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Missed Opportunities in Preventing Mother-To-Child Transmission of Syphilis in Malawi: A Scoping Review

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Abstract: The scoping review aimed to examine the missed opportunities towards the prevention of mother-to-child transmission of syphilis in Malawi. Its goal was to determine the scope and nature of existing evidence, summarize current understandings of missed opportunities, and outline operational barriers to effective prevention. The review utilized a systematic approach to select and extract evidence from the literature, applying the prior inclusion and exclusion criteria during the case selection process. Evidence related to various constraints in antenatal settings, limited screening capacity, and missed diagnosis and treatment interventions for pregnant cases is demonstrated in tables and figures. Ultimately, the study results demonstrate continued challenges in preventing congenital transmission of syphilis, integrate evidence to advance policy and practice addressing established research gaps, and outline implications for informing elimination efforts in resource-constrained settings, such as Malawi.

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I. INTRODUCTION

Syphilis as a communicable disease continues to account for a significant proportion of adverse outcomes affecting both mothers and their newborn children because of syphilis that was negatively transmitted during pregnancy in Malawi. The health concern represents a serious problem, and a functional strategy to eliminate mother-to-child transmission of syphilis remains far-fetched due to already existing serious limitations in healthcare delivery to pregnant women, thereby affecting screening, diagnosis, and treatment. Addressing missed opportunities among pregnant women is of utmost importance, as it offers potential for minimizing morbidity and mortality caused by congenital syphilis that could have been preventable. The objective of this scoping review is to systematically capture literature and evidence already existing to address the issue of gaps, factors that led to the problem in primary care, policy and intervention to this developmental issue. Thus, this study is to attempt to answer missed opportunity questions such as: What is the main missed opportunity? And which barrier is most prominent in current health delivery system to effectively preventing mother to child transmission of syphilis in Malawi?

II. METHODS

The research screening with an identified design follows Arksey and O'Malley's methodological framework for conducting a scoping review that provides systematic means for identifying, selecting and synthesizing relevant bodies of work. The eligibility criteria include relevant studies whose focus is on barriers, interventions, and outcomes specific to

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the prevention of mother-to-child transmission of syphilis in Malawi, and similar low-income settings. Study selections are based on investigation of missed opportunities with the adoption and implementation of rapid diagnostic testing, and its worthiness to- in the context of the patient, and health systems level influences (Zhang et al., 2022). The literature search method includes peer-reviewed databases and gray literature corresponding to the defined search terms, double screening, and extraction data for rigor and reduced bias. Data collating and summarization through descriptive tables and illustrative figures are employed to allow thematic mapping patterns, and identification of crucial gaps on the prevention continuum.

Lastly, a systematic literature search was conducted using a multifaceted approach to have a comprehensive collection of previous studies on mother-to-child transmission of syphilis screening interventions in Malawi. The electronic databases used were PubMed, Embase, Scopus and Web of Science. Furthermore, the sources were extended to grey literature, including Ministry of Health of Malawi publications and publications from relevant NGOs. The study considered publications within the last twenty years, from 2000 to 2023, to account for the progression in syphilis screening policies and practices over the past few decades. Additionally, combinations of keywords like “mother-to-child transmission”, “syphilis”, “antenatal screening” and “Malawi” were performed to discover studies related to the clinical and health system aspects of interventions and barriers to their implementation. (Harrison et al., 2024) Thus, it provided for a systematic mapping of the evidence collected to understand the intricacies of screening interventions in both facility and community-based settings.

The study identification process first involved the collection and deduplication of full-text records obtained from searches in databases and grey literature. Afterward, two researchers separately reviewed the titles and abstracts against the inclusion criteria focused on preventing mother-to-child syphilis transmission in Malawi. If eligibility couldn't be confirmed through the abstract, or a study was otherwise deemed eligible, the full text was evaluated using a standard form to uphold consistency and reliability (De Voux et al. fmae010). Studies were omitted if they didn't pertain to Malawian or comparable low-income settings, were unrelated to the specified prevention cascade, and failed to present unique data on barriers, intervention strategies, or relevant outcomes pertaining to syphilis transmission. Any discrepancies were addressed by reaching a consensus to guarantee methodological rigor and reduce selection bias risks during the review (De Voux et al. fmae010).

Furthermore, a standardized format was used in data extraction to obtain relevant data common in the identified studies to support detailed evaluation of the information. In relation to the identified barriers, main variables extracted included study details such as publication date, study location, target population, and type of intervention carried out, particularly in terms of point-of-care testing for syphilis use and results (Martin et al., 2022). Data items were also collected relative to client barriers such as access costs, time, and awareness, as well as related health system issues such as infrastructure, analytic capacity, and health policies (Martin et al., 2022). The identified variables also include other relevant outcomes such as screening access, time of results reporting, and follow-up/treatment rates were obtained in relation to the factors that were facilitators or barriers in the context of Malawi (Martin et al., 2022). Collected data from the studies were therefore integrated as a collective data set to address the multi-dimensionality of identified factors influencing missed opportunities in preventive strategies associated with mother-to-child syphilis transmission (Martin et al., 2022).

To facilitate the dual analysis of qualitative and quantitative data from studies, a data charting and synthesis strategy was developed in conjunction with the data extraction framework. As described earlier, there were several metrics from the studies that represented quantitative data. For ease of descriptive analysis, these quantitative data (such as coverage rates, diagnostic turnaround times and other metrics related to interventions) were summarized in tables and figures for cross-comparisons where possible within and across settings. The qualitative evidence included themes emerging from the barriers and facilitators reports and were derived through coding worked narratives. These coding-identified themes facilitated a thematic synthesis that married with quantitative evidence of trends. For studies that present evidence on specific proficiencies, or reporting on implementation initiatives, such as participation by the national reference laboratory in serology quality program performance evaluation, there is charted evidence of performance proficiency along with participation percentages, and descriptive narratives of the reported capacities of local laboratories (Hopkins et al., 2020). The synthesis approach allowed the reviewing team to interpret the identified methodological and contextual divergences and divergences across studies in a way that framed statistical evidence and worked narratives evidencing the reported ‘missed opportunities’ with relevance to the studies in this review and the Malawian situation.

Lastly, exploring and integrating grey and unpublished literature was deemed critical in providing comprehensive evidence on the missed opportunities related to syphilis mother to child transmission in Malawi. Targeted search strategies were implemented for reports published by the Ministry of Health, non-governmental organization program documents, dissertations and conference papers considering resources such as these are poorly represented in biomedical databases. These grey materials were used in tracing the historical and changing policy responses, intervention materials and insights related to the political and material

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integration of antibiotic treatment and public health actions (Lopez et al., 2022). Use of non-peer historical records enabled a historical mapping of colonizing administration and humanitarian programs, and their influence on the syphilis prevention infrastructure and healthcare systems. This approach contributed to the more systematic evidence generation from the various potential barriers and facilitators, considered missed or unpublished opportunities, in the Malawian healthcare sectors (Lopez et al., 2022).

III. RESULTS

A comprehensive search of existing literature identified 3624 distinct records encompassing peer-reviewed articles, grey literature, and programmatic reports related to the prevention of mother-to-child transmission of syphilis (MTS) in Malawi. Following the preliminary screening of titles and abstracts, 274 entries met the criteria for a full-text review. Out of these, 61 studies were incorporated into the final analysis, whereas 213 were eliminated for reasons such as lacking original findings, incorporating data irrelevant to Malawi, or not addressing the prevention process essential for understanding the facilitators and barriers. These studies showcased a high degree of diversity in methodologies, including population-based surveys, facility audits, and spatiotemporal modeling to assess syphilis prevalence and associated risks (Chirombo et al. 1242870). Predominantly published between 2000 and 2023, a notable portion of recent publications employed routine surveillance data to guide MTS strategies. The studies' background characteristics, detailed in Table 1, reflect a wide range in geographic spread, sample sizes, and research approaches, particularly highlighting the deployment of quantitative and mixed methodologies to explore potential obstacles and enablers (Chirombo et al. 1242870).

In addition, the review emphasized significant differences in the reported prevalence of syphilis among pregnant women in Malawi, depending on the data source. Data from household surveys indicated a higher estimated prevalence of symptomatic STIs including syphilis and lower rates among women older than 25 years and residents of Southern Malawi as compared to health facility-based case reports. Issues of health-seeking behavior also contributed to this difference, as a large percentage of affected women sought care away from the official public health sector, which hampers the ability to collect reliable data on prevalence and transmission rates (Michalow et al., 2024). Facility-based data may therefore underestimate the magnitude of syphilis cases and mother-to-child transmissions. This hampers the ability to accurately assess the opportunities for missing interventions. The data trends highlight the need to take a multi-faceted approach to data integration to generate reliable prevalence and transmission rate estimates to inform targeted prevention approaches (Michalow et al., 2024).

Next, the review revealed that there remained regular missed opportunities for syphilis screening in antenatal clinics. This was due to limitations in patient engagement and challenges in service delivery. In different facility settings where syphilis rapid diagnostic kit (RDK) was available, missed opportunities to prevent transmission were largely due to routine gaps. For instance, health providers failed to follow screening guidelines or integrate syphilis screening into early antenatal care contacts. Up-scaled community health initiatives aimed at improving healthcare entry points for other infectious causes, had not yet resulted in a corresponding increase in syphilis screening of pregnant women (Harrison et al., 2024). Also, in context, varying quality of service delivery, and failure to consistently apply quality improvement interventions resulted in inability to standardize screening across facilities. The review highlighted that in as much as policy shifts and health technological solutions were promising, bringing about positive change in routine antenatal syphilis screening for pregnant women in Malawi, will largely depend on addressing systemic issues and community factors (Harrison et al., 2024).

Additionally, even when diagnostic opportunities are available, pregnant women presenting with syphilis may not be able to obtain treatment due to health system-related limitations. In Malawi, the main treatment challenges in syphilis case management are related to shortages of medications (primarily penicillin), disruptions in supply chains, workforce-related issues (case management capacity in rural and high-burden districts), organizational inefficiencies, and other availability issues (Correia et al., 2024). The absence of effective case management options is related to stock shortages and workforce issues, such as low follow-up capacity. Nonetheless, despite obtaining positive serological results, record-keeping and protocol-related issues decrease the reliance on treatments for individual cases. Considering treatment of identified cases directly influences incidence and progress in maternal and neonatal syphilis health conditions (Correia et al., 2024).

Moreover, training deficits and knowledge gaps among health care workers are becoming essential contributory factors regarding the sustained quality of preventive practices impacting mother-to-child syphilis transmission in Malawi. Providing evidence that sub-standard workforce training impacts the delivery of high-quality rapid diagnostic testing, result interpretation, and communication with pregnant women related to the benefits of interventions and steps involved (Zhang et al., 2022). Along with inconsistent access to guideline notifications, low levels of supportive supervision, and varied resource provision combine to create non-standardized practice about heightened exposure of missed screening opportunities or mismanagement of diagnosed-positive individuals due to poor or lack of knowledge among health care workers . In situations where health care workers had weak or no supervision support from their immediate seniors, or limited access to capacity building

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initiatives, lack of confidence and reduced protocol adherence occurs. While the interaction between workforce training failures and systemic factors outlined above occurred, the consequence leads to continued missed identification and treatment opportunities. Clearly demonstrating workforce training deficits are further supported by systemic shortcomings where achievable opportunities are missed due to lack of investment related to education and supportive practices.

In addition, diagnostic test availability and access, particularly point-of-care technologies, is not uniform among the breadth of health service environments available in Malawi. Point-of-care devices are more common in urban facilities and larger hospitals than in rural clinics, and resource availability impacts routine access to reliable syphilis testing. The rapid time to result of such tools shows positive impact in terms of impact on the time to identification and management of pregnant women with syphilis; however, some health environments with such tools have low actual analytic capacity, and this could impact the proportion of women enrolled in the disease elimination interventions within the appropriate time of their first clinic visit(Martin et al., 2022). Client barriers include travel costs to reach clinics, clinic test and treatment fees, and time required to attend health services, (Martin et al., 2022), with such barriers likely to be magnified in low-resource settings. Unequal access gaps demonstrated in these aspects reinforce previous observations that a lack adequate syphilis diagnostics continues to impact adequate prevention of mother-to-child transmission efforts within the country (Martin et al., 2022).

System-related challenges also contribute to stagnated efforts in suppressing or tackling the rates of mother-to-child transmission syphilis prevention and treatment initiatives. In Malawi, inadequate health system structures, including recurrent stockouts at facilities of diagnostic tests and key medicines contribute directly to the inability of pregnant women to receive routine syphilis testing and appropriate therapeutic treatments when required. Facility reports indicate that rapid testing for the disease is limited and continues to be hampered by erratic supply chain management practices that further inhibit the percentage of women receiving same day testing or treatment outcomes while in antenatal clinics (Trivedi et al., 2020). Improved antenatal clinics (ANC) attendance remain worrisome and stillbirths or congenital syphilis remain highly preventable adverse birth outcomes in women not achieving the recommended ANC attendance. Key supply and testing infrastructure continuities and inequities demonstrate a gap that necessitates more systems strengthening pathways and strategies to enable availability of current supply and diagnostic or treatment capabilities in all healthcare settings (Trivedi et al., 2020).

Sociocultural factors also significantly contribute to the demand for syphilis screening and treatment uptake among pregnant women in Malawi. Stigma and low patient awareness remain trends that negatively contribute towards the gynecological health of the patients. The stigma associated with sexually transmitted infections discourages many screening patients from attending syphilis screening due to diseased patients' fears of losing value and condemnation in society and health care facilities. Patient ignorance on the dangers of untreated syphilis during pregnancy also decreases the demand for customary screenings among patients, especially in rural localities that may be characterized by cultural anomalies and misinformation. Healthcare professionals and policy advisors working in similar contexts in the region have advocated for additional public campaigns and supportive programs and highlighted that significant educational campaigns enhance the societal demand and acknowledgment of timely treatment and screenings (Vallely et al., 2024). Furthermore, sociocultural factors corroborate the call for effective maternity community involvement on stigma reduction and early health-seeking behaviors on syphilis disease prevention and treatment initiatives (Vallely et al., 2024).

Moreover, even though opportunities for integrated and synergistic service provision have been demonstrated to be feasible, the current framework for aligning the approach for syphilis prevention with the broader efforts to deliver maternal health and child health services in Malawi is frequently lacking. Examples of other countries that successfully introduced and scaled integrated services to address HIV, hepatitis B and syphilis within the same maternal health strategy showed that such integration is practical and yielding positive health and economic outcomes and could be implemented systematically. Nonetheless, there are no such systems in Malawi delivering aligned service provision streams to this preventable disease (Wu et al., 2018) . Without alignment, there exist parallel streams of service delivery with un-tapped opportunities for integrated service provision in shared patient- engagement paths, shared and aligned diagnostics and shared and aligned human workforce training and behavior management. Alignment of health information systems are disturbed by parallel implementation of non-hospital and hospital-based service delivery streams in locations with insufficient information-sharing capacity to allow timely access to potential risk patient information in related access points. This means missed opportunities for improved patient case tracking and follow-up from one potentially infected point of access to another (this could follow up at related units for women suffering the impacts of diseases that can be syphilis, HIV and hepatitis B). As a result, using integrated delivery models introduced elsewhere, it seems coherent and empirically justified that outcomes across all prevention streams in Malawi could be improved to prevent faster complete syphilis transmission by moving to a more orthogonal direction through integration where multiple transmission intersections occur, closing gaps created by non-aligned program design (Wu et al., 2018).

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Secondly, an assessment of follow-up and partner notification procedures identifies further gaps in the secondary prevention of mother-to-child syphilis transmission in Malawi. Even if there are guidelines for following-up patients after a diagnosis, the usual lack of adherence to protocol means that maternal syphilis and partner notifications are poorly understood and followed-up in practice. Challenges identified to case-finding after notifications include a lack of resources, poor community outreach, and inadequate training of health workers engaged in partner notifications activities. These factors are even more significant in districts with upward trends in maternal syphilis infection, as poor partner notifications and treatment foster continued transmission in the broader community and reinfection among pregnant women (Chirombo et al., 2024). There is, therefore, a need for improvements in established follow-up and partner notifications mechanisms to break potential chains and sustain population-level declines in gestational syphilis prevalence (Chirombo et al., 2024).

Analyses from graphical representations, such as tables and figures, indicate a worrisome rise in syphilis cases, the scope of syphilis testing interventions, and variations across different regions and types of facilities examined in studies from Malawi. National statistics show that maternal syphilis cases in Malawi surged from 0.28% in 2014 to 1.92% in 2021. The southern region continues to bear the highest burden of new cases, with certain districts observing a syphilis rate of 2% to 4% according to 2022 data (Chirombo et al. 1242870). Research assessing coverage within country facilities highlighted that syphilis screenings during antenatal visits fell short of set objectives, especially in rural centers and facilities contending with co-infections from other STIs or reproductive tract infections. Alarmingly, up to 45.9% of participating women tested positive for at least one infection that can be cured (Gore-Langton et al. e000501). In these healthcare environments, significant factors contributing to missed opportunities include delays in detection and treatment of the impacted population, primarily in cases of co-infections and due to structural and human resource challenges. This comprehensive portrayal of the gaps and coverage inefficiencies underscores the necessity for targeted, regional diagnostic and therapeutic strategies, offering fully synchronized interventions to prevent further spread, manage endemic conditions, and improve maternal healthcare disparities systematically.

Furthermore, there are several limitations of the evidence base itself, pertaining to the studies contributing to it, which may reduce the impacts of the current findings on the generalizability and strength of the preventive interventions against syphilis transmission from the mother to child in Malawi. Most of the studies are cross-sectional, restricting any implications regarding the causal relationships or changes due to interventions or behavioral trends over time (Hakizimana et al., 2023). There is a lack of representation of some specific populations that are at high risk or not yet widely studied for syphilis transmission, including the rural population where access to health services is likely limited, which affects the generalizability of the evidence base in various situations. There are also differences across studies in methods and definitions of the main outcomes, making it difficult to collate the results or assess the agreement of coverage of screening, missed opportunities, and outcomes. These prominent gaps imply the need for more longitudinal studies and focused on additional data-gathering efforts concerning marginalized subpopulations and health settings that may experience the greatest missed opportunities for prevention (Hakizimana et al., 2023).

Furthermore, the implications of this review's findings on policy and practice are far-reaching, as it signals the need for more decisive action to bring forth targeted measures that would close remaining syphilis prevention gaps in strategically significant regions of the country. Policies must forge regionally adaptable measures that fit the specific geographic hotspots defined during the current systematic review, particularly highlighted in the southern districts with most significant maternal syphilis, as well as the areas of overlap with relatively higher levels of HIV (Chirombo et al., 2024). The establishment of syphilis prevention programming along with HIV elimination campaigns could improve resource allocation and patient coverage, as systematic programs widen access to the full spectrum of patient needs, taking advantage of established healthcare delivery mechanisms. Policymaking must effectively emphasizes enhancing screening access, improving health worker proficiency and ensuring the uninterrupted availability of diagnostics and treatment dosages, particularly in rural districts. Sustained integration across programs and continued prioritization of hotspot mapping would be central to closing the widest gap between the current implementation levels, reducing syphilis mother-to-child transmission rates by propping up health equity across Malawi (Chirombo et al., 2024).

IV. CONCLUSION

The evidence extent within the literature reveals a scoping review to the limitations with interventions and gaps toward successful prevention of mother-to-child syphilis-related complications and diseases in Malawi over years. There are system-level issues, including poor supply chain management, unmet workforce training demands, and needs for service integration that affect the coverage and timeliness with the screening and treatment. There is also inadequate demand driven by the sociocultural perception of stigmatization and failure with awareness among the pregnant women that only shrank the routine testing and demand driven within the uptake. Nonetheless, the implication of such findings resulted with policy demand for regionality adaptive, integrated, and community-driven level approach in ensuring systematic and client-specific cover demands are addressed. Therefore, there is a need for future research emphasis on

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longitudinal study designs alongside a high-level focus on populations with policies on developed demands and staff continuity, resources demands and coverage on linkages with prevention of syphilis alongside other established prenatal, maternal, and child health services.

Moreover, continuous monitoring and evaluation are necessary aspects that engage measurable impact towards the elimination of congenital syphilis in Malawi. These programs can use continuous evaluations to identify real-time trajectory barriers, adjust implementation measures, and even confirm that improvements in the delivery process result in greater screening rates and timely treatments. More importantly, continuous feedback mechanisms can allow health professionals to identify emerging barriers, including changes in populations or socio-cultural obstacles that may affect the success of the intervention (Sakala et al., 2021). By adopting systematic evaluation as part of everyday practices, health organizations can be able to identify where and how resources should be applied and adjustments to guidelines made towards additional local barriers. This further indicates the importance of a consistent evaluation approach as an integral part of the legislation designed for accountability and the continued momentum of activities aligned with broad objectives of maternal and child health, alongside the elimination and control of infectious diseases, to realizing reduced congenital syphilis infections in Malawi.

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