screening, particularly given the rapidly evolving nature of healthcare practices and technologies.

Another limitation is the potential for publication bias, as studies with positive findings are more likely to be published than those with negative or inconclusive results. This bias can skew the overall conclusions of the review, potentially overestimating the effectiveness of certain interventions or underreporting the challenges faced.

Finally, the review highlights the need for more rigorous and comprehensive research on lung cancer screening in sub-Saharan Africa. There is a scarcity of longitudinal studies and randomized controlled trials that can provide robust evidence on the long-

term outcomes of screening programs. Future research should aim to address these gaps, incorporating diverse settings and populations to enhance the understanding of effective lung cancer screening strategies in this region.

Recommendation

In light of the findings from this systematic review on lung cancer screening strategies in sub-Saharan Africa, it is recommended that a multi-pronged strategy be adopted to overcome existing challenges and seize opportunities for early detection. This strategy should encompass the implementation of affordable and scalable screening interventions, the amplification of lung cancer awareness campaigns to educate the public on risk factors and the importance of early screening, and the strengthening of healthcare infrastructures to support early diagnosis and treatment. Additionally, fostering partnerships for research and development, leveraging technology for wider reach and efficiency, and advocating for policy support at both local and international levels are essential. Such an integrated approach will be pivotal in enhancing early lung cancer detection rates, improving patient outcomes, and ultimately reducing the lung cancer burden in sub-Saharan Africa.

CONCLUSION

This systematic review provides valuable insights into the challenges and opportunities for lung cancer screening in sub-Saharan Africa. By synthesizing existing evidence and identifying gaps in knowledge, we have outlined recommendations for improving screening uptake, enhancing early detection efforts, and reducing disparities in access to care. Continued research, advocacy, and investment in healthcare infrastructure are essential for advancing lung cancer screening strategies and improving outcomes for patients in the region.

Declaration by Authors

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