

When it is available, will you pay for it? A Systematic Review and Meta-analysis of Willingness to Pay (WTP) for Malaria Vaccines in Africa

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ABSTRACT:

Background: Malaria vaccination holds significant potentials for combating malaria in Africa and its implementation is underway in many endemic countries. However, the economic climate on the continent raises concerns around sustainable financing for the program. Yet, evidence of the willingness to pay (WTP) for the vaccines by Africans in a cost-based provision model is unclear. Therefore, this systematic review and meta-analysis aims to summarize the available evidence of the WTP for the malaria vaccines in Africa.

Methods: We conducted a systematic search for relevant literatures in databases such as PubMed, Scopus, Google Scholar, and *CENTRAL* following the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines and our inclusion criteria. The primary outcome measures included the WTP proportion, prices, and determinants for any malaria vaccine reported in any African country since the year 2000. We applied the DerSimonian-Laird random-effects meta-analysis for effect estimation, with the pooled results presented alongside 95% confidence intervals (CI) calculated using the Clopper-Pearson method.

Results: Of the 1,398 literature screened, 8 studies reporting WTP data for 6102 adults and primary caregivers from 6 African countries were included in the final analysis. The pooled proportion of the WTP was 85.9% (95% CI: 76.0–92.1), with significant heterogeneity ($I^2 = 98\%$, $p < 0.01$). However, the average prices participants were willing to pay varied across countries. The WTP prices ranged from approximately \$1 in Sierra Leone to \$8.03 in Nigeria for adults, and from \$0.69 in Sierra Leone to \$26.90 in Ethiopia for children. The review identified a host of sociodemographic, vaccine-related, and situational factors influencing African adults and caregivers WTP for the malaria vaccines. Participants' levels of income (ability to pay) and education were frequently reported determinants of WTP.

Conclusion: There is a shortage of studies on the WTP for malaria vaccines in Africa. We found a seemingly high WTP level for the malaria vaccines in Africa, delimited by income and educational levels across households and countries. African health policymakers should consider their local realities to deliver an equitable yet sustainable malaria vaccination program.

Keywords: vaccines; willingness to pay (WTP); malaria; meta-analysis

INTRODUCTION

According to the World Health Organization (WHO), an estimated 236 million malaria cases and 590,000 deaths occurred in Africa in 2022, representing about 96% of the global burden of the disease [1]. Although children below age five are the predominant victims, malaria also exerts a high health and economic toll on adults in endemic countries throughout their lifetime [2]. The two WHO-recommended malaria vaccines, RTS,S and R21/Matrix-M, are poised to be game-changers in the efforts to eradicate malaria on the continent [3]. Currently, the WHO recommends that high-burden countries include the malaria vaccines in their national childhood immunization programs, coupled with existing malaria control strategies [3]. Researchers have added that mass vaccination, as opposed to vaccinating children only, is one of the best ways to maximize the malaria vaccines' utility to achieve herd immunity in Africa, given the large adult reservoir for malaria parasites [4].

As of July 2024, nine African countries including Benin, Burkina Faso, Cameroon, Côte d'Ivoire, Ghana, Kenya, Liberia, Malawi, and Sierra Leone have incorporated the malaria vaccines into their national malaria control plans, with nine more planning to follow [5]. Although the vaccines are yet to be introduced to some high-burden areas such as Nigeria, the Democratic Republic of the Congo, Uganda, and Mozambique, there is a high hope of achieving significant progress in combating the disease in 2024. Despite the success of integrating malaria vaccines into national immunization programs, issues of accessibility, acceptability and affordability remain significant concerns [3,6].

Like other malaria control interventions, the malaria vaccine deployment in Africa has been supported largely by funding from donors like GAVI, the vaccine alliance and the World Bank [7]. Hitherto, this has allowed vaccine delivery to children at no cost to households. However, concerns exist with the sustainability of the free provision model when external funding stops. Seven countries hosting 31% of the African population are expected to transition out of GAVI support by 2030 [7]. This reality is further underscored by the current budget deficit for malaria intervention on the continent, member countries financial crisis, rising costs of vaccines, and large numbers of people to be vaccinated especially in a mass vaccination program [8-11]. Therefore, discourse about the willingness to pay (WTP) for the malaria vaccine by African populations becomes relevant as African nations seek sustainable financing for the malaria vaccination program in a domestic funding model.

Willingness to pay (WTP) refers to the maximum amount individuals are willing to pay for a commodity, in this context the malaria vaccines. WTP may indicate the intrinsic value for malaria vaccines within the African population. Evidence of the WTP for the malaria vaccines in Africa is also invaluable to national and international policymakers, enabling them to implement a culturally and economically appropriate, equitable, and sustainable malaria vaccination program that is responsive to local needs and aligned with global health priorities [12]. Additionally, WTP data from Africa may support decisions to scale vaccine manufacturing and supply to countries.

Several factors influence WTP for health services. Steigenberger et al. [13] reported 22 determinants of the WTP across 5 thematic domains including; sociodemographic characteristics, perceived threat, perceived benefits and pre-knowledge, perceived barriers, and other context-specific factors termed “other information”. Primary studies on WTP for the malaria vaccines in Africa have reported diverse proportions and prices individuals were willing to pay within and between countries for different hypothetical and approved malaria vaccines [14-21]. Understanding the most critical determinants of WTP for the malaria vaccines on the continent is also important. Therefore, this systematic review and meta-analysis aims to synthesize the currently available evidence of the WTP for the malaria vaccines among adults and primary caregivers in Africa to inform policies that drive the sustainability of the malaria vaccination program on the continent.

METHODS

Study protocol and registration

This Systematic Review and Meta-analysis was conducted following the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines [22]. A protocol for the review was registered in PROSPERO (CRD42023460076) on September 13, 2023.

Search strategy

Two authors conducted a systematic literature search using the following databases: PubMed, Scopus, Google Scholar and CENTRAL. To ensure comprehensiveness, backward and forward searches were performed to capture any citations missed by electronic searches [23]. The search

terms were blended using the following concepts: (i) Malaria (ii) Vaccination (iii) Payment (iv) Countries in Sub-Saharan Africa. The full details of the electronic search strategy is provided in Appendix 1.

Inclusion and exclusion criteria

We considered all English-language observational studies (cross-sectional, case-control, and cohort study designs) published since 2000 that reported on the willingness to pay (WTP) for the malaria vaccine and factors associated with it among caregivers in Africa. We excluded editorials, conference reports, comments, letters, qualitative studies, systematic reviews, publications lacking full texts, studies of other disease conditions aside malaria, and studies that did not indicate the WTP for the malaria vaccines.

Outcome of interest

The primary outcome measure was the proportion of the sampled participants that were willing to pay out-of-pocket for the malaria vaccine for themselves and/or their children under five. The secondary outcome measures include the amount respondents were willing to pay, and factors influencing WTP among them. We prioritized the proportion measure of the WTP for the vaccines in this study for a few reasons. One, the proportion measure indicates the WTP level which serves as a direct indicator of public demand and an indirect indicator of social acceptance and public confidence in the vaccines than a hypothetical price. WTP level may offer an easily accessible and comparable metric to support policy decision-making without the complexity of exact monetary figures. Secondly, the WTP level is less susceptible to the hypothetical bias and scope effect that may affect the predictive accuracy of WTP prices. Kanya et al. in their meta-regression analysis of 84 WTP studies showed that the hypothetical WTP prices are a weak indicator of actual WTP as hypothetical WTP was 3.2 to 5.7 times higher than the actual WTP [24]. The wide variation was attributed to differences in study designs and methodologies. Lastly, the proportion measure is a frequently reported outcome variable in many studies as found in preliminary searches. Nonetheless, we captured the WTP prices where given to corroborate the proportion measure yielding complementary insights into respondents' economic behavior.

Study selection

All references from the databases were imported into Covidence and checked for duplication. Two authors (FBE and RDD) screened the studies title and abstract independently using the inclusion and exclusion criteria. These two authors retrieved full texts of references with possible relevant review results and independently examined them for eligibility. Disagreements were settled through discussion. Covidence was used to conduct quality assessment and data extraction. The PRISMA flow diagram was used to summarize the study selection process (Fig 1).

Data extraction

Two authors independently extracted the general characteristics of the studies using a data extraction format designed in Covidence. All authors agreed upon the final data extraction template in advance. The data abstraction format contains the general information of the studies such as the author's name, country of origin, year of publication, study design, data collection methods, sample size, willingness to pay for the vaccine, magnitude or amount to be paid for the malaria vaccine, and factors influencing WTP (Table 1). All costs were inflated and converted to 2023 US dollars using the CCEMG EPPI Centre online cost converter tool using the International Monetary Fund dataset for purchasing power parity values and the year of data collection if available, otherwise the year of study publication [25]

Quality assessment

The quality of included studies was assessed using a checklist adapted from the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies [26]. The checklist was used to assess the overall methodological quality and evaluate the risk of bias (additional file 2). The tool covered questions on study design and setting, confounding factors identification and control, outcome measurement validity and reliability, and the appropriateness of the statistical methods employed. Although the JBI Critical Appraisal Checklist for Analytical Cross-Sectional studies does not have a standardized score system [26], we used a four-out-of-seven or above criteria to classify studies as having good methodological quality.

Data analysis

The statistical analysis was conducted using the meta-package in R. A DerSimonian-Laird random-effects meta-analysis was employed to estimate participants' WTP for malaria vaccines, with the pooled results presented alongside 95% confidence intervals (CI) calculated using the Clopper-Pearson method. The I^2 statistic was utilized to measure the degree of variability due to heterogeneity across studies, with a value of $\geq 75\%$ indicating substantial heterogeneity [27]. Although we aimed to explore WTP variations within and between study variables, this subgroup analysis could not be conducted due to insufficient data. Furthermore, publication bias could not be assessed since the meta-analysis model included fewer than the minimum of 10 studies required for a funnel plot asymmetry test [28]. As a secondary objective, a narrative synthesis was performed to summarize the predictors of WTP for malaria vaccines in Africa.

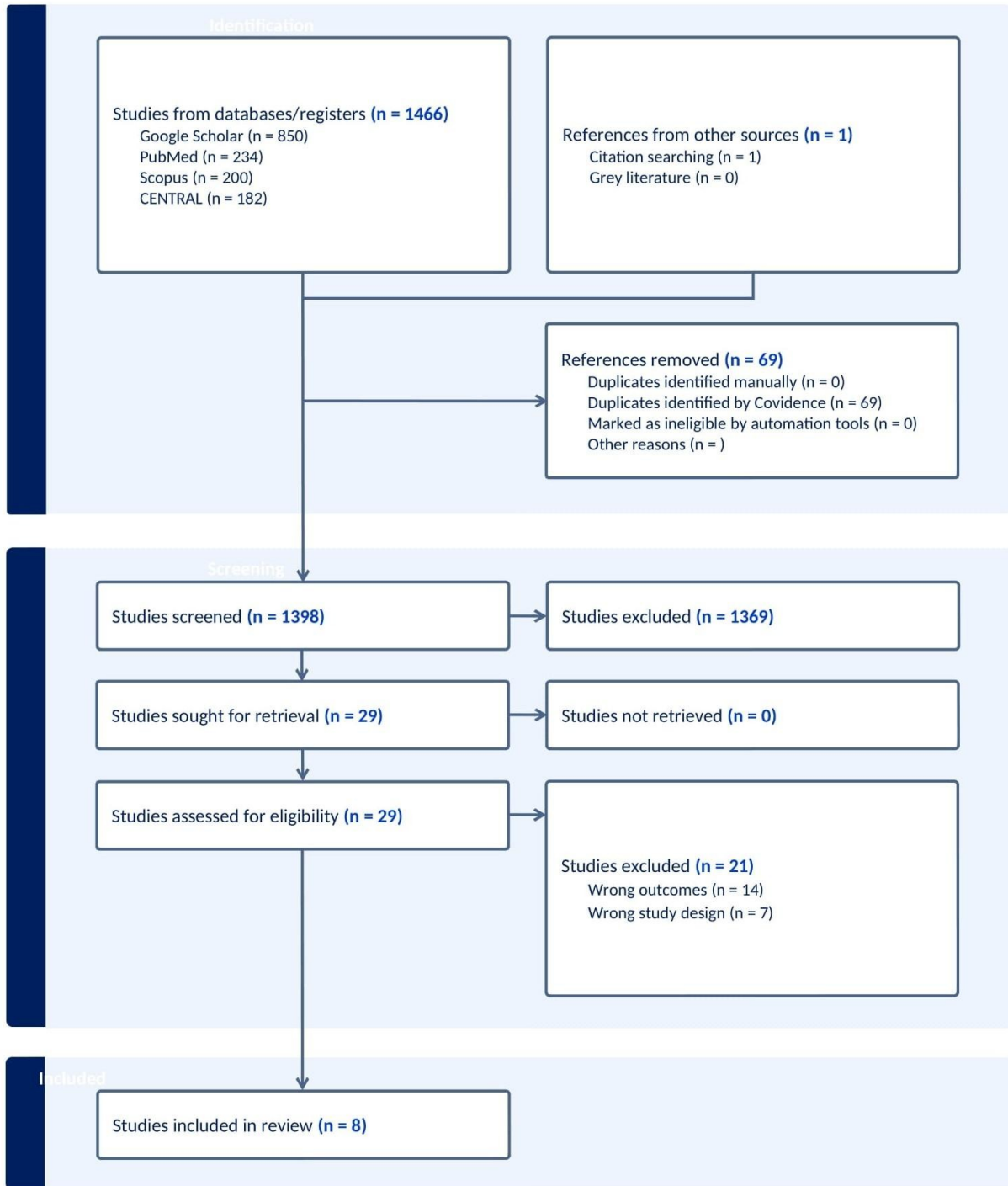


Figure 1: Preferred reporting items for systematic reviews and meta-analyses (PRISMA) flow diagram of included studies, review of adults and caregiver willingness to pay for the malaria vaccines, 2013–2023

RESULTS

Description of the included studies

Of the 1,398 screened studies for this review, 8 were included in the final analysis (Figure 1). The eight studies present WTP data for any malaria vaccine among a total of 6102 adults and caregivers of children below ten years old from six African countries (Table 1). These include 3 studies from Nigeria [17, 20, 21], and one study each from Sierra Leone [14], Burkina Faso [15], Ghana [16], Cameroon [18], and Ethiopia [19]. The majority of the studies were published in 2021 [14, 18, 19]. Only Sauerborn et al. [15] was published before the last decade. All the studies were cross-sectional studies [14-21] using a contingent valuation methodology to elicit respondents' WTP. Only 3 studies [16, 18, 19] investigated WTP in the context of the RTS,S (Mosquirix™) vaccine, which is an approved vaccine, others focused on various hypothetical malaria vaccines with similar efficacy and safety profiles as candidates in the pipeline but of unclear cost profiles [29]. Following quality appraisal, all the studies were deemed to be of satisfactory methodological quality (additional file 2).

Meta-analysis of the WTP

All the included studies had data that enabled us to conduct a meta-analysis on the extent to which participants were WTP for the malaria vaccines. One study [17] assessed the willingness of participants to pay for 3 different hypothetical malaria vaccines. Hence, we included each vaccine option from this study separately in our analysis to ensure comprehensive coverage of varying vaccine scenarios. Across the included studies, the proportion of participants who were WTP for the vaccines ranged from 49.3% to 100%. The pooled proportion of the WTP was 85.9% (95% CI: 76.0–92.1). As shown in Figure. 2, there was a significant level of heterogeneity among the studies ($I^2 = 98\%$, $p < 0.01$).

Table 1: Characteristics of the included studies

Author	Country	Study Population	Study design	Sample Size (N=6102)	Proportion WTP	Average amount WTP (\$)
McCoy et al. 2021 [14]	Sierra Leone	Adults and caregivers of children <10 years old	Mixed methods study	615	63%	\$1.07 for themselves and \$0.75 for their children
Sauerborn et al. 2005 [15]	Burkina Faso	Adults over 20 years	Cross-sectional study	2,326	100%	\$3.91 for maternal malaria vaccine, and \$2.66 for childhood malaria vaccine
Darkwa et al. 2022 [16]	Ghana	Caregivers of RTS,S eligible children	Cross-sectional qualitative study	20	100%	\$1 for their children
Udezi et al. 2010 [17]	Nigeria	Adults and caregivers	Cross-sectional study	359	Vaccine B (96.1%), Vaccine C (85.5%), Vaccine A (100%)	\$8.03 for themselves
Defo et al. 2021 [18]	Cameroon	Adults 18years+	Cross-sectional study	1,187	100%	\$7.45 for themselves
Wagnew et al 2021 [19]	Ethiopia	Caregivers of under-five children	Cross-sectional study	604	60%	\$26.90 or \$6.73 for their children
Chukwuocha et al. 2018 [20]	Nigeria	Caregivers	Cross-sectional study	500	41%	NA
Chinawa et al. 2024 [21]	Nigeria	Caregivers of under-five children	Cross-sectional study	491	49.3%	NA

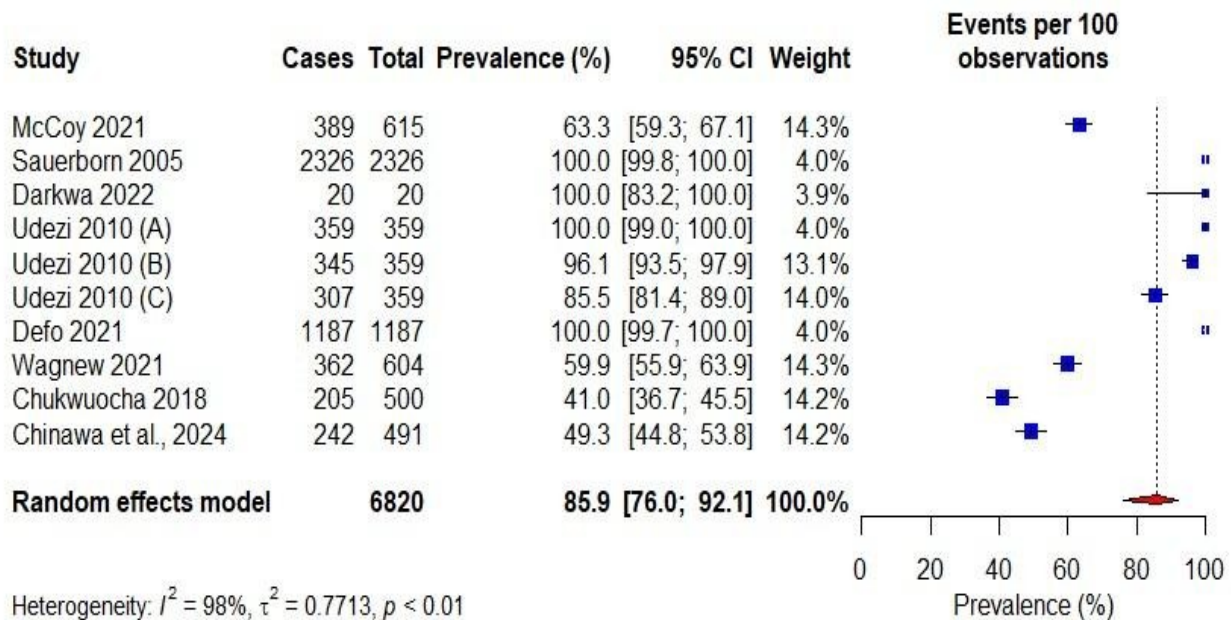


Fig 2: Forest plot for the pooled proportion of WTP for malaria vaccines

Average Amount Respondents were WTP

The average amount respondents were willing to pay was also extracted from the studies. Two studies did not report this data [20, 21], and most other studies did not report measures of variation with the WTP prices. This precluded pooled estimation via meta-analysis, and therefore, a narrative summary was adopted. The average prices respondents were willing to pay differed by country and by the intended vaccine recipients i.e. adults or their wards. In Sierra Leone, respondents were willing to pay an average of \$1.07 for themselves and \$0.75 for their children [14]. Whereas in Burkina Faso, they were willing to pay an average of \$3.91 for maternal malaria vaccine, and \$2.66 for childhood malaria vaccine [15]. In Ethiopia, respondents were willing to pay \$26.90 or \$6.73 per dose for their children [19]. In Ghana, mothers were willing to pay \$1 for their children [16]. According to studies conducted in Nigeria and Cameroon, participants were

willing to spend \$8.03 and \$7.45 for themselves respectively to get the vaccines [17, 18]. However, it is noteworthy that some respondents prefer the vaccines to be given for free (\$0) [17, 19]. Wagnew et al [19] illustrated this using an iterative bidding technique, showing that the WTP level increased from 60% of caregivers who were willing to pay the full cost (\$23.11) for the RTS,S vaccine to over 90% if offered at \$0.

Factors influencing WTP for vaccine

Several factors were identified to influence the WTP for the malaria vaccines. Majority of these factors emerged under sociodemographic characteristics of participants, vaccine-related and external concerns, past and situational context.

Sociodemographic factors

Several sociodemographic factors significantly influence WTP for malaria vaccines. Sex played a notable role, with studies consistently showing that males tend to be more willing to pay than females [15, 17]. Furthermore, participants who lived in urban areas [19], were working (employed) [17], had a higher educational level [17, 19], and earned a high income [15, 17, 18], were more willing to pay for the vaccines. The size of participants' households also influenced their WTP, with the results of two studies indicating a higher WTP level among households with smaller family sizes [15, 19]. Specifically, Wagnew et al. [19] found that participants who had a family size of less than 5 were more willing to pay for the malaria vaccines than those with a much larger family size.

Vaccine-related and external concerns

Certain concerns related to the malaria vaccines influenced the WTP for the vaccines. Notably, participants who were skeptical about the effectiveness of the vaccines were less willing to pay [14]. Similarly, those who were uncertain about the safety of the vaccines were also less willing to pay [14]. McCoy et al. [14] noted that vaccine safety concerns were fueled by unfounded rumors about vaccine campaigns causing infertility or spreading other infectious diseases, further hindering the WTP. Furthermore, the fear of adverse effects or reactions associated with vaccines influenced their WTP for the malaria vaccines [14, 15]. External concerns that influenced the WTP for the vaccines included participants' trust in the government and their religious and cultural beliefs. In particular, participants who had mistrust for the government were less WTP for the

malaria vaccine [14]. Additionally, those who had religious and cultural concerns concerning the vaccines were not WTP for it [20].

Past and situational context

In relation to the past and situational context that influence the WTP for malaria vaccines, McCoy et al., [14] reported that some participants were less willing to pay for the malaria vaccines due to supply shortages in past vaccine campaigns. Additionally, participants who have suffered malaria episodes in the past year were less WTP for a malaria vaccine which was highly effective (95%) but least well tolerated [17]. In contrast, participants who were recently hospitalized for malaria were more willing to pay for a malaria vaccine which was 85% effective, moderately tolerated and protected for 6 years [17]. Another past and situational context that shaped WTP for the vaccine was participants' previous experience with vaccination. Notably, Darkwa et al. [16] reported that a participant was concerned about the wellbeing of the child and was willing to pay for the malaria vaccines because previous vaccination had a positive impact. Furthermore, situations whereby a child's father was not supportive of vaccination, influenced their WTP for the malaria vaccines [20].

Other influential factors

Other factors that influenced the WTP for the malaria vaccines encompassed the accessibility to vaccine and healthcare services, knowledge of malaria, and the motivation for broader public health goals. Participants who envisaged that the malaria vaccines will not be accessible were not willing to pay for it [20]. Moreso, those who lived a far distance to a health facility, possibly precluding their accessibility to healthcare, were less willing to pay for the vaccines [15]. On the other hand, adults and caregivers who had adequate knowledge about malaria prevention and control were more willing to pay for the malaria vaccines [19]. Chukwuocha et al. [20] revealed that some participants were willing to pay for the malaria vaccines to ensure its continuous availability and to promote its total acceptance, showing the influence of knowledge-based public health motivations on WTP for health interventions.

DISCUSSION

As more African countries transition into the domestic health financing model, national policymakers will rely on the evidence of the willingness and capacity of their citizens to pay for health programs to guide their implementation and sustainability strategies. This consideration is relevant to the malaria vaccine roll-out in Africa where the estimated vaccine need is projected to surpass donor-assisted supply, prospecting the potential for a cost-based provision model [30]. Moreover, measuring the WTP level may reflect the true demand and market value of the vaccine to the population [31]. Thus, this systematic review and meta-analysis synthesized the evidence of the willingness, its determinants, and the average amount that adults and primary caregivers are willing to pay for the malaria vaccines in Africa.

There is a dearth of studies on WTP for the malaria vaccines in Africa. The majority (6 out of 8) of the included studies came from the West African region, missing insights from some high-burden countries in other regions like DR Congo, Mozambique, Uganda and Tanzania. Our meta-analysis found an overall high WTP (85.9% pooled proportion) for the malaria vaccine among the study population but a wide variation in the average price people were willing to pay per country. The WTP level for the malaria vaccine found in this study is higher than the WTP proportion values reported for some other recently introduced vaccines across the continent, such as the COVID-19 vaccines, [31, 32] the Typhoid Vi-conjugate vaccine, [33] hepatitis B vaccine, [34] and Human Papilloma Virus (HPV) vaccine [35, 36]. In addition, the high WTP for the malaria vaccine may correlate with the high acceptance rate for the vaccine reported in previous studies, since people are more willing to pay for a well-accepted vaccine. For instance, a recent meta-analysis by Sulaiman et al. 2023 [37] reported a pooled acceptance rate of 95.3% for the RTS,S vaccine among 14,666 caregivers of under-five children in Africa. Nigeria, Ghana, and Tanzania featured the highest acceptance rates among the represented countries. The reverse is true for the COVID-19 vaccine in which a low-to-modest acceptance rate for the vaccine runs parallel to the low WTP level recorded. In systematic reviews of studies conducted among African health workers, the pooled acceptance rates of the COVID-19 vaccines was between 46% and 55%, despite the studied population being a prioritized group in the COVID-19 vaccination program [38, 39]. In Ghana, Alhassan et al. reported a 44% acceptance rate for the COVID-19 vaccine for which only 55% of the willing participants were keen to pay \$6.0 [31]. While the low acceptance may contribute to the low WTP level recorded for the COVID-19 vaccine, differences in community knowledge and familiarity with malaria compared to COVID-19 may also account for some differences [14].

Presumably, overlap exists between the predictors of acceptance or hesitancy and WTP for a given vaccine. Our study identified various sociodemographic, vaccine-related, and situational factors influencing the WTP for the malaria vaccines. These factors include differences in gender, family size, religious beliefs, income level, educational attainment, perception of vaccine efficacy and side effects, malaria risk perception, and severity of past malaria attacks. This same set of factors including past vaccination experience and community perception of the vaccine were noted to influence the acceptance or hesitancy toward the malaria vaccine in most malaria-endemic settings [37, 40]. From the literature, similar overlap can be seen between the determinants of acceptance and of WTP for the COVID-19 vaccines [31, 32, 38, 39]. This suggests that by addressing the factors promoting vaccine hesitancy such as fear of side effects and distrust in the government, the acceptance and WTP for the malaria vaccine could be further enhanced.

The importance of education in fostering vaccine acceptance and WTP cannot be overstated. Our review found that people with correct knowledge of malaria prevention measures and those with positive public health motivation were more willing to pay for the malaria vaccine. Similarly, global experience with the COVID-19 vaccination program also indicated that having higher levels of education positively impacts attitudes toward vaccination [41]. Hence, educating end users through various means, including community engagement and advocacy, about the value of the vaccine is imperative, particularly among populations with lower educational levels.

From our findings, the average prices that African adults were willing to pay for the malaria vaccine ranged from ~\$1 (Sierra Leone) to \$8.03 (Nigeria) for themselves and from \$0.69 (Sierra Leone) to \$26.90 (Ethiopia) for their children. The seemingly higher average WTP price reported in Ethiopia may be associated with study methodology (iterative bidding) where the researchers used the full cost of the RTS,S vaccine (\$23.11) as the starting bid after a brief explanation of the vaccine's benefits to the respondents. A socioeconomic argument may also be given since Ethiopia has the second largest population and fifth largest gross domestic product (GDP) sizes on the continent. However, the methodological reason may still prevail over the socioeconomic standpoint as Nigeria, which has larger population and GDP sizes and comparable literacy rates than Ethiopia, still reports lower average WTP prices. Moreover, none of the studies from Nigeria used cost reflective estimates in their methodologies as did Wagnew et al [19] from Ethiopia [19]. Nevertheless, the reality of the diverse prices found in this study holds important implications for

the malaria vaccination program in Africa in the long run. One, the wide variation in the amounts people were willing to pay reflects the differing capacities to pay for the vaccines within and between African countries. Richer households and nations with larger economies (such as Nigeria and Ethiopia) reported higher WTP prices than their respective counterparts. As a result, unequal capacity to pay for the malaria vaccine raises concerns about equitable coverage in a cost-based provision model. Similar challenges have ensued with the cost-based COVID-19 vaccination program in the post-pandemic era [12].

Indeed, the income level of end users is a major demand-related factor influencing the WTP of various vaccines across different countries. In a study of the relationship between household wealth and childhood immunization uptake in Northern Nigeria, a disparity was observed between the poor and the rich, as the odds of children receiving complete immunization was reportedly 1.96 times higher among children of the rich than the poor [42]. As such, financial constraints faced by less wealthy households in a cost-based vaccination program may exacerbate the existing missed opportunity for vaccination and incomplete immunization problems on the continent. Therefore, African governments need to consider this important factor in the program funding and price fixing for the malaria vaccines to ensure that low-income households will be able to afford the malaria vaccine.

Furthermore, the average amounts the participants were willing to pay by country in this study fell short of the estimated delivery cost of the available malaria vaccines, especially the RTS,S vaccine which costs approximately \$10.90 per dose [10]. According to Baral et al. [43] to introduce the donor-subsidized RTS,S vaccine at \$5, the incremental financial cost per dose administered may reach a total of \$5.74, and the economic cost may be two or three times the financial cost across countries. Although it is noteworthy that the RTS,S vaccine remains cost-effective compared with some other interventions like mosquito control measures and its introduction cost is similar to past vaccines [43, 44]. However, the R21 vaccine which costs \$3.90 per dose and is almost as cost-effective as bednets may prove to be a more affordable alternative for African countries in the long run [44].

Strengths and Limitations of the study:

The main limitation of this study is the high level of heterogeneity detected among the reviewed studies as well as the inherent limitations of their cross-sectional design. Also, only English-based studies and six countries were represented, potentially missing insights from other high-burden and non-English-speaking countries like Mozambique and DR Congo. These factors may reduce the certainty and generalizability of our recommendations. However, the relative uniformity in methodology among the included studies, i.e. using the contingent valuation method, enables the meta-analysis of the WTP level, which is relevant to our study objectives.

Implications of findings for policy and research

This systematic review found a seemingly high WTP level but varying financial commitment or capacity for the malaria vaccines among adults and wards of under-five children in Africa. Determinants of WTP were similar to factors influencing the acceptance of the vaccine suggesting the opportunity for cross-utility of strategies to improve both acceptance and WTP. However, addressing the unequal capacity to pay among the African populations requires that country-level policymakers carefully plan the transition to a cost-based malaria vaccine delivery to accommodate the least wealthy subpopulations. This may also involve adopting the most cost-effective malaria vaccine type and supporting local vaccine manufacturing.

Furthermore, the majority of the reviewed studies were based on hypothetical malaria vaccines in periods before the final approval of the two currently used vaccines. Given the success of the pilot implementation programs and the subsequent rollout in countries across the continent, temporal changes in WTP levels can be expected. Hence, further studies are required to evaluate the WTP for the currently approved malaria vaccines across many African countries based on their actual efficacy, safety, and cost profiles. This is especially required for the R21 vaccine given its different cost profile from the RTS,S vaccine and the insufficient data on its post-approval acceptance and WTP. Future studies should also prioritize cost-reflective estimates in evaluating WTP among respondents.

CONCLUSION

This study found, though with low certainty, evidence of a high WTP for the malaria vaccines among African adults and primary caregivers, attributed to a prevalent positive perception of the value of the vaccines. However, socioeconomic factors, such as differences in education and

income levels, may influence actual payment commitment as reflected in the wide range of prices people were keen to spend across households and countries. Therefore, national health authorities across Africa must consider their local realities in the malaria vaccine implementation for equitable coverage, especially when the recipients or caregivers are required to pay for the vaccine. Implementing initiatives to educate people on the need to pay for program sustainability will also become imperative. Lastly, as the malaria vaccination program continues, further research into the economic behaviors of stakeholders on the continent is required for the best outcomes.

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Conflict of Interest

The authors declare no conflict of interest

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Authors contributions

FBE: Conceptualization, Literature Search, Screening, Writing

IAH: Writing, Review, and Critical Edits

EE: Analysis, Writing

DAO: Writing

JBA: Writing

RDD: Screening

MA: Writing

All authors validate the final version.

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