A SYSTEMATIC SCOPING REVIEW OF MALARIA PREVENTION PROGRAMS IN PREGNANCY

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ABSTRACT
There are few guidelines for health workers to follow when providing and managing malaria prevention therapy during pregnancy, but due to a lack of effective treatment options, malaria management during pregnancy has become non-standard in many countries. This study aims to assess the malaria prevention program in pregnancy, including its advantages, challenges, and obstacles. It was carried out using a systematic scoping review of the literature to identify publications that addressed the prevention program. A structured search was conducted on different databases using predefined eligibility criteria for the 17 selected articles. Malaria prevention programs in pregnancy are effective, but they must be integrated and involve the community. Various countries are having difficulty implementing WHO-recommended strategies, such as Long-Lasting Insecticide Nets (LLINs), antimalarial drugs, and Rapid Diagnostic Tests. Therefore it is necessary to develop an integrated program to prevent and treat malaria in pregnancy.

Introduction

Malaria is a vector-borne disease that affects global health with approximately 3,4 billion people at risk (Ingabire et al., 2014);(Dako-Gyeke & Kofie, 2015). Despite being preventable and curable, the disease continuously has a devastating impact on people's health and livelihoods across the world (Flaherty et al., 2017). The World Health Organization (WHO) reported that malaria cases decrease from 238 million to 229 million in 87 malaria-endemic countries, with cases per 1000 population at risk, which reduced from 80 in 2000 to 57 in 2019 (Liu et al., 2021); (WHO, 2021). Apart from Africa, the disease's prevalence in Southeast Asian countries needs to be addressed because they have the world's second-highest case rate. In 2019, the Southeast Asia Region had nine malaria-endemic countries, accounting for about 3% of global cases. Since 2000, the number of active cases has fallen by 74%, from 23.0 million in 2000 to around 6.3 million in 2019. According to a previous study, India had the largest absolute reduction from around 20 million cases in 2000 to approximately 5.6 million, followed by Indonesia, which had an incident rate of over 600,000 people in 2019 (Arisco et al., 2021).

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According to the Indonesian Ministry of Health, the Annual Parasite Index (API) (per 1000 cases) in 2020 is 0.9, and three provinces have values higher than the national figure, namely Papua (63.12), West Papua (10.15), and NTT. (2.76) (Flaherty et al., 2017).

Although malaria control has resulted in a 47% reduction in malaria-related mortality since 2000, prevention of the disease during pregnancy (MiP) has been less impressive. This is because approximately 50 million women in malaria-endemic countries become pregnant each year. During pregnancy, this disease kills an estimated 100.000 of these women and 200.000 of their children (Agarwal et al., 2015);(Bharatwajan & Mahapatra, 2009). It was also discovered that pregnant women and newborn children are the most vulnerable to infection and require special protection to avoid disease and death (Bharatwajan & Mahapatra, 2009);(Chico et al., 2015).

Pregnant women and women of childbearing age will require special attention during mass malaria eradication campaigns. Because malaria susceptibility increases during pregnancy, pregnant women serve as a major parasite reservoir in their communities (Fried & Duffy, 2017). They are especially vulnerable to the disease because pregnancy weakens a woman's immune system and makes her more susceptible to infection, increasing the risk of severe anemia and death. Maternal malaria also increases the risk of spontaneous abortion, stillbirth, premature birth, and low birth weight in the fetus (Bharatwajan & Mahapatra, 2009).

The World Health Organization (WHO) recommends a three-pronged approach to MiP control: intermittent preventive treatment in pregnancy (IPTp) with sulfadoxine-pyrimethamine (SP), the use of insecticide-treated nets (ITNs), and effective case management of malaria illness and anemia. It was also suggested that every woman attend an antenatal clinic to receive at least two doses of SP after the first trimester for malaria prevention, and three doses for HIV-positive patients. During the COVID-19 pandemic, however, there was a shift in the administration of necessary doses, with the recommendation to maintain quality MiP services, including ITNs and IPTp for dealing with malaria in pregnancy. It was suggested that an RDT be used for early detection and that ACTs be used for treatment. Sulfadoxine Pyrimethamine IPTp supply must be guaranteed, and direct observations of SP and ITN's treatment must be considered. It was also suggested that pregnant women with malaria symptoms be tested with RDTs and COVID-19 and that all healthcare workers be adequately protected. COVID-19 safety precautions apply to routine ANC services, including MiP, and MiP services must be kept separate from potential hazards (Fried & Duffy, 2017).

Because of several unique host-parasite interactions that make malaria difficult to treat during pregnancy, elimination strategies must be tailored. Malaria is more common in pregnant women than in other adults, but it is difficult to diagnose and treat. Malaria patients should be treated with an effective drug that kills the parasites quickly (Fried & Duffy, 2017);(Omo-Aghoja et al., 2008). Although there is no convincing evidence that any of the current antimalarial drugs cause teratogenic effects in humans, there are theoretical concerns about the safety of antimalarial drugs for the fetus. In addition, there is insufficient evidence that they are safe to use during pregnancy (Nwagha et al., 2014). WHO recommends that every woman attending an antenatal clinic receive at least two doses of SP after the first trimester for malaria prevention. There are, however, few guidelines for health workers to follow when providing and managing malaria prevention therapy during pregnancy. Malaria management during pregnancy has thus become non-standard in many countries. Various community-based efforts, such as the combination of laboratory diagnosis, therapy, and vector control, were also undertaken, but their successes and challenges have yet to be fully identified. Therefore, this study aims to examine several malaria prevention programs that have been implemented in different countries. It was carried out by considering some specific goals such as:

1. Determining malaria prevention programs for pregnant women in different countries.
2. Identify how the programs have worked in different countries.

3. Learn about the challenges and obstacles that various programs faced in different countries.

Method

The preparation of the systematic scoping review of literature consists of several stages, including:

1. Making Study Questions

Before starting the literature review, the objectives and study questions were formulated to guide the literature search (Khan et al., 2003). The study question developed is "How are the malaria elimination programs in pregnancy among various countries and what are the successes and obstacles that they faced?"

2. Searching for Data Sources and Literature

After developing study questions, the next step is to search for journal articles published through electronic databases. A systematic search of the literature between 2010 and 2021 was performed using data from PubMed and Google Scholar. During the examination of the Malaria in Pregnancy Prevention Program worldwide, keyword searches in data-based such as PubMed Central (PMC), and Google Scholars for PubMed were used, which involve the term "Malaria in Pregnancy [All Fields] AND ("Program" [MeSH Terms] OR ("Community" [All Fields]). For Google Scholar, Scopus, and Springerlink, the keywords used were "Malaria in Pregnancy, Prevention Program". Meanwhile, articles were included in this review when they identify Malaria in Pregnancy Program in various countries.

3. Inclusion/Exclusion Criteria

Articles were eligible when they met the following criteria, (1) Acces: Full paper, (2) Design: Randomized and non-randomized controlled trial (RCTs), Cross-sectional, Survey, case study, and quasi-experiment, (3) Outcome: Malaria in Pregnancy prevention and treatment program, and (4) Relevance: Articles published in English and Indonesian addressed eliminating malaria in the pregnancy program.

4. Articles Selection

The database contained a total of 1299 titles/abstracts. After excluding duplicates, there were 1200 articles left, with 230 duplicated copies removed, and 1069 titles/abstracts obtained. Following that, full-text articles were thoroughly reviewed, and the 580 articles were screened. A total of 351 articles were excluded because they did not focus on the prevention and management of malaria in pregnancy, 128 were not research articles, and 84 were biomedical, genetic, and drug research articles. Only 17 articles met the inclusion criteria. This review focused on malaria prevention and management programs in various countries. All included articles were evaluated to reduce the risk of bias. The selection process is illustrated in Figure 1.

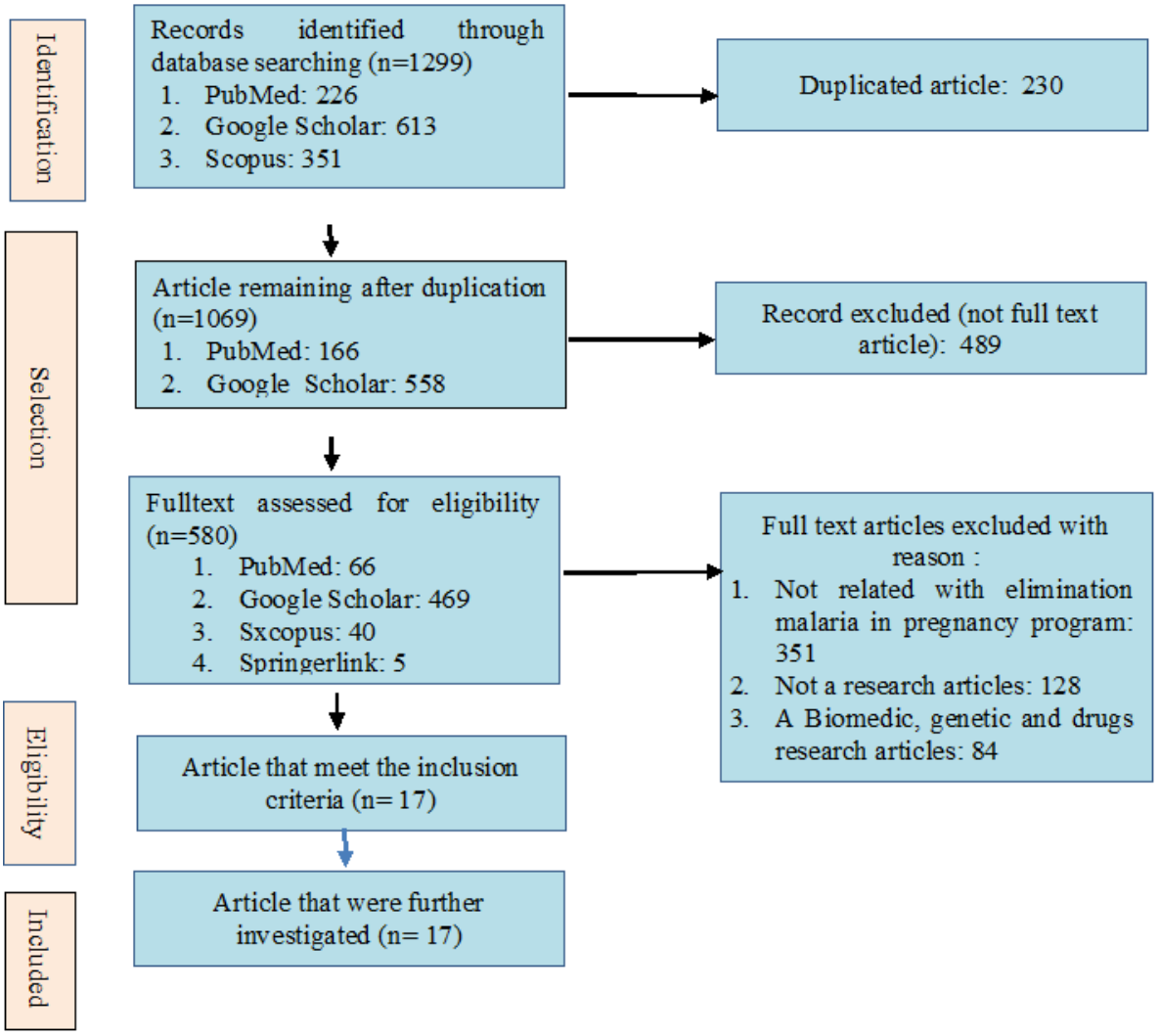

Figure 1. PRISMA Flowchart for the Article Selection (Khan et al., 2003).

Result and Discussion

Based on the result of the screening of 17 articles selected from 2010 to 2021, all articles were analyzed using qualitative methods, with a content analysis design. The summary of the review literature is presented in Table 1.

NO	Authors	Study objective	Subject	Design	Place	Findings	Recommendation

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1	(Khan et al., 2003)	In the context of the clinical trial, assess the acceptability and perceptions of health providers and pregnant women toward Intermittent Screening Therapy (ISTp) and Intermittent Preventive Therapy (IPTp) versus Single Screening and Treatment (SSTp).	Health providers and pregnant women	Qualitative	East-west Sumba and Mimika Papua, Indonesia	Pregnant women and health providers agreed to malaria screening at every ANC visit. Antimalaria medication was given to expectant mothers as part of a comprehensive package of ANC services. Concerns about potential harm to the mother and baby, as well as drug resistance, prompted providers to be hesitant to administer antimalarial presumptive as IPTp.	It appears that replacing SSTp with IPTp will be a more difficult conceptual shift for providers. However, because of its superior efficacy and lack of reliance on RDTs, providers in Indonesia's higher transmission settings may be persuaded to consider it as a more realistic strategy.
2	(Fernandes et al., 2016)	The study explored how health system, socio-cultural, economic, environmental, and individual factors influence the ownership and use of LLINs among pregnant women in two Ghanaian regions	Health workers, pregnant women, and community members	Ethnographic study with non-participant observations	2 Ghanaian Regions (3 districts in Ashanti and 2 districts in Volta Regions of Ghana)	The availability of LLINs in healthcare facilities influenced ownership and use. Receiving accurate information from health providers and encouragement from public officials regarding the application of increased LLIN. Women who	Giving out LLINs at the facility level needs to be accompanied by comprehensive information about the sociocultural context where women live. Facilities need to be promoted to keep LLINs in stock at all times to ensure ANC registrants receive LLINs for use.

						had previously used LLINs before becoming pregnant and those with young children were investigated. LLIN use was reduced due to the irritating effects and a preference for traditional mosquito-repellent methods was adopted. Pregnant women with household and family members who used LLINs were positively influenced. Gender power dynamics between husbands and wives influenced women's LLIN use. Inconsistent use was exacerbated by the type of housing and weather conditions. Staying out late for business and conversing exposed pregnant women to mosquito bites.	

3	(Fernandes et al., 2016)	Investigated whether Screening with RDT and treatment of those positive (ISTp) at routine antenatal clinic attendance is as effective and safe as SP-IPTp in pregnant women.	Health workers in health facilities and pregnant women	Randomized Control Trial	Ejisu Juaben and Afigya Sekyere East districts of the Ashanti Region of Ghana	The study showed that ISTp, using SP (Sulfadoxine Pyrimethamine) or AS+AQ was not inferior to IPTp with SP in preventing maternal anemia and low birth weight, according to the non-inferiority criteria that were set before the trial, in women who used an LLIN in an area of moderately high malaria transmission in Ghana.	In an area with moderate-high malaria transmission, IST with SP or Artesunate+Amodiaquine (AS+AQ) may be a safe and effective strategy for controlling malaria in pregnancy. However, there is a need to confirm these results in other geographical areas.

4	(Mading & Willa, 2018)	Description of Anopheles mosquito behavior about malaria prevention in pregnancy	Pregnant women who live in the study area	Descriptive cross-sectional	Wailabubur and Bilacenge Villange, Eas West Sumba Region	There are 6 species of Anopheles mosquitoes in the 2 villages. Mosquito activity is mostly discovered outside the house, with a peak at 01.00-02.00. Efforts made for vector control include cleaning the bushes around the house and burning insect repellent using repellents. However, pregnant women still do not regularly use	Approach community leaders for a ban on going out at night. Equitable distribution of mosquito nets for pregnant women.

						mosquito nets and still travel out of the house at night	
5	(Okedo-Alex et al., 2020)	Present results of the pre-implementation baseline survey, highlighting recently pregnant women's malaria knowledge, perceptions of Community Health Workers (CHWs) and barriers to care seeking, to better understand how the community I delivery of IPTp-SP (cIPTp) can impact IPTp coverage and ANC attendance.	Pregnant women aged 16-49 years who had a pregnancy, leading to live births in the previous 12 month	Household Survey	Ntcheu and Nkhata Bay Districts in Malawi	Women reported positive experiences with CHWs, but there was no focus on MiP women. Those in Nkhata Bay were more likely to be assisted by CHW, receive IPTp 3+, and had better knowledge. Increasing CHW focus on the dangers of MiP and implementing cIPTp has the potential to raise IPTp coverage.	To help women understand the importance of IPTp and increase uptake, new approaches are required. IPTp coverage was higher in Nkhata Bay, where women were more knowledgeable. This is because it was anticipated that by increasing CHW's focus on malaria in pregnancy, promoting routine ANC attendance and IPTp uptake, and providing IPTp in the community.
6	(Okedo-Alex et al., 2020)	The study involved proof of concept implementation to determine satisfaction with and effectiveness of community-directed distribution of IPTp-SP on uptake among pregnant women.	Women with second-trimester pregnancy and had not received a dose of SP in the previous month	Intervention study without control or randomized conducted in three phases, where baseline and post-implementation Intervention were Community directed distributor training,	Ebonyi State, Nigeria	The results showed a significant increase in the use of IPTp, followed by a community-based intervention to promote MiP, with a rise in the application of ITNs. Therefore, the study demonstrated that community-directed distribution of IPTp-SP	It is recommended to carry out sustained large-scale scare implementation of community-directed distribution of IPTp with active community participation.

				sensitization and post-implementation evaluation		improved the uptake of IPTp-SP and ITN's use. During pregnancy, it was reported that the cases of fever were less frequent. The majority of participants rated the CDD services highly, were satisfied with the project, and preferred communication-directed distribution over facility-based IPTp administration.	
7	(Okafor et al., 2019)	Assessed knowledge, perception, and preventive practices for malaria in pregnancy (MIP)	Women between the ages of 21 and 49 years who have been pregnant at least once in the 2 years before the second trimester pregnant at the time of study	Cross-Sectional Study	Lagos State, Nigeria	All respondents were aware of MiP but there was a misunderstanding about the cause of malaria and only half had a good understanding of MiP. There was also a lack of understanding about the complications of MiP in mothers. The majority of respondents used insecticidal spray and coils to prevent MiP, where only 39.5% applied IPTp and 24.4% applied ITNs, and approximately 20% used no form of prevention.	Public health education on MiP needs to be expanded at the community level to improve knowledge as well as prevention and correct the misconception.
8	(Tarr-Attia et al., 2018)	To obtain information on the barriers and opportunities	Pregnant women, traditional community,	Qualitative design (Grounded theory study)	Monrovia, Liberia	Librarians believed in malaria treatments by	Malaria studies in Liberia can help top design

		for pregnant women to participate in a malaria study	representatives, SJCH medical laboratory, and management staff			resorting to traditional medicine and spiritual care to cure the disease. Malaria patients were reportedly hampered by a lack of regular access to effective prevention methods such as bedaquiline and insecticide spraying.	evidence-based education to change current malaria prevention diagnostic and treatment-seeking attitudes and develop more acceptable technology.
9	(Mbonye et al., 2016)	To assess the quality of care in the private sector for patients seeking care in this outlet, specifically for the prevention of malaria in pregnancy.	Private health facilities	Survey	Mukono District, Bordering Lake, Central Uganda	Antimalaria and artemisinin base SP combination therapy for malaria prevention in pregnancy was commonly prescribed without considering gestational age. Correct treatment of fever in pregnancy had the greatest influence on malaria and the availability of knowledge on treatment guidelines.	Antimalaria SP was commonly prescribed without considering gestational age. For malaria prevention during pregnancy, all private facilities prescribed SP and artemisinin-based combination therapy. The treatment of fever in pregnant women according to government guidelines was inadequate.
10	(Paintain et al., 2020)	Estimate the incremental cost-effectiveness of intermittent preventive treatment with dihydroartemisinin-piperaquine	Data from a cluster randomized trial (STOP MiP) and provider perspective.	Cost-effectiveness Analysis	Papua, Indonesia	IPTp with dihydroartemisinin-piperaquine is a more expensive alternative to single effective screening and treatment for	Intervention to address provider and user acceptability needs to be considered alongside any future policy

		compared to single screening and treatment with dihydroartemisinin-piperaquine for controlling malaria in pregnancy.				malaria infection prevention in pregnancy. The higher cost is due to monthly administration compared to the single screening and treatment.	changes, while the costs and effectiveness must also be closely monitored.
11	(Okeibunor et al., 2011)	To assess the prevention of malaria in pregnancy programs through community-directed interventions.	All pregnant women who reside in the 6 programs of local government Areas (LGAs).	Pre-post parallel group design	Eket senatorial zone in southern Nigeria	When combined with supply-side interventions, the inclusion of community-based programs can significantly increase effective malaria prevention and access to formal health care assessments in general, as well as antenatal care attendance in particular	Community-directed program is a cost-effective method to improve malaria prevention. The participatory approach underlying community-directed intervention can also strengthen the ties between the formal health sector and local communities.
12	(Balami et al., 2021)	Focused on the secondary outcomes, which are behavioral (ITN's use and IPTp uptake) and clinical factors (hematocrit, malaria infection, and pregnancy outcomes).	Pregnant women attend the state specialist hospital in Maiduguri for their antenatal care.	Randomized Control Parallel Group Study	Maiduguri, the Borno State capital, is located in northeastern Nigeria	The intervention significantly improved reported ITN use, IPTp uptake, and hematocrit levels, but did not affect the incidence of reported malaria diagnosis or baby birth weights. The use of ITNs was increased in both groups from baseline to the time of the second follow-up.	It is recommended that healthcare education intervention modules be developed and implemented in routine antenatal care programs in health centers.

13	(Unwin et al., 2020)	To describe the performance of the ADT and standard RDT care start malaria HRP2pL DHPfVOM Combo (cs RDT) in stored blood regimen of asymptomatic pregnant women in Indonesia compare to a composite molecular test.	A total of 270 stored red blood and plasma samples were obtained from asymptomatic pregnant women	Trial Method	Southeast Papua, Indonesia	The ADT had a sensitivity of 19.6% and a specificity of 98.2%. The cs RDT was 22.8% sensitive and 95.5% specific for P. falciparum infection. The performance of ADT was non specifically different from cs RDT. RDT outcome was stratified qPCR cycling threshold (Ct) and the performance of RDTs was found to be comparable across parasite loads.	The ADT performed similarly to currently used csRDTs in detecting P. Falciparum in asymptomatic pregnant women. In these settings, molecular diagnostics are currently the most sensitive for malaria.
14	(Scott et al., 2014)	To evaluate Community Scheduled Screening and treatment using Community Health Workers against the primary outcome of the prevalence of placental malaria and coverage of IPTp and ANC coverage	All pregnant women resident in the study area and those who are willing to remain until delivery will be invited to participate	The multicentre trial involved 3 countries with varying malaria endemicity	The Gambia (Low), Burkina Faso (high), and Benin (High)	To reach successful global malaria control, there is an urgent need to access those at the greatest risk of infection. CSST project designing to develop a low-cost intervention for pregnant women. This will have an immediate impact on the malaria burden in resource-limited countries.	Adding community scheduled screening Treatment by Community Health Workers to the Standard IPTp-SP delivered through the health facilities is an extension strategy to communities in rural areas, thereby bringing health services closer to where women live.
15	(Ampofo et al., 2018)	To measure the relationship between the active participation of	All pregnant women of the parties who were	Cluster randomized controlled trial with ANC clinic being	Fuse-Juaben Municipality and Sekyere-	Although its potential was evident, there was no significant	Exploring factors influencing health worker compliance to

		pregnant women in ANC with control of malaria and anemia in pregnancy	visiting the ANC clinics in the 2 areas for the first time for their pregnancies	the unit of randomization	East District of Ashanti region	beneficial effect of women participating in their malaria and hemoglobin test on pregnancy outcomes.	intervention implementation and patient adherence within this context need to be considered to improve intervention effectiveness.
16	(Andrew et al., 2015)	Explores knowledge attitudes and practices related to malaria during pregnancy and its prevention in Madang Papua Nuginea, a high-prevalence area.	Pregnant women Health Staff and community members.	Qualitative study, exploring MiPO and participator y technique (free listing and sorting).	Madang, Papua Nuginea	Although the term “malaria” was widely known, it was frequently confused with general illness or pregnancy-related symptoms. Furthermore, many MiP prevention methods were linked to general healthy living practices. Various messages about the risks of MiP were received from healthcare workers, stating that other factors influenced intervention uptake. This includes the beliefs about the seriousness and risk of MiP availability and the perceived comfort of sleeping under ITNs.	During ANC visits, healthcare providers need to allow two-way communication, promote women to ask questions, and possibly test their knowledge. Clinics can also collaborate with traditional healers and community education programs that can promote people to seek treatment from clinics.
17	(Ahmed et al., 2019)	Reporting the result of the first trial in the Asia Pacific region designed to compare the safety and efficacy of monthly IST or	Local nurses and midwives	Open-label 2 sites 3 arm clusters randomized superiority trial	Eastern Indonesia (Sumba Island and Papua)	IST was associated with a lower prevalence of malaria than SST at delivery, but the prevalence of malaria in this	In areas of Asia pacific with moderate to high malaria transmission, IPT with dihydroartemis inin Piperaquine is

		IUPT with dihydroartemisinin-piperaquine with the standard SST strategy for decreasing the risk of malaria infection in pregnancy.				group was also lower at enrollment.	a promising alternative to SST. Interpreting the effect of IST is difficult. More studies on a highly sensitive malaria rapid diagnostic test need to be conducted.

As shown in Table 1, the results can be summarized below:

1. Malaria elimination programs in pregnancy are carried out in various countries, including those in the WHO recommendations, which consist of:

a. The consistent use of insecticide-treated mosquito nets (ITNs) in pregnant women results in mosquito bite prevention. This is influenced by mothers' and families' availability, ownership, knowledge, and perceptions of the impact and dangers of malaria in pregnancy.

b. Intermittent malaria screening, Intermittent Preventive Therapy (IPTp), and Sulfadoxine Pyrimethamine therapy. Pregnant women receive these screening services as part of a comprehensive ANC package. Furthermore, the effects of the drugs on the mother and fetus during therapy must be taken into account. IPTp (Intermittent Preventive Therapy) with SP or AS + AQ has the same effect on malaria prevention in pregnancy as SP. IPTp with dihydroartemisinin-piperaquine is a more cost-effective option for malaria screening and treatment than single malaria screening and treatment. In comparison to screening and treatment, intermittent delivery is more effective, with a lower prevalence of malaria. According to (Unwin et al., 2020), the performance of ADT was not significantly different from that of cs RDT for Rapid Diagnostic Treatment of P. falciparum infections.

c. Pregnant women with higher education prefer to be served by community health workers in carrying out IPTp and therapy with three doses of SP in Case Management Implementation, which can affect the success of malaria prevention programs during pregnancy. It was also discovered that community-based interventions increased the use of IPTp and ITNs significantly. The inclusion of community-based programs can significantly improve malaria prevention and access to formal health care assessments in general, and antenatal attendance in particular. The Community Scheduled Screening Treatment program is intended to be a low-cost intervention for pregnant women that will have an immediate impact on the malaria burden in resource-constrained countries.

2. Malaria prevention programs in pregnancy have worked in different countries.
   Several articles reported that the three malaria prevention programs in pregnancy based on WHO recommendations can function effectively, with the keys to success being the integration of malaria prevention programs in pregnancy (prevention and treatment) with ANC services, community involvement in program implementation (screening and treatment), integration of malaria prevention strategies with existing community programs, and increasing public awareness of perceptions and understanding of malaria.
3. The challenges and obstacles that different malaria prevention programs in pregnancy face in different countries.

At the facility level, LLIN distribution must be accompanied by detailed information about the socio-cultural context in which women live. Antimalarial SP was commonly prescribed without regard for gestational age. MiP public health education should be expanded throughout the community. Malaria research has been discovered to aid in the development of evidence-based education. In the meantime, community-based malaria prevention programs appear to be a cost-effective way of improving malaria prevention. The ADT performed similarly to currently used csRDTs in detecting P. Falciparum in asymptomatic pregnant women. In areas of Asia Pacific with moderate to high malaria transmission, IPT with dihydroartemisinin-piperaquine is a promising alternative to SST. Furthermore, more research on highly sensitive malaria rapid diagnostic tests is required.

Malaria in pregnancy has adverse consequences for both mother and baby. During pregnancy, infections can lead to symptomatic malaria in areas of low or unstable transmission, where women have little acquired immunity (Hill et al., 2013); (Hoyt et al., 2018). WHO recommends IPTp with SP, ITNs, and effective case management to treat the disease during pregnancy (WHO, 2020). This requires several efforts and the program must be properly designed to give maximum results (Tagbor et al., 2010); (Yaya et al., 2018). Many studies have been conducted on malaria prevention programs in pregnancy and their effectiveness in various countries. However, important lessons from these practices can be used in the future to design and develop malaria prevention programs. This study will summarize various malaria prevention efforts and programs in various countries, including their successes and challenges. The results obtained are as follows:

Malaria elimination programs in pregnancy are carried out in various countries, including those in WHO recommendations, which consist of:

1. Prevention of mosquito bites using insecticide-treated mosquito nets is obtained through the consistent use of ITNs in pregnant women. This is also influenced by the availability, ownership, knowledge, and perceptions of mothers and families on the effect and dangers of malaria during pregnancy. Although the most frequently mentioned prevention method was the use of bed nets, knowledge and practice contributed to the use of ITNs.

   In a study conducted in Nigeria, it was discovered that with the low overall ITN coverage in rural communities, people were knowledgeable about malaria and the benefits of prevention (Uneke et al., 2018). The negative association of relative wealth with bed net ownership can be explained by the area's severe poverty and the prohibitive cost of purchasing bed nets from shops and markets. Compared to older women, young mothers were more likely to mention the use of bed nets as a preventive measure. This is because, in comparison to previous years, young mothers are more aware of the benefits of using antenatal facilities. Pregnant women are also given free bed nets at such facilities (Masangwi et al., 2012); (Nsagha et al., 2011); (Ogwang et al., 2012). This showed that the mother believes in the efficiency of ITNs to prevent mosquito bites, thereby effectively preventing malaria during pregnancy. This condition is affected by the ITN's' ownership, while its use is significantly influenced by the mother's knowledge, belief, and understanding of the dangers of malaria during pregnancy. (Wagbatsoma & Aigbe, 2010) Therefore, the role of health workers in providing health promotion and appropriate information about malaria in pregnancy and the use of ITNs is critical as pregnant women continuously use them. (Nkunzimana & Babale, 2020).
2. Intermittent malaria screening for pregnant women (IPTp) and therapy with Sulfadoxine Pyrimethamine.

   Malaria screening services are provided to pregnant women as part of a comprehensive ANC package. Attention must be paid to the effects of these drugs on the mother and fetus during therapy. IPTp (Intermittent Preventive Therapy) with SP or AS + AQ has an effect on malaria prevention

in pregnancy that is similar to giving SP. Furthermore, IPTp with dihydroartemisinin-piperaquine is a more cost-effective alternative to single malaria screening and treatment. Compared to single screening and treatment, intermittent methods are more effective at delivery, with a lower prevalence of malaria. discovered that the performance of ADT was not significantly different from the cs RDT for Rapid Diagnostic Treatment for P. Falciparum infections (Unwin et al., 2020).

In early 2020, WHO recommended IPTp for pregnant women in malaria-endemic areas, with at least 2 curative doses of the antimalarial drug SP, one in the second and the other in the third semester of pregnancy. The recommendation was updated in 2012, increasing the number of SP doses to 3 or more. Women in moderate and high malaria transmission areas need to receive SP at each antenatal visit during the second and third trimesters, with one-month intervals between doses. However, IPTp strategies do not completely prevent MiP, and the protective effects are dependent on the timing of the first dose and between treatments. Other studies showed that replacing SP with Dihydroartemisinin-Piperaquine, Mefloquine, and Chloroquine Azithromycin Combination is an alternative to IPTp SP. The Intermittent Screening and Treatment in Pregnancy (ISTp) strategy involves the use of RDT to screen women for malaria infection during antenatal clinic visits and to treat an infection with an antimalarial drug (Bharatwajan & Mahapatra, 2009); (Fried & Duffy, 2017); (Lagerberg, 2008).

Since pregnant women are at a higher risk, screening for malaria during pregnancy through an antenatal visit is recommended. This demographic group has become an important parasite reservoir in the community and a key target for interventions during elimination efforts. Meanwhile, pregnant women and women of childbearing age will require special consideration during any mass administration campaigns.

3. Case Management Implementation,

Pregnant women with higher education prefer to be served by community health workers in carrying out IPTp and therapy with 3 doses of SP, which can affect the success of malaria prevention programs during pregnancy. It was also discovered that community-based intervention showed a significant increase in the use of IPTp and ITNs. The inclusion of community-based programs can significantly increase effective malaria prevention as well as access to formal health care assessments in general, and antenatal attendance. Community Scheduled Screening Treatment is designed for low-cost intervention in pregnant women, which will have an immediate impact on the malaria burden in resource-limited countries.

Community Health Workers (CHWs) have demonstrated a willingness to engage and correctly carry out CCMm. Other studies from different countries also reported that CHWs can perform RDTs correctly and adhere to test results. This showed that with proper training and supervision, CHWs can be trusted to carry out in communities. Since the program has also been accepted by community members, it can be successful when implemented properly. However, for the CCMm program to be sustainable, CHWs must be motivated, because they are the foundation for implementation (Arnaldo et al., 2019); (Habimana et al., 2020); (Malpass et al., 2020). Commodities such as RDTs and drugs must be available in health facilities for CHWs to use in their community work. Meanwhile, the program cannot be successful unless clinicians, health facility in-charges, and technicians are involved in its implementation (Boakye et al., 2018); (Das et al., 2014); (Fried & Duffy, 2017); (Oppong et al., 2019); (Salam et al., 2014).

All studies showed that implementing case management for malaria in the community is more effective, based on the evaluation of health who reached the targets. However, this program will not succeed when there are no adequate tools and drugs

as well as health workers, doctors, and health facilities to support the program.

2. Malaria prevention programs in pregnancy have worked in different countries.

Increasing public awareness and understanding of malaria in pregnancy, as well as screening and treatment, will contribute to the success of malaria prevention and treatment programs in pregnancy (Tunçalp et al., 2017); (WHO, 2020). Several articles reported that the 3 malaria prevention programs can function effectively. For the control of malaria in pregnancy, 3 evidence-based strategies, namely ITNs, IPT, and effective case management are available, but the widespread implementation of effective programs remains a significant challenge (Rollback Malaria Working Groups, 2018); (WHO, 2020). Therefore, this study summarizes malaria prevention practices from various countries that have produced positive results. Some points to emphasize in the practice of preventing and treating malaria in pregnancy include the availability of policies and supervision of their implementation, integration between health workers and the community in ensuring the program's sustainability, and the supply chain of malaria prevention and control tools. Furthermore, some of the practical efforts that have yielded good results include supporting as well as considering cultural and environmental factors in designing malaria prevention programs, increasing cases of ANC clicks, and improving the capacity of ANC workers and communities regarding malaria prevention programs.

The challenges and obstacles that different malaria prevention programs in pregnancy face in different countries. The distribution of LLINs at the facility level needs to be accompanied by detailed information about the socio-cultural context in which the women live. Antimalarial SP was frequently prescribed without considering the gestational age, therefore, MiP public health education must be expanded in the community. Malaria studies can also aid in the development of evidence-based education. Based on the discoveries, community-based malaria prevention programs appear to be cost-effective methods to improve malaria prevention. In detecting P. Falciparum in asymptomatic pregnant women, the ADT performed similarly to currently used csRDTs. IPT with dihydroartemisinin-piperaquine is a promising alternative to SST in areas of Asia Pacific with moderate to high malaria transmission. More investigations need to be carried out on highly sensitive malaria rapid diagnostic tests. Many women, specifically those living in remote areas, have limited access to medical care and effective malaria control tools such as ITNs. The delivery of cost-effective malaria prevention to pregnant women will necessitate improved antenatal care. It was also reported that the integration of malaria control with other health programs for pregnant women and infants increased community awareness and financial investment. The reward for accomplishing the program will be safer pregnancies and fewer infant deaths. However, in the future, the mother's and ANC attendants' compliance needs to be closely monitored. This is because the need for malaria prevention and treatment guidelines for mothers, communities, and health workers during pregnancy is still being considered.

Conclusion

The results showed that the prevention and treatment of malaria in pregnancy is still a concern. This is because pregnant women who have the plasmodium parasite can be asymptomatic and become a reservoir of parasites for their environment. This made different countries carry out several efforts which include implementing strategies according to WHO recommendations (ITNs, IPTp, and good case management). However, there is difficulty in the implementation of these programs. This is because some good practices by various countries are integrating the efforts with existing community programs and involving community workers in carrying out the program without adequate policies, prevention tools, and antimalarial drugs. Supervision and competent staff also affect the success of the program. Some investigations also stated that there is a challenge in the prevention and management of malaria in

pregnancy, which include the availability of guidelines for mothers, health workers, and the community. This aims to improve the knowledge, perceptions, and beliefs of mothers, health workers, and the public about malaria in pregnancy.

This study indicates the need for developing integrated health promotion, prevention, and interventions to prevent and treat malaria in pregnancy. Integrative prevention and interventions need to use multi-sectoral approaches that involve health care professionals, families, government, and communities.

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