

Exploring Which Public Health Interventions Are More Effective to Reduce Maternal and Child Health Inequalities in South Asia: A Systematic Literature Review

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Abstract

Background: Maternal and child health disparities remain a pressing public health concern in South Asia. This systematic review addresses a critical gap in the literature by evaluating the effectiveness of public health interventions targeting these disparities in Bangladesh, India, and Pakistan. Distinguishing itself from prior studies, this research provides a thorough examination of the combined effects of community-based programs, financial assistance, and nutritional supplementation, offering a fresh and comprehensive perspective on strategies to reduce health inequities in the region. **Methods:** A systematic review and narrative synthesis were conducted using databases such as PubMed and Medline, covering articles published between 2000 and 2019. The inclusion criteria focused on observational and experimental studies evaluating interventions aimed at improving maternal and child health. The quality of the studies was assessed using the CASP checklists. **Results:** The review included 19 studies that demonstrated significant reductions in maternal and child health disparities. Key interventions included demand-side financial assistance, community education, and nutritional supplements. For example, Iron Folic Acid (IFA) supplementation, combined with antenatal care and tetanus toxoid vaccination, significantly reduced postnatal and under-5 mortality (OR = 0.66, 95% CI: 0.45–0.98). Another study reported a 30% reduction in the maternal mortality rate (MMR) among targeted populations. **Discussion:** Integrating mental health support within maternal healthcare is crucial to addressing exacerbated vulnerabilities. Effective public health initiatives—including financial aid, community-based programs, and improved healthcare services—have demonstrated potential in reducing these disparities. Policy recommendations include combining nutritional supplementation with antenatal care, expanding conditional cash transfer schemes, and enhancing mental health services. **Conclusion:** Community-based and targeted interventions are essential for reducing health disparities. Policies should prioritize integrated care models, targeted subsidies, and enhanced mental health services to achieve sustainable improvements in maternal and child health outcomes.

Keywords: Maternal Health, Child health, Healthcare services, South Asia, Inequalities, Systematic Review

Introduction

Most of the middle- and low-income developing countries have made a significant achievement in reducing maternal and child health mortality and morbidity. However, a different segment of the population still suffers from the disparity in maternal and child health. These disparities persist because improvements in healthcare access and quality are often unevenly distributed, with marginalized and rural populations continuing to face significant barriers to care. Additionally, social determinants of health, such as poverty, lack of education, and gender inequality, contribute to ongoing health inequities. One major reason for the persistence of disparities is the uneven distribution of healthcare resources. Urban areas often have better healthcare infrastructure, more healthcare providers, and greater access to advanced medical technologies compared to rural areas (Riley, 2012).

This urban-rural divide means that people living in rural areas may not receive timely or adequate medical care, leading to higher mortality rates.

Socioeconomic factors also play a critical role. Individuals from lower socioeconomic backgrounds often face multiple barriers to accessing healthcare, including financial constraints, lack of health insurance, and limited transportation options. These barriers can prevent them from seeking necessary medical care, resulting in poorer health outcomes (Pampel et al. 2010). Education is another significant factor. Higher levels of education are associated with better health literacy, which enables individuals to make informed health decisions, adhere to medical advice, and navigate the healthcare system effectively. Conversely, lower levels of education can limit individuals' understanding of health information and reduce their ability to access and utilize healthcare services (Bayati et al., 2018). Cultural and social factors, such as gender inequality and discrimination, further exacerbate health disparities. South Asian women face significant maternal and child health disparities not only in their home countries but also globally. For example, in the UK, these disparities among South Asian immigrants can exacerbate socio-economic vulnerabilities, potentially increasing the risk of severe knife crime within these communities. This heightened risk is particularly pronounced among South Asian women, who may face additional challenges such as limited access to healthcare and social services, further compounding their vulnerability to violence and crime (Vinnakota et al., 2022). In many societies, women and girls may have less access to healthcare due to cultural norms that prioritize the health and well-being of men and boys. Discrimination based on race, ethnicity, or caste can also lead to unequal treatment within the healthcare system, resulting in poorer health outcomes for marginalized groups (Manuel, 2018).

Additionally, there are inconsistencies in the maternal mortality rate (MMR), infant and under-five mortality rates, adolescent birth rates, and other MDGs and SDGs indicators among different segments of the population throughout the country. This segmentation could be based on education level, economic status, age, gender, and other social determinants. For example, in south Asian countries, MMR has been reduced from 395 to 163 death per 100,000 live births between 2000 to 2017 (Kuhnt, 2017). Still in India, 47.1% of maternal death were reported from Slum area in Chandigarh compared to urban area (25%) (Kaur et al., 2018). This disparity is often noticeable in different population strata in south Asian countries. Only in this region (South Asia), nearly a quarter of global maternal death occurred in 2015 and where India alone contributed 17% of the global death (El-saharty, 2015). Pregnant mother from rural and remote area suffers from the distance barrier to access the health care services, mainly during emergency (Fukuda-Parr, 2004). Inequality exists between poor and rich communities. Even, under-five mortality rates are double in poor families compared to those children who come from affluent households (Langer et al., 2015). Inequal access and distribution of health services between urban and rural areas result in the highest mortality rate in rural areas in contrast with urban areas. In Pakistan, around 75% of women give birth at home without skilled attendants compared to the deliveries in urban areas (43%) (Shaheen et al., 2022).

Moreover, according to report, MMR in rural areas is nearly double the urban areas (Rossen et al., 2022). In Bangladesh, study revealed that quarter of a maternal and child death occurred just due to the long distance for accessing the primary health care (Amin et al., 2010). Among the South-Asian countries, low middle-income countries mainly Bangladesh, India, Pakistan have the worst health inequalities in a different segment of populations because of their high-density population, lack of adequate services and facilities across the country, urbanization, and neglect towards the rural setting (Akseer et al., 2017). For example, though, the maternal mortality rate decreased by 223 from 2000 to 2015, (WHO, 2016), still only 18% of deliveries in the rural area have skilled attendant at birth, while 74% of deliveries among richest households get skilled attendant at birth. Furthermore, institutional delivery in urban residence was noticed double (nearly 60%) compared to the deliveries in rural residence (Jo, 2024). Antenatal care coverage has shown a significant gap from the poorest to richest households. For example, antenatal care coverage was 6 times (53%) higher in richest households that of pregnant women in the poorest households (9%) (WHO, 2016). In 2014, among the poorest households, 42 infants died per 1,000 live births compared to 20 deaths among the affluent families (Hossain, 2024). In India, 1,900 babies die each day before reaching their first month and the main cause of neonatal mortality is prematurity (43.8%) (Hug, Alexander et al. 2019). Compared to the national average, the different demographic regions showed the worst scenario in terms of neonatal mortality rate, infant mortality rate and the maternal mortality rate. For example, when the national average of infant mortality rate (IMR) was 34 per 1,000 live births, IMR was 47 per 1,000 live births in Madhya Pradesh in 2016 followed by Assam (44), Odisha (44) and Uttar Pradesh (43) (Goswami, 2018). In terms of Adolescent fertility rate (births per 1,000 women ages 15-19), Bangladesh has reported 83 births per 1,000 women ages 15-19 in 2017, the highest Adolescent fertility rate compared to the other south Asian countries (World Bank, 2017b). Even if the national average for the adolescent fertility rate was 13 births per 1,000 women ages 15-19, in Tripura, 1 in 5 women aged 15-19 years were reported as mothers or pregnant (Talukder et al., 2017). It is already evidenced that disparity exists depending on demographic location, race, ethnicity, caste, education level, income, household size, age and gender among the south Asian countries (Akseer et al., 2017). These deaths are preventable, and these complications are avoidable if appropriate interventions can be implemented to reduce the gap between urban and rural areas, and different population strata.

Various interventions from government and non-governmental organizations are aimed at reducing maternal and child mortality and morbidity rate have been initiated in these countries. Some of them focus to secure the improved maternal and child services through providing free ambulance services, free drugs, and logistic support to the pregnant mother in deprived areas (Gupta et al., 2017); Home visitation, tetanus immunization coverage, maternity knowledge and education (Lassi et al., 2014); some interventions involve in providing financial and physical support such as maternal voucher scheme, free institutional delivery and postnatal care, free food for the pregnant and lactating mother (Salam et al., 2014). Health promotion by providing education, skills, and knowledge through behavioural change interventions (Willis et al., 2011). Every setting and the targeted location are different for each of the intervention. Moreover, integrated mental health support in maternal health interventions is imperative, as the COVID-19 pandemic has exacerbated mental health issues in the Indian subcontinent. Vulnerable populations, such as perinatal women, have experienced increased anxiety and depression. Universal health promotion is aimed at the national level and targeted interventions are focused on certain population groups (Kabir et al. 2023a). All the effects of these interventions have different effects on the targeted population. Appraisal of these various effects in different population segments could identify the most effective intervention to lessen the gap between advantaged and disadvantaged population groups. It is important to identify the most effective interventions and policies that significantly succeeded in reducing the maternal and child mortality rate not only in the wealthy and highly educated community but also in the deprived and the unschooled community to achieve sustainable development goals by 2030.

While several reviews have explored the effects of interventions on maternal and child health outcomes, there remains a significant gap in the literature regarding their impact on health inequalities. Specifically, no systematic review has comprehensively assessed whether these interventions have succeeded or failed in reducing maternal and child health disparities. This gap is particularly evident in the context of South Asian low middle-income countries, where health inequalities are pronounced and persistent. This systematic review aims to identify interventions that have effectively addressed disparities in maternal and child health outcomes in South Asian countries, with particular emphasis on Bangladesh, India, and Pakistan. This study will specifically focus on examining effective strategies to reduce inequalities in these regions. By systematically evaluating the impacts of available interventions, this review will provide a detailed analysis of how these interventions influence health disparities across different population subdivisions. This comprehensive assessment will offer valuable insights into the effectiveness of current strategies and highlight areas where further efforts are needed to achieve equitable health outcomes.

Addressing the Literature Gap

This study addresses a critical gap in the literature by evaluating the combined effects of community-based programs, financial assistance, and nutritional supplementation on maternal and child health disparities in South Asia, specifically in Bangladesh, India, and Pakistan. Unlike previous reviews that often focus on single interventions, this research provides a comprehensive analysis of synergistic strategies. The unique contribution of this study lies in its holistic approach, integrating multiple intervention types to assess their collective impact. We expect significant contributions in sectors such as public health policy, maternal and child healthcare practices, and community health initiatives, providing actionable insights for reducing health inequities in the region.

Research Questions

“Which Public Health Interventions are most effective in reducing maternal and child health inequalities in low middle-income South Asian countries?”

Using the PICO search tool, the research question of this study was developed. PICO is considered a more useful and meaningful tool in producing a precise and concise research question (Methley et al., 2014).

Methods

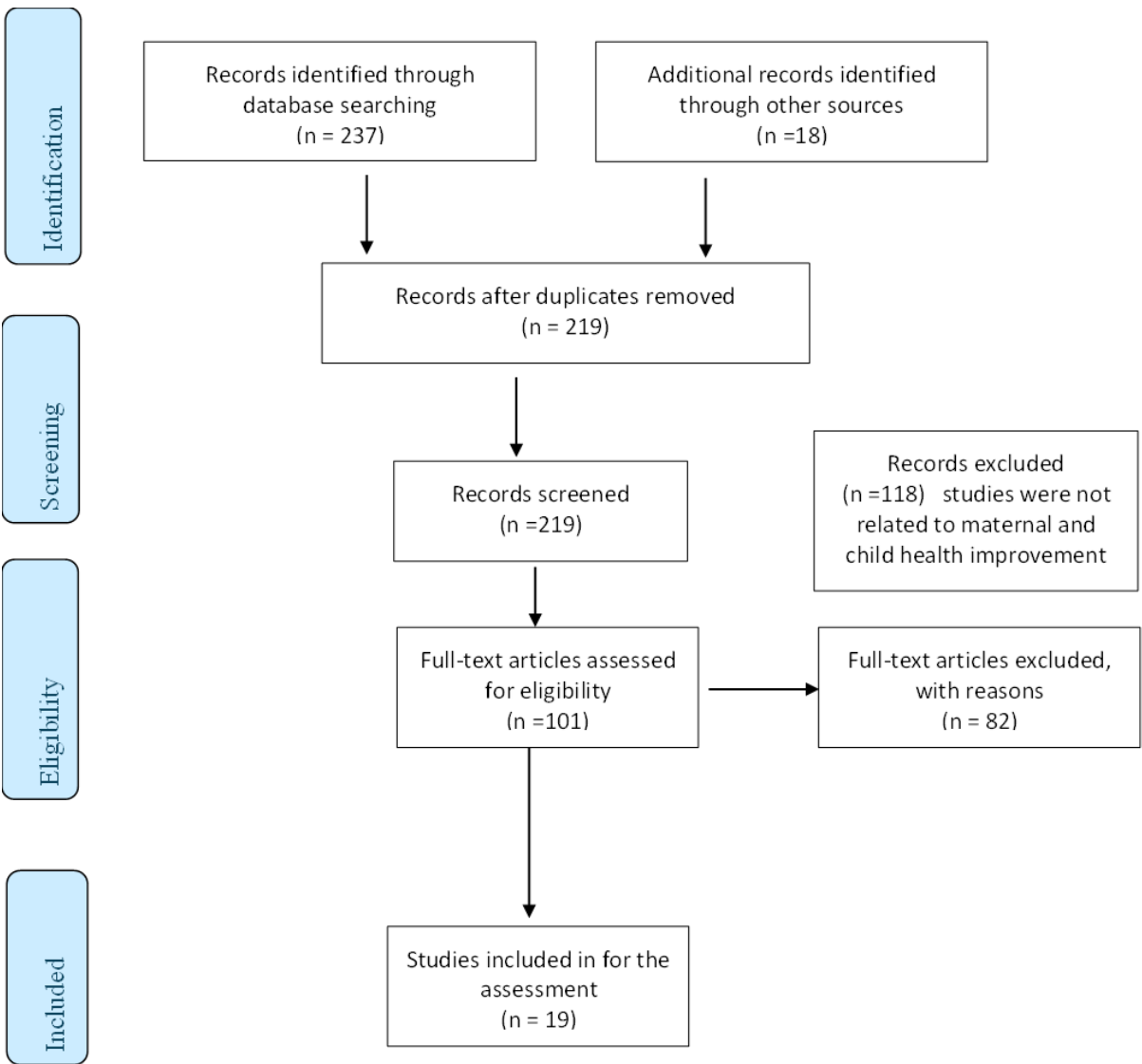
This study used a systematic review for answering the research question. This study included the experimental or non-experimental studies which assessed the different types of interventions that focused on maternal and child health outcome improvement (Kabir et al. 2023c). For example, Randomised Control trials (Interventional studies), Case-control studies (Observational Studies). All interventions aimed to improve maternal and/or child health in Low-middle income countries in South Asia were considered. According to the world bank (2019) data source, Bangladesh, Bhutan, India, and Pakistan are the low middle-income countries in South Asia. But, Bangladesh, India, and Pakistan have got the highest density population and similar ethnic group and socioeconomic culture which have influenced to select these countries. This review has considered and included those studies which were implemented between the Millennium development goals set up, 2000 and until the data

extraction phase. In terms of the outcome measures, articles which have reported and the intervention outcome relating to official MDG 4,5 and SDGs 3 and 5 indicators such as family planning, antenatal and postnatal care coverage, skilled attended at birth, institutional delivery, adolescent birth rate, female education, women empowerment, under-five mortality, etc. Details of the indicators are presented in [table 1](#).

Search Strategy

Public health (01/09/2019), Medline (02/09/2019), and Thesis database (10/09/2019). Also, Local and National health journal were searched for finding articles, such as Journal of Health Population and Nutrition (30/08/2019), Indian Journal of Community Health (30/08/2019), Journal of Epidemiology and Community Health, etc (31/08/2019). The databases were explored from 2000 to the search date.

Figure 1. PRISMA Flow Diagram the selected studies



Key Terms

Terms that were used to search the database included: Health Inequality, maternal and child health, maternal mortality, infant mortality, adolescent birth rate, maternal health inequality, child health inequality in Bangladesh, India, and Pakistan. All types of interventions were considered in this search approach. In a systematic review, the search strategy and key terms used to explore the record must be formulated carefully. It is recommended to do manual hand searching from the reference lists of the papers obtained (Higgins and Green, 2011). For example, the search design was prepared for PubMed ([Appendix 6.C](#)) to facilitate the searching process.

Inclusion Criteria

Inclusion criteria were set based on the initial searching and the aim of the study before starting the systematic review. These criteria involved experimental and observational studies that contributing to maternal and child health outcomes. Accordingly, studies employing various research designs, including randomized controlled trials, quasi-experimental studies, cohort studies, and case-control studies, were considered. Additionally, time-series studies, such as before-after comparisons, were included to assess the impact of interventions over time. Interventions focused on improving the maternal and child health together or individually in any type of a population group, such as universal interventions (population as a whole) and targeted interventions (specific community or group of people). Also, interventions designed to reduce the health inequality for mother and child health were considered. However, searching for studies were limited to the Low-middle income countries in South Asia which are Bangladesh, India, and Pakistan.

Studies that reported the consequences of intervention on official MDG 4 and 5, and SDG 3 and 5 indicators were only included in that systematic review to assess the outcome measures. Details of the indicators are mentioned above (refer to table 1). it's important to check the area of the interventions in various segments of the populations since the universal interventions have the effect on the whole population which can keep the inequalities hidden. especially the situation of the vulnerable population gets hidden (Barros, 2013). A specific category has been made which includes gender, age, ethnicity, religion, resident's location, education, physical and psychological health status, employment, socioeconomic status of the population sample (Tugwell et al., 2010). (See Appendix: [Table-2](#))

Exclusion Criteria

Studies were excluded if they did not meet the following criteria:(1) Studies that were not conducted in the designated South Asian countries (Bangladesh, India, and Pakistan); (2) Studies that were published prior to 2000 or after 2019. (3) Articles that are not available in English; (4) Research that did not concentrate on the health outcomes of mothers and children; (5) Interventions that did not seek to mitigate health disparities; (6) Studies that lack a clear methodological design, such as randomized control trials, quasi-randomized control trials, cluster-randomized control trials, cohort studies, or case-control studies; (7) Studies that failed to report outcomes related to the Millennium Development Goals (MDGs) 4 and 5, or Sustainable Development Goals (SDGs) 3 and 5 indicators. (8) Studies that failed to generate an adequate amount of data for extraction and analysis; (9) Commentaries, editorials, reviews, and opinion articles; (10) Studies that did not include a comparison group or control group to evaluate the effectiveness of the interventions. (See Appendix: [Table-2](#))

Study selection Criteria

Titles and the abstracts of all studies found from the early searching were scanned to eliminate those research that didn't evaluate the efficiency of the intervention to advance the health of the mother and children. For example, cluster-randomized trials, randomized trials or any other primary studies assessing outcome compared against the control group or each other focusing on mother and/children health of a family/community/district/national level living in any areas of Bangladesh, India, and Pakistan. Furthermore, all the titles and abstracts were scanned repeatedly to exclude those studies that didn't investigate inequality's effectiveness. Further scanning was made through reading the complete texts to retrieve the studies which evaluated the outcomes of the interventions on inequalities directly or indirectly. Any confusion during the study selection process was resolved by online search, reading articles and Cochrane guidelines and discussion with the supervisor until consensus was reached. (See Appendix: [Table 3,5](#))

Data Extraction

All the selected studies have been extracted based on the key information from the full texts into an Excel file. any difficulties faced during data extraction such as confusion on judgment were resolved through further investigation and discussion with the supervisor. Key information was included after consulting with the supervisor as follows:

- a. Basic Information: First author's name, year of publication, the title of the article, publication type (e.g. journal publication, conference abstract)
- b. Intervention content: Study design, aim(s)/objective(s)
- c. Participant information: sample size, participant characteristics (e.g. gender, age, ethnicity, religion, education)
- d. Setting/location/country: the setting of the study (e.g. community, institution, urban or rural)
- e. Outcomes: key findings, primary outcomes (indicators from Table 1), outcome measures, method of analysis

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Data extraction focused on quantitative measures, such as proportions and numerators, to assess the utilization of healthcare services. However, due to the heterogeneity of the included studies, a meta-analysis was not feasible. Instead, a narrative synthesis approach was adopted to analyse and interpret the findings from multiple studies (Jahan et al., 2016). This approach allowed for a comprehensive understanding of the evidence, despite the limitations in conducting a formal meta-analysis.

Quality Appraisal

Each study was assessed in terms of its methodological quality, bias, confidence interval, and external validity such as target population and study settings (urban/rural/national). The quality of the individual study was assessed by the researcher alone using critical appraisal skill program (CASP) Randomize Control Trial, CASP Case-Control Study Checklist, CASP Cohort Study Checklist based on the type of the studies (Brice et al., 2019). A six-item checklist developed for the effective public health project was also used to assess the study quality (Thomas, 2004). This checklist consists of selection study bias, Study design confounder control, blinding, data collection method, and withdrawals and dropouts during study execution. All the studies then being rated on a scale from “Strong”, “Moderate” and “weak” for each item. Afterward, the rating was given for the entire study. Strong represents ‘no weak rating for any item’, Moderate represents “one weak rating for each item”, and weak means “two or more rating for each item”. The consensus was reached through reading articles and discussions with the supervisor when obstacles were faced. (See Appendix: [Table-4](#))

Data Analysis

Because of the heterogeneity of the studies, the narrative method was used to synthesize the intervention’s effect. As this systematic review contains both quantitative and qualitative, experimental and quasi-experimental study is not adequately similar, Narrative synthesis was used instead of meta-analysis (Nyamtema, 2011). In the beginning, all the studies were summarized and categorized in terms of their characteristics, including intervention type, outcome measures, and methodological strengths. As the aim of this systematic review was to find the most effective intervention in reducing maternal and child health inequalities, change of inequality were measured in terms of whether the intervention was more successful in advantaged population (inclined disparity), or in deprived/disadvantaged community (declined disparity), or no change in inequality across the groups. Depending on the significance of the change in inequality, interventions were classified into ‘’ Increase’ or ‘Decrease’. The details information extracted using the excel file is presented in the result section (See Appendix: [Table-7](#)).

Results

Characteristics of the Included Studies

After searching the five databases, 255 references were identified and 219 were left after excluding the repeated articles. Among them, 118 studies that were not related to maternal and child health improvement through interventions were removed. Remaining 101 studies were relevant to the effectiveness of interventions on maternal and child health segmented to the disadvantaged population groups. Finally, 19 studies were selected after the complete reading of the texts which produced the outcome and effect of the interventions on different population groups across the nations (Figure-1).

The results were organized from the included studies cover all MDG 4 indicators, but five indicators from MDG 5 which includes, maternal mortality ratio, the proportion of births attended by skilled health personnel, contraceptive prevalence rate, adolescent birth rate, and antenatal care coverage, but not the unmet need for family planning. Inequality aspects of the outcomes from the selected studies were narrated by sociodemographic status, economic status, employment status, level of the education, race or caste, place of the accommodation and age. the overall information including general information of the study, intervention type, study design, quality of the study, inequality aspects and the Inequality measurement and outcomes of the included studies are presented in Table 6, extracted from the excel file. Also, effect of those interventions on inequality from the are presented in Table 7.

Nutrition Supplementations

It is presumed that nearly half of the pregnant women globally are anaemic and the majority of them are from lower and middle-income countries (WHO, 2016). Therefore, pregnant women from deprived areas are more likely to in high demand for daily intake of Iron and Folic Acid. In terms of Nutrients supplements, only one study resembled the criteria for this review which aimed to reduce the under-five mortality among the targeted population in Bangladesh (Abir et al., 2017). The supplementations included Iron Folic Acid (IFA) during

pregnancy. This study with overall strong quality succeeded in reducing child mortality among the targeted population. However, this is a joint intervention that was not only based on the IFA supplements alone but pooled with the provision of antenatal care (ANC) and tetanus toxoid (TT) vaccination during pregnancy. This means that the study found a combined effect of multiple interventions given to mothers during pregnancy, IFA supplementation, ANC, and TT vaccination on reducing postnatal and under-5 mortality rates. Hence, the study found that mothers who received all three interventions had a significantly lower risk of postnatal and under-5 mortality. Those interventions were measured using standardized indicators. For instance, ANC coverage was measured by how many times mothers have visited ANC service throughout their pregnancy period; mothers were monitored for their haemoglobin levels during pregnancy as part of the IFA supplement measurement; and mothers were also examined for the incidence of tetanus cases during pregnancy for TT vaccine effectiveness. Thus, effects for the IFA supplementations alone were only derived from the study's statistical analysis. Findings after an analysis showed that postnatal and under-5 mortality odds were lower in mothers who had just the IFA supplementations [OR = 0.66, 95% CI: (0.45–0.98)]. This suggests that mothers who received IFA supplements were 0.66 times as likely to have children who survived compared to mothers who did not receive supplements. In other words, they were 34% less likely to experience postnatal or under-5 mortality. The IFA supplement was most effective when combined with TT and ANC. Regarding inequality reduction, this intervention positively affected under-5 mortality among the poorest in socioeconomic status, education level, and age. However, no substantial changes were found in affluent families.

Interventions to improve healthcare providers and services

A total of nine articles published between 2008 and 2017 evaluated the effects of improving healthcare providers and services in reducing the inequalities among the disadvantaged population group in India (Kumar et al., 2008; Baqui et al., 2008; Wills et al., 2011), Bangladesh (Haider et al., 2017; Hotchkiss et al., 2011; Quayyum et al., 2013) and Pakistan (Bhutta et al., 2011). While all studies aimed to improve healthcare services, the specific interventions and outcomes varied. In addition, interventions are labeled as strong and weak based on methodological rigor used, delivering the intended outcome, measuring what it intended to measure, and improving maternal and child health outcomes. These findings are reported below.

About the evidence mentioned in the introduction about the high rate of Infant, neonatal, and maternal mortality in Uttar Pradesh, India, compared to the national average, interventions were implemented in this region with the joint teamwork of NGOs and the government sector. This collaboration prioritized maternal and child healthcare services through strengthening the community health workers, volunteers, and skilled birth attendants within this geographical area. Thus, Interventions focused on strengthening community health workers, increasing home visits, and improving newborn care. These efforts effectively reduced inequality in antenatal care coverage and skilled deliveries, particularly among the poor (Kumar et al., 2008; Baqui, 2008).

Another intervention conducted in the same location was identified as a strong study, which resulted in an increasing number of visits during the antenatal and postnatal period, and the neonatal mortality rate was lowered among those who received postnatal visits. Thus, A community-based intervention targeting newborn care and immunization reduced neonatal mortality, especially among lower-caste groups (Willis et al., 2011). Similarly, a government community-based maternal and neonatal health program was implemented to improve maternal and newborn care practices and increase healthcare utilization. However, the intervention had a limited impact on reducing inequality (Baqui et al., 2008). It is required to mention that the methodological study was considered “weak.”

Intervention in maternal health care utilization was implemented in four districts of Bangladesh with a high level of disparities in maternal and neonatal health services. This intervention aimed at increasing the utilization of pregnancy-related care effectively reduced inequity in accessing skilled birth attendants and institutional deliveries (Haider et al., 2017). This study had strong methodological quality, which aimed to increase the utilization of pregnancy-related care for all socioeconomic strata in the targeted region. Compared to the other districts, this intervention effectively reduced inequity in receiving ANC from a trained provider, institutional delivery, and delivery by skilled personnel.

Another study found which aimed to expand the private sector to facilitate contraceptive use by improving family planning services among women from the deprived, disadvantaged population group. Though this intervention aimed to improve family planning services for disadvantaged groups, its impact on reducing inequality was limited (Hotchkiss et al., 2011). The most successful intervention was implemented under the supervision of the BRAC, targeting disadvantaged populations, increased antenatal care utilization and skilled birth attendance, reducing disparities (Quayyum et al., 2013).

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In the Hala and Matiari subdistricts of Pakistan, a community-based intervention was implemented aiming to lower infant mortality by improving perinatal and newborn care (Bhutta et al., 2011). The intervention package included group discussion about pregnancy-related circumstances, the importance of sanitation, newborn care after delivery, and essential primary health care services. Thus, it has effectively reduced stillbirths and neonatal mortality rates in intervention clusters in comparison with the control groups.

Expanding Immunization campaign

Three articles published between 2000 and 2011 are the evaluation studies that assess the enlarging immunization program that was implemented in Bangladesh ((Bishai, 2002; Bishaia et al, 2003). Using the outreach immunization services with the help of the local health workers, one intervention intended to increase the immunization rate (strong study) (Bishai, 2002). This study concluded that outreach immunization services may be more effective in measles immunization for children with less educated mothers and in small living places. The other two pieces of research implemented vaccination aiming to reduce under-five mortality (Bishaia et al., 2003; Koenig et al., 2001). The result obtained from these two studies evidenced that, measles immunization reduced the disparities in under-five mortality amid the size of the living area and various socioeconomic backgrounds.

Community education and access to mass media

Only one study was found in India related to adolescent health published recently, which showed that Community-based intervention through providing education in youth information centers for the adolescent population and exposure to the mass media effectively delays early marriage and early pregnancy (Mehra et al., 2018). Youth information centers (YIC) were effective in decreasing the number of early marriages and early pregnancies among adolescents from powerless educated families.

The institutional support through demand-side intervention

Demand-side intervention (community-based participatory) was implemented in India where the participating group was directed and guided by the appointed health personnel. During each session, types of maternal and neonatal health problems and immediate solutions were discussed which eventually increased the demand for health services regarding antenatal, postnatal, and other healthy maternal behaviour (Houweling et al., 2013). This intervention was identified as a strong methodological quality that had a meaningful effect in decreasing the infant mortality rate among women from socially demoted backgrounds. A similar study was found in Bangladesh where a Women-focused development program through training on skill development, functional literacy, and financial loan arrangement assisted the disadvantaged women group where inequality in maternal and child health outcomes was higher (Bhuiya and Chowdhury, 2002). This strong quality study findings evidenced a significant decrease in infant mortality rate when evaluating the post-study effect. However, within a similar socioeconomic background, the extent of effectiveness was higher for those mothers who participated in the development intervention.

Mixed interventions

In 2013, two studies were published to evaluate the effect of mixed interventions in improving the uses of maternal and child healthcare services in a rural district of Bangladesh (Kamiya, 2013) and rural north India (Amudhan et al., 2013). The former study assessed whether the community-based intervention under the Model Union approach had a favourable impact on women's access to and knowledge of maternal health care during pregnancy and childbirth. The results showed that the project successfully increased the utilization of antenatal visits and postpartum emergency and obstetrics care (EmOC) services and also enhanced women's knowledge of danger signs during pregnancy and delivery. Also, the project has reduced income inequalities in access to antenatal care. The latter study, on the other hand, aimed at assessing cash transfer schemes for the socio-economically disadvantaged (Janani Suraksha Yojana; JSY) and the strengthening of the primary health centre (PHC) network to provide 24/7 obstetric care in promoting institutional deliveries. Also, the result showed that among the disadvantaged, institutional deliveries increased by 34.4%, compared with 24.8% among the non-disadvantaged. Also, the introduction of PHC 24/7 care in this group has increased institutional deliveries by 4-fold; OR 4.2 (95% CI: 1.9, 9.0) compared with 3-fold for JSY alone; OR 3.2 (95% CI: 1.8, 5.6).

a) Joint nutrition and health care program

Japanese aid-funded project called Safe Motherhood Promotion Project was implemented in the nursing districts and its subdistricts hospital. This project involved community mobilization and intervention to empower and strengthen the local organizational, institutional and human capacities to handle the maternal and child health problem in the deprived and rural areas (Kamiya et al., 2013). This intervention was proven by strong evidence to

have greater effectiveness in reducing the income disparities to access antenatal care which eventually lessened the extent of inequality in maternal health outcomes.

b) Janani Suraksha Yojana (conditional cash transfer scheme) and the primary health centre (PHC) network empowerment

This intervention was conducted by the Indian government in rural areas to offer obstetric care services pooled with the conditional cash transfer scheme for the disadvantaged population group to use the medically trained birth attendant (Amudhan et al., 2013). This evaluation was conducted before and after the study and provided moderate proof that the effectiveness of mixed intervention could increase the rate of delivery in the presence of skilled birth attendants and also could raise the number of institutional deliveries among the underprivileged group compared to those from affluent backgrounds.

Discussion

This review systematically gathered and evaluated evidence from selected studies on the effectiveness of interventions targeting maternal and child health inequalities in low- and middle-income countries in South Asia. It also assessed how these interventions align with the Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs). Only 19 studies, out of the 237 initially identified, specifically designed to address maternal and child health disparities across population groups were included in this review.

Effectiveness of Nutrition Supplements

Nutrition supplements emerged as a key approach in reducing infant mortality, particularly when targeted at disadvantaged populations. Iron Folic Acid (IFA) supplementation was found to be highly effective when integrated with other interventions, such as antenatal care and tetanus toxoid immunizations (WHO, 2016). For instance, the free distribution of these services to impoverished pregnant mothers in rural Bangladesh reduced disparities in infant mortality significantly. The combination approach ensures comprehensive coverage, addressing nutritional deficiencies while enhancing maternal care. This integrated model's success underscores the importance of bundled interventions over standalone measures, which may lack the reach and holistic benefits required for substantial impact. Comparatively, while demand-supply interventions, such as conditional cash transfers (e.g., “Janani Suraksha Yojana” in India), effectively address financial barriers, their impact is amplified when coupled with nutrition and health education initiatives. The evidence suggests that the multifaceted nature of nutrition-based approaches makes them uniquely suited for addressing the multifactorial causes of infant mortality, such as malnutrition, anaemia, and inadequate access to healthcare services (WHO, 2016).

Health Care Services Interventions

Most of the studies included in the review primarily focused on interventions related to health care provision. Despite variations in study designs and methodological quality, the majority demonstrated significant reductions in maternal and/or child inequalities. The urgent need for targeted public health interventions is highlighted by the severe challenges posed by violence and stigma among female sex workers in India (Kabir et al. 2024b), impacting both mental and maternal health outcomes. This review identifies several reasons for the positive outcomes of health care provider interventions. Firstly, the community-level implementation of these interventions has been shown to be particularly effective. Previous reviews have evidenced that community-level interventions are more successful in reaching populations where the demand for services can be easily identified among individuals and groups (Barros et al., 2015). Secondly, priority was given to primary health care services so that preventable obstacles during pregnancy and post-pregnancy can be tackled. However, in terms of equity, the community-level intervention could result in decreased equity if interventions target the privileged populations. Moreover, enhancing critical appraisal skills among healthcare professionals can significantly improve maternal and child health outcomes by promoting evidence-based practices and reducing health disparities (Taylor et al. 2004).

Environmental, Health, and Mental Health Challenges

Enhancing mental health support is also crucial for improving maternal health outcomes. The need for integrated mental health and substance abuse support within maternal healthcare is underscored by the significant impact of high rates of mental health challenges, compounded by illicit drug use, tobacco consumption, and socio-economic stressors, on maternal health outcomes in Bangladesh (Hasan, 2024). Overall, the increase in health care services utilization through advancement in primary care services including institutional support tended to lower the gap of inequality between advantaged and disadvantaged population groups. There are several reasons behind the worsening maternal health situation. One of them is respiratory infections, frequently due to hazardous pollution

levels. In Dhaka city, Bangladesh, conditions like asthma, cough, and pneumonia are prevalent. This issue is also common in other Asian capital cities, highlighting the importance of environmental justice. These urban areas suffer more acutely from pollution-related health problems, significantly impacting both maternal and child health (Hasan, 2022). Moreover, in South Asian regions, particularly Bangladesh, microbial dysbiosis in children, especially those with conditions like diabetes and enteric hepatitis, significantly impacts maternal and child health, highlighting the need for integrated public health strategies to address these interconnected challenges (Hasan, 2023). In Bangladesh, the high population density exacerbates maternal and child health disparities, making it challenging to provide adequate prenatal and postnatal care, which in turn affects the overall health outcomes for mothers and their children (Khatun, 2019). Moreover, during the perinatal period, mental health is often overlooked, but it is very vital for both the mother and the child. Perinatal mental health challenges in South Asian regions are exacerbated by significant cultural stigma and limited recognition of mental health conditions as medical disorders, which create barriers to seeking and accessing care. Women in these regions face higher prevalence rates of perinatal mental disorders compared to high-income countries, further highlighting the need for culturally sensitive support and improved access to mental health services (Howard, 2020).

Demand-Supply Interventions

Apart from providing health care services, nutrition supplementation, and education, another approach in interventions included demand-supply projects aiming to eliminate the financial obstacle among the disadvantaged group were also effectively successful when it comes to inequality reduction. Such as “Janani Suraksha Yojana” in India which implemented a conditional cash transfer scheme to the poor families which enabled them to encounter financial barriers to access the health care services (Amudhan et al., 2013). This financial help secured the pregnant mother during any urgent need throughout the pregnancy period to seek health care. Postpartum mental health issues, such as depression, substantially increase the risk of suicide among young mothers in Bangladesh and India, requiring the implementation of targeted support systems in maternal health care (Kabir et al. 2024a). Furthermore, Women-focused development programs through community participation for the disadvantaged pregnant mother and women (Mehra et al., 2018), and youth information centres and access to mass media for the adolescent from the deprived and lower socioeconomic background efficiently helped to increase the awareness about the importance of each step of the health care. These types of interventions benefited the underprivileged population most. Such as, a substantial reduction in adolescent marriage and early pregnancy were noticed among the rural and deprived population groups after the implementation of the intervention (Bhuiya, 2002). Moreover, nursery school children experienced significant psychosocial impacts during COVID-19, including increased anxiety and disrupted social development, highlighting the need for targeted mental health support (Hasan, 2024).

The critical need for targeted maternal mental health interventions is further demonstrated by the fact that young women in Bangladesh, particularly those under the age of 30, are at an elevated risk of suicide because of factors such as familial conflict, social isolation, and conjugal dispute (Kabir et al. 2023b). Another significant factor identified is the disparity in institutional delivery rates between urban and rural areas, which greatly impacts child mortality rates. Urban regions have far greater rates of institutional delivery (60%) than rural ones (30%). This discrepancy emphasizes how difficult it is for rural communities to have access to medical facilities and trained birth attendants. Reducing mother and child health disparities requires addressing these problems with focused interventions. Few studies were found as a joint of the mentioned interventions. The assessment of these collaborative approaches has evidenced that it is mandatory for reducing the disparities most efficiently. For instance, combining the cash transfer scheme with the strengthening of the primary care centre network had a greater impact on increasing the institutional deliveries in India, especially for those from the ignorant and the deprived group.

Strengths and limitations of the collected evidence

The included studies, after the quality assessment, only one study was rated as weak, seven were rated as moderate and 11 studies were graded as strong both in methodology and the overall quality. For this assessment CASP checklist for a specific kind of study, such as experimental or observational studies with a control group, and a six-item quality criterion was used. thus, it can be stated that the quality of the included studies was adequate. Most of the studies were conducted by the reputed international and national organizations with the involvement of the government sector which have ensured that highly professional human resources were used. Moreover, all the studies were peer-reviewed, which again, satisfied the authenticity of the articles published in the journals.

All the studies only mentioned the effect of the conducted study; however, it is very possible in low middle income developing countries that the targeted population is not only having one intervention at a time since several interventions conduct at the same time and the same population group. Moreover, the majority of the studies only evaluated the impact of the intervention in maternal and child health outcomes rather than describing the

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intervention itself. The detailed process of the intervention could be useful in identifying the influence of each step of the implemented intervention in the population.

Strengths and limitations of the conducted review

This systematic review included different types of study designs which enabled the review in involving a wide-ranging intervention and evidence. Also, this review is extremely precise in terms of the target population. Three countries were selected from south Asia using PICO where all these countries show mostly similar culture, high-density population, socioeconomic status. This method of selection helped to identify intervention which can be suitable for any of the nations for further implementation.

However, this review is conducted by the researcher himself only under the supervision of the university teacher. Therefore, whatever decisions were made and taken during the study period, no additional judgment, review and quality assessment of this review was possible which may lead to bias. It is important to have more authors. Also, the overall duration for conducting this review was one month (timeline in appendix) which can be considered as a serious limitation. Apart from this, only six types of interventions were identified. Thus, it is possible to not recognized all relevant interventions. Moreover, this study focused to identify the most effective interventions in reducing maternal and child health only which excluded those interventions which might affect changing the inequality to some extent.

Actionable Recommendations

Above mentioned basic findings suggest that the most useful approach of the inequality's reduction intervention is the provision of principal health care for both mother and the children which includes nutrition and health education, supplementation, protective health care services such as immunization, vaccination, and contraceptive use. Moreover, improvement of the existing health infrastructure through the door-to-door visits and increasing the number of community health workers and medically trained birth attendants were also effective. A collaboration of these approaches during designing the new health strategies and interventions could simply lower the obstacle and difficulties to get easy access to the utilization of health care services. It could also overcome the long-distance barrier to seek primary health care because of the increasing number of medically trained community worker's availability.

This is the time for achieving sustainable development goals by 2030. It could be possible to achieve the goals if the gap in maternal and child disparities is eliminated. Interventions could target on a small scale to understand the effects on disparities. This small-scale intervention focusing on the smaller groups could produce a greater result on the effectivity and result from the subgroup intervention could use in developing more stronger interventions with strong evidence. Moreover, faith-based intervention could be implemented where the involvement of religious leaders could increase awareness about the importance of antenatal and postnatal care.

To effectively reduce maternal and child health inequalities, policymakers should prioritize the following strategies:

i. Integrated Care Models: Comprehensive care models that combine nutrition supplementation, antenatal care, mental health support, and community-level interventions should be developed. This holistic approach ensures that all aspects of maternal and child health are addressed. For example, integrating Iron Folic Acid (IFA) supplementation with regular antenatal check-ups and mental health screenings can provide a more rounded care experience for expectant mothers. Community health workers can play a crucial role in delivering these services, ensuring that even the most marginalized populations receive adequate care.

ii. Targeted Subsidies: Conditional cash transfer schemes should be expanded to directly link payments to health outcomes, such as institutional deliveries and vaccination coverage. This incentivizes the use of essential health services. For instance, providing financial incentives to families who ensure their children receive all recommended vaccinations can significantly increase immunization rates. Similarly, subsidies for institutional deliveries can reduce maternal and neonatal mortality by ensuring that births are attended by skilled health professionals.

iii. Environmental Health Measures: Policies to reduce environmental health risks, including lowering air pollution and improving urban sanitation, should be implemented. These measures are crucial for preventing respiratory conditions and addressing microbial dysbiosis in children. For example, initiatives to reduce emissions from industrial sources and vehicles can improve air quality, while investments in clean water and sanitation infrastructure can prevent waterborne diseases. These environmental improvements are essential for creating healthier living conditions that support maternal and child health.

iv. Enhanced Mental Health Services: Mental health screening and support should be integrated into primary healthcare systems, focusing on high-risk groups like young mothers. This ensures comprehensive care for maternal mental health. For instance, routine mental health assessments during antenatal visits can help identify and address issues such as depression and anxiety, which are common during pregnancy and the postpartum period. Providing access to counselling and support groups can also help mothers cope with the stresses of childbirth and parenting.

v. Community Engagement: Active participation in health programs should be promoted by involving women and adolescents through youth-focused centers and mass media campaigns. This builds community trust and ensures interventions are culturally relevant. For example, community health education programs that involve local leaders and use culturally appropriate messaging can increase awareness and acceptance of health interventions. Engaging adolescents through school-based programs and social media can also promote healthy behaviours and reduce the incidence of early pregnancies.

By adopting these comprehensive and targeted strategies, policymakers can effectively tackle the complex challenges of maternal and child health inequalities. These measures not only address immediate health needs but also create a supportive environment that promotes long-term health and well-being. Achieving equitable health outcomes for all population groups requires a multifaceted approach that integrates health services, financial support, environmental improvements, mental health care, and community engagement. Through these efforts, a future where all mothers and children have the opportunity to thrive can be realized.

Faith-Based Interventions

Faith-based organizations hold a unique position in addressing health inequalities by leveraging their community trust and networks. Interventions led by these organizations can effectively address cultural barriers and stigma, especially in regions where traditional beliefs influence health-seeking behaviours. For example, faith leaders can promote the importance of antenatal care and vaccinations, reduce stigma associated with mental health, and encourage institutional deliveries. Evidence from other global contexts highlights the potential of faith-based initiatives in increasing healthcare access and compliance, particularly in underprivileged communities. Future studies should focus on systematically evaluating the role of faith-based interventions in South Asia to optimize their integration into public health frameworks.

Collaborative Approaches for Maximizing Impact

The review underscores the importance of combining interventions to achieve the greatest impact on health inequalities. For instance, integrating conditional cash transfer schemes with the strengthening of primary care center networks in India led to increased institutional deliveries among marginalized groups. Similarly, community-based programs that coupled mental health support with economic empowerment initiatives, such as microfinance for disadvantaged women, demonstrated improved maternal health outcomes. Ultimately, the World Bank Group's focus on strengthening surgical systems can help reduce maternal and child health disparities by improving access to essential surgical care in low- and middle-income countries (Peters et al. 2019).

Ethical Statement

The ethical application was submitted through the Middlesex Online Research Ethics (MORE) system and approval was obtained before conducting the research. This is a secondary research study without involving any participants. The overall process of this project carried out based on the existing research findings.

Recommendations

In South Asia, maternal and infant health inequalities remain a significant public health concern, with disparities between urban and rural areas and across socioeconomic categories. Effective public health initiatives, including financial aid, community-based programs, and improved healthcare services, have shown potential in addressing these disparities. Consistent efforts are needed to ensure equitable access to maternal and child healthcare, addressing underlying socioeconomic, educational, and geographic constraints. Integrating mental health support into maternal health interventions is crucial, as mental health issues significantly impact maternal and child health outcomes. The COVID-19 pandemic has exacerbated anxiety and depression, highlighting the need for comprehensive care, including psychological support for vulnerable populations like perinatal women. While individual interventions show promise, their impact on health inequalities is most pronounced when delivered as part of an integrated, multi-pronged strategy. This review emphasizes the need for a holistic approach combining nutrition supplementation, financial incentives, mental health support, and community engagement to address the complex determinants of maternal and child health disparities. Future policies should prioritize evidence-based,

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context-specific interventions and foster partnerships between governments, NGOs, and community organizations, including faith-based groups, to ensure sustainable progress in reducing health inequalities in South Asia. To achieve sustainable development goals, it is essential to improve healthcare infrastructure in rural areas, expand the pool of competent healthcare providers, and ensure culturally sensitive and accessible interventions for marginalized groups. A multifaceted strategy integrating financial, educational, and healthcare interventions, supported by robust policy measures, is imperative to address maternal and child health disparities in South Asia.

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