

Preconception Care in Low- and Middle-Income Countries

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Abstract

Prior to pregnancy, the preconception period is pertinent to optimising the health of women and their partners in respect to biomedical, behavioural, and social factors to reduce their impact on maternal, neonatal, and child health outcomes. In Low and Middle-Income Countries (LMICs), this is particularly crucial where women and girls are most vulnerable to these risk factors that lead to adverse pregnancy outcomes. With the rising importance of preconception care in LMICs, this review summarises current evidence on direct and indirect intervention approaches to preconception spanning biomedical, behavioural, and social factors. Direct intervention approaches focus on health issues such as infections, chronic disease, mental health, and substance abuse, whilst indirect interventions address social factors, such as gender inequality, that influence preconception health and accessing care. Despite this, significant gaps remain to be addressed for preconception care in LMICs, particularly for male preconception care and involvement of male partners in reproductive/preconception health and mental health interventions for reproductive-aged women. To strengthen the delivery of preconception care in LMICs, sustainable and collective efforts by all relevant stakeholders are important to ensure preconception care interventions are not fragmented and the most vulnerable women are reached.

Introduction

The preconception period is a critical time for the implementation of health interventions to support maternal and neonatal health outcomes [1,2]. Capturing the period before pregnancy, maternal and paternal preconception health has the potential to positively or detrimentally affect maternal health, pregnancy outcomes, and future offspring health [3,4]. Preconception health broadly captures an individual's health and wellbeing that contributes to reproductive outcomes, such as chronic diseases, infectious diseases, and lifestyle factors including nutrition and physical activity to reproductive health, including gamete quality and the subsequent health of the offspring [5]. In addition, lifestyle factors and health behaviours during the preconception period have been suggested as a critical preventive measure towards alleviating congenital anomalies, for example, through the promotion of folate supplementation prior to pregnancy [4,6].

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Preconception care includes any interventions and programs that aim to optimise health before pregnancy occurs to improve maternal and child health outcomes, including alleviating risks associated with biomedical, behavioural, and social factors [1]. Following a World Health Organization (WHO) assembly of experts in 2011, the importance of preconception care as a preventive strategy to support positive maternal and child health has gained traction [7]. Additionally, this consortium of experts provided a number of recommendations for what preconception care should entail. Therefore, preconception care includes the use of reproductive planning supported by contraception, screening, and management of health and social risks, which contribute to pregnancy outcomes, education, and promotion, including preconception care counselling, and vaccination and nutrition supplementation [7].

Factors typically considered in preconception care include modifiable factors, such as nutrition, physical activity, alcohol

and substance use, and the treatment and management of existing conditions, including infectious and chronic diseases. Recognising the contribution of the social environment to pregnancy health, preconception care may also target broader social factors such as domestic and gender-based violence and educational opportunities. Previous evidence has demonstrated that earlier care results in better health outcomes for the mother and offspring [3]. Reflective of this is the recommendation to recognise and implement preconception care and interventions up to a year before trying to conceive or allowing for behaviour change and recognition of broader scopes of preconception care, such as the provision of contraceptives to adolescents [8].

Preconception care can be implemented across educational, community, and health settings and involve various facilitators such as community health workers, peer educators, school faculty, community and religious leaders, and health professionals [9]. The most appropriate interventions are dependent on the desired outcome, whether a woman wants to avoid pregnancy or initiate unprotected sexual intercourse to achieve pregnancy [10]. For example, preconception care for adolescents may include comprehensive sex education, including education on contraception and access to delay pregnancy [11,12]. In line with this, preconception care should employ a lifecycle approach involving a continuum of care, adapting care appropriately to an individual's life stage and reproductive planning goal [13,14].

Globally, the majority of pregnancies occur in Low- and Middle-Income Countries (LMICs), and these settings often have a higher prevalence of risk factors compared to High-Income Countries (HIC) that can affect maternal health and pregnancy outcomes such as malnutrition [15]. Lifestyle factors, the existence and management of comorbidities, structural obstacles in accessing health care, and gender inequality all contribute to high maternal mortality rates in these settings [16]. While there has been a decrease in maternal mortality by 38% in 2017 since the launch of Millennium Development Goals in 2000 [17], investment in interventions and programs that support the health of all genders before pregnancy is essential to alleviate risk factors that occur across biomedical, behavioural and social domains.

In LMICs, an estimated 21 million girls become pregnant each year, with 777,000 births to adolescent girls below 15 years of age [18,19]. While pregnancy and birth rates vary by region, for example, the highest adolescent pregnancy rates are found in Sub-Saharan Africa; adolescent pregnancy poses a greater health risk than other women of reproductive age [20]. Adolescent pregnancy provides an additional high-risk context due to a number of physiological and social factors, such as underdeveloped reproductive system (e.g. incomplete pelvic development) and child marriage practices that endure in some cultures [21,22]. In addition, adolescent pregnancy is associated with increased risks of poor maternal outcomes such as hypertension disorders and anaemia and poor neonatal outcomes, including preterm births and neonatal mortality [23,24]. Preconception care has been suggested as particularly relevant to adolescent girls [25], in part to buffer against the poor outcomes associated with adolescent pregnancy while also recognising adolescence as a key period for establishing healthy behaviours.

Currently, the uptake of preconception care amongst women and couples is low, especially in LMICs [26-28]. A number of determinants specific to LMICs have been identified that act as barriers to accessing and implementing preconception care

[27]. Determinants included lack of awareness and misconceptions of preconception care, accessibility of preconception care influenced by financial constraints and geographical location, and level of education, which are important factors to consider when developing preconception care interventions [27].

There have been a number of systematic reviews synthesising the evidence of preconception care interventions across LMICs, including nutritional interventions and adolescent pregnancy interventions [6,9,12,29-33]. This review sought to summarise the current literature and intervention approaches to preconception care spanning biomedical, behavioural, and social factors. We focus on interventions that directly influence preconception health and acknowledge interventions that can challenge gender inequality that exacerbates the challenges of achieving optimal preconception health and accessing care.

Direct health sectoral interventions

Delaying age of first pregnancy

There is substantial evidence on the need to delay pregnancy after adolescence to counter the higher risks associated with adolescent pregnancy [34]. Delaying pregnancy in adolescence ensures that a woman's body has matured appropriately to carry a pregnancy and deliver a child while also providing her with greater educational and future employment opportunities. Adolescent pregnancy has been associated with greater risk for the mother and offspring, including increased maternal and neonatal mortality, delivery-related complications, and small-for-gestational-age [23,35,36]. A number of risk factors for adolescent pregnancy have been identified which may be targeted in interventions, including limited education, low socioeconomic status, inaccessibility and low use of contraception, and early marriage [37]. Increasing access, consistent use, and knowledge of contraception, including condoms, is a key strategy for delaying adolescent pregnancy [38]. However, a number of barriers exist in accessing contraceptives, especially for unmarried adolescents in LMICs [39]. One systematic review, including seven qualitative studies in LMICs, identified hormonal methods, such as the oral contraceptive pill and long-acting reversible contraceptives, were underutilised due to lack of knowledge, accessibility, and fears around side effects [40]. While condoms were seen to be more available, there were still a number of constraints in accessing and using condoms, especially concerning the association of condoms with promiscuity and male control [40].

Several systematic reviews have synthesised the evidence of educational interventions on unplanned adolescent pregnancy and related outcomes such as knowledge of pregnancy prevention [25,33,41,42], with only one of these systematic reviews restricted to interventions in LMICs [33]. Dean and colleagues found only one study from Chile that demonstrated an effect on preventing adolescent pregnancy [25], where secondary school girls randomly assigned to an abstinence-based sex education program had reduced pregnancy rates compared to the control group [43]. While this program was promoted as an abstinence-based intervention, the curriculum utilised skill-building activities encouraged in comprehensive sex education and included a unit on contraceptive methods, though this was merely mentioned and not encouraged, unlike abstinence [43]. More recently, incorporating content on gender and power in sexuality education effectively reduces unintended pregnancy and STIs [41]. While the results from this review demonstrated that programs that included gender or power were more effective in

reducing pregnancy rates, very few interventions were based in LMIC settings. Two studies were included in this systematic review set in LMICs that significantly reduced childbearing [44] and pregnancy [45]. The first intervention incorporated a non-government-directed HIV information campaign and saw a 28% decrease in the prevalence of childbearing [44]. A more recent systematic review [33] demonstrated that educational interventions significantly improved the uptake of contraceptive use (RR=1.71, 95% CI=1.42-2.05), though these interventions did not significantly impact the risk of unintended pregnancy.

Birth spacing/inter-pregnancy intervals

In addition to delaying the age of onset for the first pregnancy, ensuring adequate spacing between pregnancies is an important component of preconception care. The WHO has recommended that the optimal inter-pregnancy spacing between pregnancies is 18 to 24 months from the previous livebirth, with a minimum of 24 months to provide an adequate timeframe for breastfeeding and associated nutritional benefits [25] [46]. It is evidenced that shorter inter-pregnancy intervals (less than 12 months) can lead to puerperal endometriosis, anemia, and premature rupture of the membrane. In comparison, long inter-pregnancy intervals (more than 60 months) are linked to perinatal complications such as intrauterine foetal death and preeclampsia [25]. In addition, both short and long pregnancy intervals are associated with adverse pregnancy outcomes such as LBW, preterm birth, and small for gestational age [25]. A recent systematic review from 2021 has identified interventions that have shown improvements in achieving optimal inter-pregnancy intervals or increasing birth spacing, including the provision of sexual health education, contraceptives, and the active involvement of male partners in contraceptive decision-making to improve uptake [33,47].

Nutrition

Globally, LMICs carry a significant burden on the prevalence of reproductive-aged women, including young women and adolescents, who suffer from stunting, underweight, and micronutrient deficiencies, due to sub-optimal diets [48]. It is evidenced that high iron, iodine, zinc, and vitamins B12 and D deficiency rates exist among reproductive-aged women in LMICs [48,49]. Nutritional risks among reproductive-aged women in LMICs may arise from a range of social determinants such as food accessibility, household income, education attainment, and political factors [48]. Nutritional risks pose reproductive-aged women vulnerable to poor maternal and foetal outcomes. Maternal underweight is associated with an increased risk for preterm birth [50]. Stunting, also known as short stature, during pregnancy leads to an increased risk of adverse maternal health outcomes including obstetric fistula, obstructed labour and maternal death, and poor neonatal outcomes such as birth asphyxia and neonatal death [51,50]. Micronutrient deficiencies can also lead to a broad range of adverse pregnancy outcomes such as maternal anaemia, low birth weight, and congenital defects [50]. Key direct interventions for addressing such preconception nutritional risk factors in LMICs to minimise adverse maternal and child health outcomes include periconceptional supplementation initiatives, particularly folic acid and iron. This may be delivered as a concurrent supplementation initiative. Periconceptional iron-folic acid supplementation interventions are evidenced to improve iron levels and reduce anaemia, which is associated with risk factors such as Low Birth Weight (LBW) and may also reduce the occurrence of neural tube defects [33].

Increasing high rates of obesity among reproductive-aged women in LMICs is also a growing concern. Obesity in pregnancy is associated with complications including pregnancy-induced hypertension, gestational diabetes, preterm birth, miscarriage, and congenital birth defects [52]. A number of preconception interventions and programs exist for the management of obesity in the preconception period, including health education, screening, and management for co-morbidities associated with obesity such as hypertension and hyper/hypoglycaemia, weight reduction, nutritional supplementation to reduce neural birth defects, physical activity and surgical interventions, such as bariatric surgery [52]. Despite this, a systematic review by Opray and colleagues suggests that the effectiveness of preconception health interventions remains unclear, with no evidence that any specific directed or individual preconception intervention or health program for obesity contributes to improved pregnancy outcomes [52].

Infectious diseases

Infections contribute greatly to the burden of disease in LMICs, with HIV, viral hepatitis, and STIs resulting in 2.3 million deaths annually [53,54]. STIs, such as syphilis and chlamydia, can adversely impact women's reproductive health and can result in a number of consequences when these diseases transmit to the developing neonate [55,56]. Depending on the stage of syphilis, this disease can lead to stillbirth and spontaneous abortion, and for offspring surviving into childhood, children with congenital syphilis can develop a range of health conditions, including seizures and cerebral infarction [55,57]. Globally, curable STIs such as syphilis, gonorrhoea, chlamydia, and trichomoniasis remain prevalent, with the prevalence of these infections highest in LMICs [58,59]. A number of challenges in the prevention and treatment of STIs remain in these settings, including low health system resources, stigma associated with these diseases [60], and interventions and treatment largely employing syndromic management of STIs, which dismisses the high numbers of asymptomatic cases [61]. Importantly in LMICs, HIV has been the focus of most STI prevention and intervention, with other STIs treated as a subset of additional outcomes in these interventions [62]. HIV can be transmitted through sexual intercourse, needle sharing, and for children, the most common avenue of infection is vertical transmission [63]. Infection with other STIs also result in an increased risk of contracting HIV [64-66], and women who are HIV positive and are infected with gonorrhoea or trichomoniasis during pregnancy have an increased risk of vertical HIV transmission [67]. WHO recommends routine screening for HIV and syphilis during pregnancy [68]; however, recommendations for screening of other STIs during pregnancy vary across regions [69]. Considering that a large proportion of pregnancies worldwide are unplanned [70] and that STI screening during pregnancy is inconsistent or inaccessible, the fact that screening during the preconception period is relatively low is unsurprising [71].

Interventions that focus on preventing STIs and HIV that have been implemented in LMICs successfully include behavioural, healthcare, and educational interventions such as mass media [29,72,73]. A 2014 systematic review demonstrated that behavioural or counselling interventions targeting STIs can decrease STI prevalence by 35% and that overall interventions targeting STIs can increase condom use by 26% [29]. A systematic review investigating interventions targeting STI prevention and treatment among adolescents in LMICs demonstrated a range of viable interventions, especially for proximal outcomes such

as condom use, health service utilisation, and abstinence [73]. Early detection and treatment of STIs and consistent management of HIV/AIDS through Anti-Retroviral Therapy (ART) can ensure the woman is in optimal health before conception and subsequently reduce the maternal and neonatal complications associated with these diseases [55,56,68]. While educational interventions have been shown to improve condom use and safer sex practices, the impact of this strategy on STI/HIV prevalence and incidence remains inconsistent [73,74]. There is promising evidence for using mass media campaigns to raise awareness on safer sex practices and mitigate the transmission of STIs.

Chronic diseases

Globally, chronic diseases, also referred to as non-communicable diseases, disproportionately affect LMICs. Of 41 million deaths attributed to chronic diseases that occur every year, WHO estimates that LMICs are accountable for 77%, predominantly due to cardiovascular diseases, cancer, respiratory diseases, and diabetes [75]. It has been noted that the disease burden in LMICs has shifted from predominantly infectious diseases, nutritional deficiencies, and maternal and child health disorders to chronic diseases, which is reflected among reproductive-aged women [76,77]. The epidemiological transition to chronic diseases in LMICs is linked to societal factors (e.g., rapid aging populations, increased urbanisation, and migration out of rural areas, marginalisation of rural communities), increasing economic development, behavioural factors (e.g., smoking, physical activity), diet (changes in food consumption behaviours), and individual factors (e.g., genetic risk factors, undernutrition, over-nutrition) [77]. Health systems in LMICs face challenges to provide effective care in the context of the growing burden of chronic diseases, alongside the existing burden of infectious diseases due to factors such as sub-optimal care, access to resources, and health financing constraints [76,77]. This is of particular concern for reproductive-aged women in LMICs due to the increased risk of adverse maternal and neonatal health outcomes associated with chronic diseases during pregnancy. For example, a study by Wei and colleagues in China evidenced that women with diabetes mellitus or impaired fasting glucose in preconception were at a greater risk of experiencing adverse pregnancy outcomes such as pre-term birth, macrosomia, spontaneous abortion, small gestational weight for age, and perinatal infant death [78].

Preconception care is pivotal for optimising maternal and neonatal outcomes associated with chronic diseases in pregnancy. Jacob and colleagues recommend that preconception care of chronic illnesses be delivered through utilising opportunities in both clinical and hospital settings and through community and home-based interventions, for example, child health services, immunization, and family planning [79]. China's dedicated preconception care program, National Free Preconception Health Examination Project, is an example of a community-level based intervention in an LMIC that has delivered care to over 85% of its population, including in rural areas, with the provision of pregnancy planning advice, health education, risk examinations, and medical advice on behavioural modifications [80]. This section of the review presents direct interventions for preconception care for chronic diseases in LMICs. However, we acknowledge that the existing evidence predominantly arises from the context of HICs.

For preconception care in LMICs, specific types of diseases should be considered. Diabetes mellitus has significantly increased among reproductive-aged women in recent decades,

thus being more prevalent among pregnant women [81]. In 2013, estimates indicate that over 19 million cases of hyperglycaemia in pregnancy were experienced by women in LMICs, compared to only 2.1 million cases in HICs [81]. Diabetes in pregnancy can lead to adverse maternal and neonatal outcomes; therefore, preconception care is pertinent for optimal glycaemic control. It is estimated that approximately 50% of women in LMICs with diabetes in pregnancy are undiagnosed [81]. Preconception care for diabetes includes strategies such as the provision of screening, assessment, and care to control blood sugar level (Haemoglobin A1c), counselling regarding self-management of the disease, and education on modification of diet and lifestyle behaviours [30]. A systematic review has evidenced that preconception care for diabetes mellitus significantly reduces the rate of congenital malformations by 70%, and counselling in combination with glycaemic control reduces the incidence of perinatal mortality by 69% [30].

Interventions for the preconception care and management of thyroid dysfunction (hyper/hypofunction of the thyroid gland) are also important given its prevalence among reproductive-aged women [82,83]. Hypothyroidism during pregnancy is associated with adverse maternal health outcomes, such as hypertensive disorders [84], spontaneous abortion and stillbirth [85,86], and foetal complications, including growth retardation, congenital anomalies, and neurodevelopment abnormalities [87]. As described in a review by Okosieme and colleague, preconception management of thyroid should include monitoring and adjustment of FT4 and TSH levels, adjustment of medication dosages to target TSH levels, delay of conception until levels are controlled, ensuring treatment adherence, and tailored conception advice for individual patients [88].

Preconception management for epilepsy, a condition characterised by seizures due to abnormal electrochemistry of the brain, is also pertinent given the risks maternal seizures have on foetal development [30]. It is suggested that episodes of seizures may increase for some women during pregnancy. Effective intervention for addressing epilepsy in pregnancy has been noted to include preconception counselling to avoid abnormal foetal development, compared to women who receive no preconception counselling [89]. Preconception care may also include a review of anti-epileptic drug therapy and the provision of folic acid to reduce neural tube defects [30].

Hypertension and heart disease are also important to be addressed in the preconception period due to the elevated risk of hypertensive disorders in pregnancy such as preeclampsia/eclampsia and risk of adverse pregnancy outcomes, including intrauterine growth retardation, spontaneous abortion, foetal loss, and hemorrhage [90]. It is recommended that preconception counselling is provided in conjunction between the consulting obstetrician and cardiologist/s to identify risks factors, such as comorbidities, obesity, smoking, advanced maternal age, review of current medications due to hypertension, cardiac diseases, or other comorbidities, and assessment of general physical health and cardiac function [91,92].

Mental and psychosocial wellbeing

Good mental and psychosocial health is equally as important as physical health to adapt to the challenges and demands of pregnancy. In LMICs, the burden of psychiatric conditions among reproductive-age women grows for depressive disorders, bipolar, and anxiety [93]. Depression and anxiety are associated with perinatal outcomes such as miscarriage, uterine

Male preconception care

Predominantly, preconception care efforts worldwide are directed toward reproductive-aged women and girls, with little focus on preconception care for males [108]. Typically, as evidenced throughout this review, preconception care is directed toward interventions that focus on addressing risks associated with women's sexual and reproductive health that can result in adverse maternal and neonatal health outcomes. However, men play an equally important role in contributing to maternal and child health outcomes. This includes but is not limited to pre-existing medical conditions, medication usage, family history and genetic risks, use of alcohol and illicit drugs, as well as physical and mental health [108]. For example, it is evidenced that men with comorbidities, including chronic and infectious diseases, are at risk of reduced sperm quality [108]. Regarding interventions for preconception care targeting men, there is a lack of evidence that exists in the context of LMICs. Interventions in LMICs have mostly focused on the involvement of men in interventions focused on contraceptive use/decision making [33,109,110] and prevention and management of diseases such as HIV and STIs [111]. From the perspective of HICs, suggested strategies to improve and implement preconception care for men into primary care services. It is also noted that women's healthcare professionals should also play an active role in educating and encouraging male partners to access healthcare services for preconception care [108,112].

Addressing social factors that influence preconception health/In-direct health sectorial interventions

Social and cultural factors can exasperate the barriers to accessing preconception care and achieving optimal health before pregnancy, which can further impact maternal and child health outcomes [7]. Gender is one barrier to accessing care and adopting appropriate health behaviours prior to conception, with different challenges present for girls and women and boys and men [7]. In LMICs, girls and women face a myriad of social challenges that dictate their preconception health including, but not limited to, child marriage, female genital mutilation/cutting, gender-based violence, sexual coercion and rape, and structural barriers such as educational attainment, employment opportunities, and consequences of poverty [7].

Interventions aimed at reducing these factors, and improving gender equality more broadly, have the potential for enhancing preconception care [7]. In respect to child marriage, interventions for reducing the likelihood of early marriages have included delivery of community-based education programmes to girls, boys, their families, and the broader community on areas such as but not limited to sexuality education, addressing gender-based norms, sexual and reproductive health and rights, life skills, consequences of child marriage, and benefits of delaying pregnancy [113,114]. Similar community-based interventions involving both female and male partners are effective for delaying pregnancies in adolescents [32]. In addition, interventions include delivering educational information via social and mass media platforms[113]. In conjunction, such strategies have effectively provided education regarding the importance of girls and adolescents remaining in school for educational attainment and employment and associated benefits, such as economic gain [113,114]. Evidence-based strategies for addressing gender-based violence pre-pregnancy includes sexuality education to change harm gender-norms associated with tolerance and perpetuation of violent behaviours, combined economic empowerment and life-skills training interventions for girls and

artery resistance, and antepartum haemorrhage [94]. Women with bipolar disorder during pregnancy are at greater risk of unsafe sexual behaviours and alcohol/substance abuse during manic episodes, leading to unintended pregnancies [30]. Before pregnancy, poor mental health has also been associated with mental health outcomes during the postnatal period. Women who experience depression preconceptionally are at a greater risk of developing postnatal depression [95]. Postnatal depression impacts the woman, family unit, and the newborn's health [96,97]. Therefore, it is important to ensure appropriate care and support mechanisms before pregnancy for psychiatric conditions. However, to date, few interventions focus on improving mental health as a part of preconception care in LMICs. It is also noted that there is a significant lack of attention by maternal health programs in LMICs regarding mental health during pregnancy and in the postpartum period [98-100]. Some examples of interventions that have been initiated to improve mental health outcomes for reproductive-aged women in HICs and LMICs have included group-counselling, education initiatives to teach coping skills, and interventions promoting women's empowerment [101-103]. Ideally, recommended preconception interventions for depression and anxiety include screening amongst reproductive aged women, preconception counselling on potential risks, and treatment or medication options to reduce adverse pregnancy outcomes and impacts on family, and referral to appropriate mental health services and interventions [95]. In respect to bipolar disorder, preconception care should ideally include counselling with the involvement of women's respective partner and family. This includes counselling on issues such as pregnancy planning, risks of relapse with the discontinuation of mood stabilisers during pregnancy, and foetal risks associated with continuation of prophylaxis and mood stabiliser medication, particularly for high-risk women [104].

Substance use

In LMICs, reproductive-aged women are particularly vulnerable to factors that are associated with substance abuse, including but not limited to poverty, social isolation, psychological distress, violence, and abuse [105]. Substance use (such as consumption of alcohol and illicit drug usage) in the preconception period is associated with a broad range of adverse pregnancy outcomes. For example, alcohol consumption in the prenatal period may lead to adverse pregnancy outcomes, including birth defects and spontaneous abortion [31]. Also, illicit drug usage (such as cocaine, heroin, and marijuana) is associated with adverse pregnancy outcomes such as infant mortality, LBW, and infant withdrawal [31]. Substance abuse in the preconception period is common among women with unintended, unplanned, or mistimed pregnancies [106]. Preconception counseling is a key intervention for addressing alcohol consumption in the preconception period. A recent systematic review by Reid and colleagues predominantly based on HICs interventions, but including one in South Africa, has shown the success of preconception counselling interventions that incorporate motivational interviewing for changing alcohol-related consumption behaviour, and/or counselling and education on contraceptive use to reduce the impacts of alcohol exposure during pregnancy [107]. Potential interventions for addressing illicit drug usage in the preconception period include identification of at-risk individual women or couples, education on the potential pregnancy impacts associated with illicit drug usage and contraceptive options until drug usage has ended, as well as referral to specialised drug intervention programs [31].

women, intervention targeting harmful alcohol use, and health-care service provision and psychological support for violence/rape survivors [7]. To address female genital mutilation/cutting, preventative strategies include discussing/discouraging practice-seeking with girls, their families, and/or partner, screening for female genital mutilation/cutting, and any potential complications that may implicate sexual intercourse, infertility, or birth [7]. In circumstances where female genital mutilation/cutting has occurred, strategies include provision of information to women and couples regarding complications, and how to access relevant treatment to reduce risks associated with childbirth [7].

Way forward

To strengthen and deliver better preconception care for women and girls in LMICs, there is a need for more efforts to address the current gaps in evidence to provide effective preconception care. One important area to be addressed is increasing male preconception care and inclusion of males in reproductive and preconception health programmes and interventions to address determinants, such as gender equality, that impact preconception care and maternal health and child health outcomes. Another crucial area in LMICs that requires attention is research and efforts to expand effective, evidenced-based interventions addressing mental health in the preconception period.

Delivering preconception care in LMICs also faces many challenges to implementing a full-scaled preconception care intervention to all reproductive-aged women and their partners due to barriers such as affordability, existing constraints on resources, coverage of prenatal care, and availability of skilled workforce [115,116]. However, one strategy to address barriers to preconception is expanding upon existing programme structures [115,116]. For example, maternal and child healthcare structures and programmes, can be expanded to deliver preconception interventions to targeted populations in the continuum of care, such as for counselling, education, screening, referrals, and treatment [116]. Preconception care may also overlap and be implemented in other existing health programmes or projects, for example, those targeted to children and adolescents [116]. Such interventions or programmes also need pragmatic oversight regarding planning, financing, implementation, monitoring, and evaluation [115,116].

Overall, this review has highlighted a significant range of direct and indirect interventions and strategies that can be implemented to address health and social determinants of preconception health for reproductive-aged women and their partners in LMICs to improve maternal and child health outcomes. It is important to recognise that different LMICs deliver preconception care at different stages and face different socio-cultural and economic contextual challenges [116]. Therefore, sustainable and collective efforts are required between all stakeholders (e.g., individuals, ministries of health, national governments, the broader community, WHO, and other international partners) [115,116]. This is pivotal, firstly, to ensure the most vulnerable women and girls who would benefit most from preconception care are not missed by fragmented and siloed preconception care interventions; secondly, in the continued path to expanding preconception care to all reproductive-aged women and couples in the context of LMICs.

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