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REVIEW

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Preconception health risks among women of reproductive age in Sub-Saharan Africa: a systematic review of implications for preconception care

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Abstract

Introduction Although preconception health risks are strongly linked to adverse pregnancy outcomes and offer opportunities to improve women's health, consolidated evidence remains limited in Sub-Saharan Africa (SSA). This review aims to synthesize evidence on preconception health risks in SSA, a region with the highest global rates of maternal and neonatal mortality and morbidity.

Methods We searched PubMed/MEDLINE, African Index Medicus, ScienceDirect, and Google Scholar for studies published up to June 30, 2023. Two reviewers independently assessed study quality using Joanna Briggs Institute tools. Studies with at least one modifiable preconception risk were included. Due to inconsistencies in outcome measurements, participant variability, and high heterogeneity, a meta-analysis was not reported. Findings were summarized in text, figures, and tables.

Results In the review, researchers selected 83 articles from a total of 3,425 retrieved articles. Overall, this review revealed a high proportion of preconception health risks among the participants which includes underweight (0.64% to 36.2%), overweight (8.3% to 76.7%), anemia (36.7% to 58.1%), unintended pregnancy (4.2% to 94.3%), alcohol intake (5.3% to 68.7%), smoking (1.1% to 20.3%), chewing khat (9.9% to 27.6%), history of chronic medical conditions (2% to 16.6%), a history of adverse pregnancy outcomes (11% to 51.9%), sexually transmitted infections (1.3% to 29.2%), psychosocial distress (13.9% to 60%), and intimate partner violence (6.7% to 43.7%).

Conclusion The systematic review found that numerous women in SSA encounter various preconception health risks factors. Therefore, the governments of respective countries need to give emphasis and adopt policies to integrate preconception care services in to the existing healthcare system so that both financial and human resources need to be mobilized. There is gaps in research, as the true burden of preconception health risks may be underestimated due to fragmented risk assessment methods.

Review registration: (PROSPERO: CRD42023446801)

Keywords Preconception health risks, Systematic review, Sub-Saharan Africa, Preconception care

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Introduction

Preconception risk factors are linked to both short- and long-term unfavorable health outcomes for mothers and infants, and optimizing these risk factors during this time offers the potential to improve health across generations. As such, preconception care (PCC) is recommended for individuals or couples who have the potential to become pregnant to optimize their health in preparation for pregnancy [1]. PCC is defined as a set of evidence-based interventions that aim to identify and modify biomedical, behavioral, and social risks that improve pregnancy outcomes during the preconception period through risk assessment, health education and promotion, and management [2, 3].

The burden of adverse pregnancy outcomes (APOs) in low- and middle-income countries (LMICs) is still an unsolved global problem [4]. Sub-Saharan Africa (SSA) is a region with one of the highest maternal mortality ratios (MMRs) in the world [5]. The MMR for the SSA was 542 deaths for every 100,000 live births, whereas the global MMR was 216 deaths for every 100,000 live births. In addition, SSA has the highest neonatal mortality rate (NMR) in the world, with 29 deaths per 1000 live births [6]; the perinatal mortality rate is 58 per 1000 total births [7], and the burden of APOs is 29.7% [4]. To lower the MMR and NMR and achieve the Sustainable Development Goals (SDGs), maternal and neonatal mortality interventions must be given priority in the region [8, 9].

Several countries in SSA face the risk of not achieving the SDG target on NMR because of the high rates of newborn deaths and sluggish trends in the reduction rate in the region [10]. Although PCC is one of the strategies for addressing the preventable causes of MMR and NMR at the grassroots level [2], it has received little attention in LMICs [11] and is reported to be poorly implemented in SSA [12].

Evidence has shown that the presence of preconception health risks among women is strongly related to poor (APOs) [13]. Most of them are amenable to correction [14].

SSA has the highest rates of APOs, including neonatal [6] and maternal mortality [5], largely due to women's high exposure to preconception health risks. However, a lack of comprehensive evidence on these risks hinders effective prioritization of prevention efforts, such as PCC. This systematic review provides the first comprehensive analysis of the literature assessing the preconception health status of women of reproductive age. Therefore, we aim to review current status of proportion of preconception health risks in SSA.

Methods

Protocol and registration

We developed a review protocol on the basis of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) 2020 statement [15]. The protocol of the review was prospectively registered in the International Prospective Register of Systematic Reviews (PROS-PERO) with Registration Number (CRD42023446801).

Eligibility criteria

This systematic review assessed the burden of preconception risk factors for adverse pregnancy outcomes among women of reproductive age in SSA. All studies published from inception to June 30, 2023, were included. The review focused on prevalence and proportion while using CoCoPop mnemonic (condition, context, and population) to determine the inclusion criteria for the papers [16]. The review focused on women of reproductive age who had at least one modifiable preconception health risk. Preconception health risk factors for poor pregnancy outcomes were defined as health conditions or diseases. The context for the review was SSA countries, which experience the highest burden of APOs and inadequate PCC services.

The review included studies that assessed health risks during the preconception, periconception, and interconception periods. Studies were required to identify at least one modifiable preconception health risk; alcohol intake, smoking, coffee consumption, khat chewing, abnormal birth intervals, abnormal body weight, chronic medical conditions, a history of APOs, infectious diseases, unintended pregnancy, anemia, psychosocial distress, intimate partner violence, dental problems, environmental exposure, and infertility/subfertility. Cross-sectional, case–control, cohort, and experimental studies conducted at the community or institutional level were considered. The review imposed no restrictions on the year of publication and included unpublished studies.

The review excluded conference abstracts, reviews, protocols, and qualitative studies. Animal studies, non-English studies, and those focused on male risk factors or that did not differentiate between risks during the preconception and pregnancy periods were excluded.

Information sources

The corresponding author (GG) performed the initial search in March 2023 and subsequently searched PubMed/MEDLINE, African Index Medicus, ScienceDirect, and Google Scholar on June 30, 2023.

Search strategy

The authors (GG, AM, and AB) systematically identified studies published up to June 30, 2023, using Medical Subject Headings (MeSH) and Boolean operators (OR, AND, NOT) across electronic databases. We developed a comprehensive search strategy with expert consultation, utilizing MeSH terms and keywords such as"preconception care,""preconception, ""prepregnancy,""periconception,""interconception, "and"preconception health,"along with the names of all 50 Sub-Saharan African countries in the PubMed database. This strategy ultimately retrieved studies from 38 countries. Additionally, we identified studies using the keywords"preconception care,"OR"pre pregnancy,"OR"interconception"from the African Index Medicus database and"preconception care,"AND"risk assessment,"AND each Sub-Saharan African country name from the ScienceDirect database.

Additionally, we found 25 papers on Google Scholar using keywords such as"preconception risks"and"preconception health status,"searching up to page twenty-five. We also reviewed the reference lists of each included paper to identify further relevant studies. The detailed search strategy is outlined (Additional file 1).

Selection process and data collection process

After searching the electronic databases, the citation identifies in the search were exported in to EndNote bibliography management software (version 8); then, duplicate studies were removed. The study inclusion process involved two screening stages. First, titles and abstracts were reviewed, and second, the full manuscripts of potentially eligible articles were retrieved and examined. Two reviewers (GG and AM) independently assessed the titles, abstracts, and full texts. Any disagreements were resolved through consensus, and when needed, a third reviewer was consulted. The selection process is illustrated using the PRISMA 2020 flow diagram [15].

The two reviewers (GG and AM) extracted data using a modified CHARMS-PF checklist [17]. To ensure accuracy, AK or AG randomly checked the extracted data from ten studies, and we resolved any disputes through consensus. We extracted the proportion of preconception risk as an outcome, along with data on the authors, publication year, study period, country, setting, design, population characteristics, sample size, exposure measurement, and preconception risk outcomes. The level of agreement between the independent data extractors (GG and AM) was assessed using kappa statistics, indicating an almost perfect agreement [18].

Data items (outcomes)

The outcomes of the systematic review included identifying at least one modifiable preconception health risk factor for adverse pregnancy outcomes. These factors include alcohol intake, smoking, coffee consumption, khat chewing, long or short birth intervals, abnormal body weight, chronic medical conditions, a history of APOs, infectious diseases, unintended pregnancy, anemia, psychosocial distress, intimate partner violence, dental problems, environmental exposure, and infertility/subfertility. In the review, unintended pregnancies included both mistimed and unwanted pregnancies. Substance use is defined as self-reported consumption of alcohol, smoking, coffee, or khat. Underweight and overweight are defined as a BMI of <18.5 and >25, respectively. Short birth intervals are those less than 24 months, whereas long birth intervals exceed 59 months [19, 20]. Chronic medical conditions are defined as having one or more of the following: hypertension, diabetes mellitus, or asthma. Infertility or subfertility is defined as the inability to conceive after 6–12 months of regular, unprotected intercourse [21]. A history of APOs includes abortion, stillbirth, preterm birth, severe perinatal hemorrhage, or congenital abnormalities. Anemia is defined as a hemoglobin level <12 g/dL. We identify infectious diseases through self-reports or lab tests for STIs, HIV, or malaria.

Quality appraisal

We assessed the quality of the papers using the JBI tool [22], which includes checklists for cross-sectional, case–control, cohort, and randomized controlled trial studies. The JBI checklist is particularly suitable for analytic quality appraisal of descriptive cross-sectional studies [16]. It includes 13 criteria for randomized controlled trials, 11 criteria for cohort studies, 10 criteria for case–control studies, and 8 criteria for cross-sectional studies.

For each criterion, we assigned a score of one for"yes"and zero for"no,""not applicable,"or"not clear."We considered the risk of bias low if more than 70% of the answers were"yes,"moderate if 50%–69% were"yes,"and high if up to 49% were"yes."[23]. Disagreements were resolved by consulting a third reviewer. All the authors independently assessed the articles selected for inclusion in the review (see Additional files 2, 3, 4, 5).

Synthesis methods

We used a Microsoft Excel spreadsheet for data extraction and entry, summarizing the results by study area, design, participants, sample size, risk measures, and outcomes. We presented the proportions of each preconception risk from the included studies in both the tables and the text. Although we considered a meta-analysis, it

was not feasible because of varying outcome measurements, participant characteristics, and high heterogeneity. Such high heterogeneity can limit the validity and interpretability of a meta-analysis, as it reflects substantial differences across the included studies in terms of population characteristics, interventions, outcomes, and study designs. When heterogeneity is high, pooled effect estimates may be misleading or lack meaningful interpretation, as they may mask important variations between studies [24].

Results

Study selection

The search strategy identified 3,425 studies through electronic databases using the specified search terms, and we removed 456 duplicates. Additionally, we found 25 papers on Google Scholar using keywords related to preconception risk and health status, extending the search to page 25. We also reviewed the reference lists of the included papers to find further relevant studies. We excluded twelve countries (Equatorial Guinea, Mauritania, São Tomé and Príncipe, Seychelles, Djibouti, Madagascar, Côte d'Ivoire, Angola, Lesotho, Chad, and Mauritius) because of the absence of relevant articles. We screened the titles and abstracts of 2,969 studies, excluding 2,624 on the basis of our inclusion and exclusion criteria. After reviewing the full texts, we excluded 267 articles for the following reasons: not focused on the preconception period [169], outcomes were not reported [87], incomplete data [9], or duplicate reports [2]. Ultimately, we selected 83 articles for inclusion in the systematic review. We detail the inclusion and exclusion process in the PRISMA 2020 flow diagram (Fig. 1).

Study characteristics

This systematic review included 83 studies. The majority of these studies were from the Eastern region of Africa, while the fewest were from Central Africa (Fig. 2).

Of the 83 studies included in the review, 55 were cross-sectional, 23 were cohort studies, 4 were case–control studies, and 1 was a randomized controlled trial. The studies were conducted across various countries: 39 in Ethiopia; 10 in South Africa; 7 in Benin; 6 in Tanzania; 3 each in Malawi, Nigeria, and Kenya; 2 each in Rwanda, Ghana, and the DR Congo; and 1 each in Cameroon, Burkina Faso, Uganda, Botswana, Zimbabwe, and Zambia. Among the studies, 40 were facility-based, and 43 were community-based. The review included 16 SSA countries. The smallest sample size was 131 from South Africa, whereas the largest sample size was 25,417 from

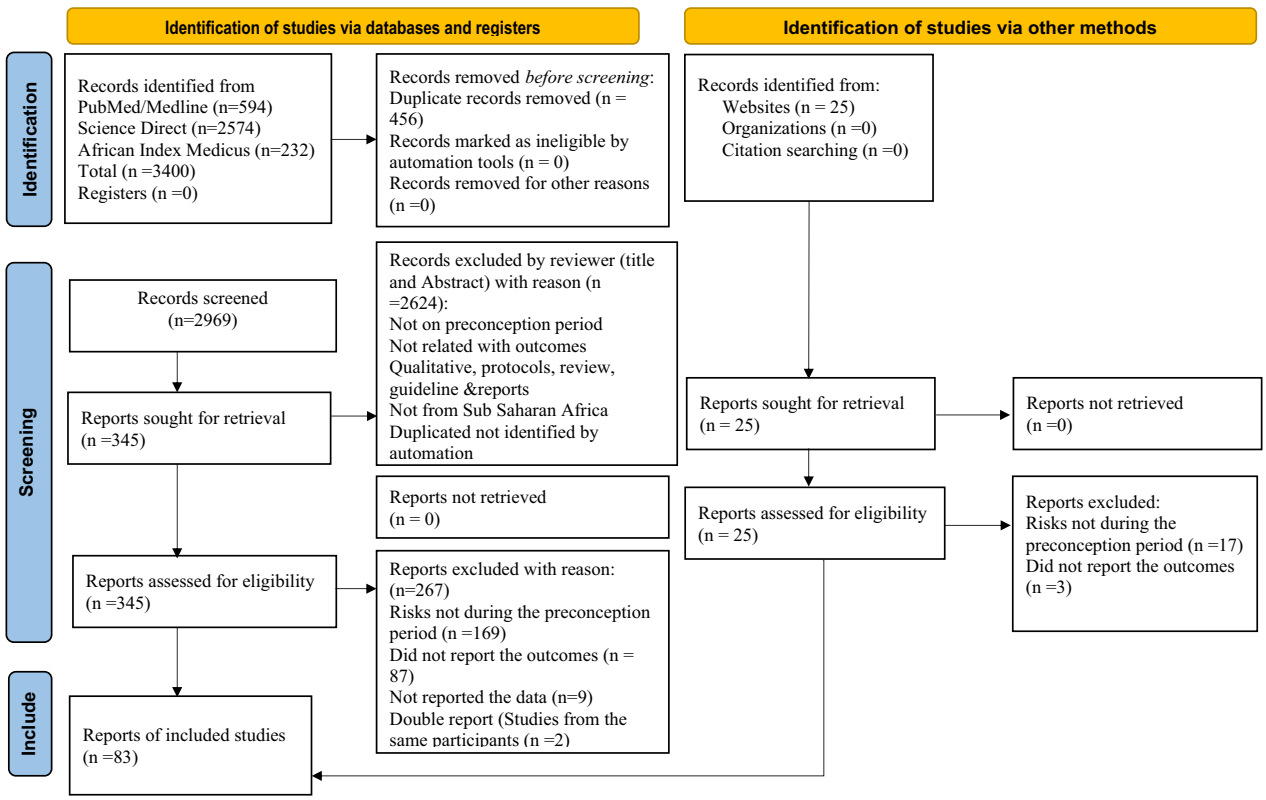

Fig. 1 PRISMA flow chart showing the identification and selection of studies

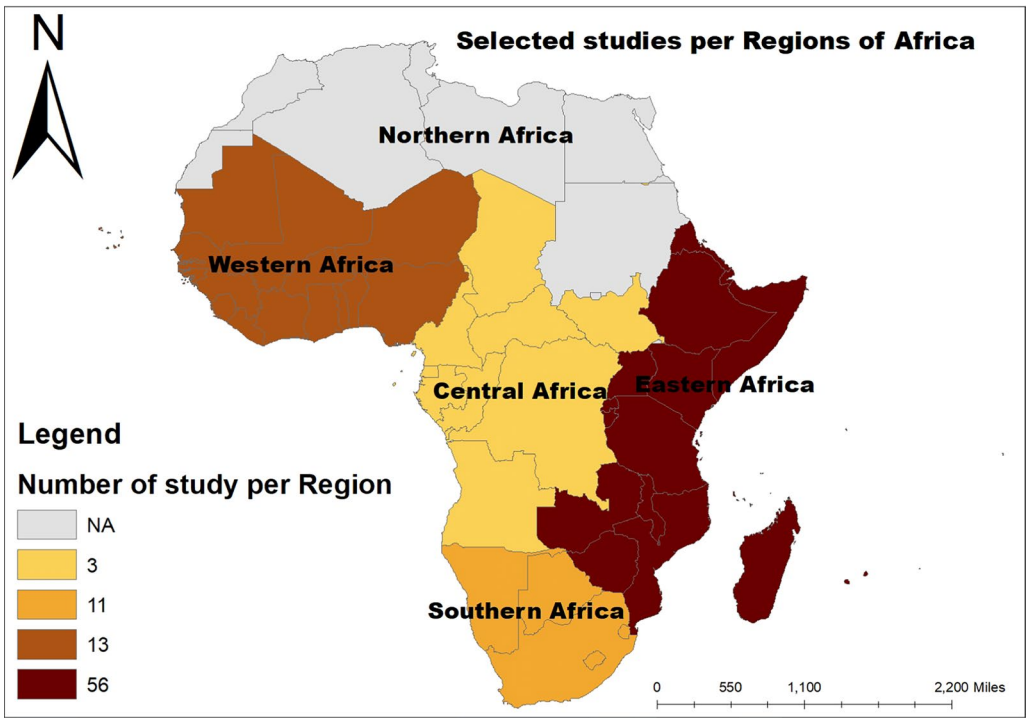

Fig. 2 Distribution of studies included in the review by region

Tanzania. In total, the review included 125,234 study participants. The review included a diverse group of participants, primarily women expected to conceive, pregnant women, and women who had given birth. It also features studies on specific groups: one each involving pregnant women with diabetes mellitus, HIV-positive pregnant women, HIV-positive couples intending to conceive, and nulliparous, nonpregnant adolescent women. The review also included two unpublished studies [25, 26]. Data collection occurred before conception, during the periconception period, and during pregnancy, with the pregnancy data reflecting historical health conditions from the preconception period. For more detailed information on each article, please refer to the provided sources (Table 1).

Risk of bias assessment

A total of 83 studies were assessed for quality, with 81 exhibiting a low risk of bias and 2 showing medium risk. Both medium- and low-risk studies were included in the systematic review, which considered studies published up to June 30, 2023.

Most (80%) of the articles are recent and were published between 2018 and 2023. The fewest studies were from 2001, 2004, and 2010, while the highest number was from 2022 (Fig. 3).

Preconception health risks

The reviewed studies identified several preconception risk factors, categorized into different groups. Nutrition-related risks included abnormal weight (n = 29) and anemia (n = 11). Reproductive health and obstetric-related risks encompassed unintended pregnancy (n = 26), infertility or subfertility (n = 4), and a history of adverse pregnancy outcomes (n = 17). Substance use was another significant factor, including alcohol consumption (n = 25), khat chewing (n = 3), coffee consumption (n = 3), and smoking (n = 13). Infectious diseases such as HIV (n = 14), malaria (n = 8), and sexually transmitted infections (n = 6) were also identified as potential risks. Psychosocial risks included psychosocial distress (n = 9) and a history of intimate partner violence (n = 9), alongside a history of chronic medical conditions (n = 17). Additionally, other identified risks comprised low physical activity (n = 2), environmental exposure (n = 1), a history of female genital mutilation (n = 1), and dental health issues (n = 1). Most of the included studies have examined multiple risk factors (Table 2).

The highest proportions of several preconception health risks particularly female genital mutilation, khat chewing, unplanned pregnancy, a history of adverse pregnancy outcomes, and alcohol consumption were predominantly reported in Eastern Africa. In contrast, the highest proportions of smoking, HIV, psychosocial

Table 1 Summary of the characteristics of the studies included in the systematic review

First Author &year	Country	Study design	Study setting	Participants	Sample size	Quality assessment
Du Toit et al. [27]	South Africa	CC	FB	Women attending ANC	131	LRB
Aychew et al. (Gray literature) [25]	Ethiopia	CS	FB	Pregnant mothers with DM history	142	LRB
Agbota et al. [28]	Benin	C	CB	Women intend to conceive	157	LRB
Moise [29]	Zambia	CS	FB	Women attending ANC	188	LRB
Schmiegelow et al. [30]	Tanzania	C	CB	Women who became pregnant	222	LRB
Msollo et al. [31]	Tanzania	CS	FB	Pregnant women	229	LRB
Gashaw [32]	Ethiopia	CC	FB	Delivered mother	243	LRB
Msemo et al. [33]	Tanzania	CS	CB	Women planning to conceive	249	LRB
Gino Agbota [34]	Benin	C	CB	Women reproductive age	260	LRB
Alemu et al. [35]	Ethiopia	CS	FB	Delivered mother	261	LRB
Davies et al. [36]	Benin	C	FB	Women intend to conceive	262	LRB
Patrick et al. [37]	Ghana	CS	CB	Nulliparous WRA	316	LRB
Firoza Haffejee et al. [38]	South Africa	CS	FB	Women attending the first ANC	328	Moderate
Kahsay et al. [39]	Ethiopia	CC	FB	Women attending ANC	330	LRB
Iyer et al. [21]	South Africa	C	CB	HIV-positive couples intend to conceive	334	LRB
Woldeamanuel et al. [40]	Ethiopia	CS	FB	Pregnant women	337	LRB
Nsereko et al. [41]	Rwanda	C	FB	Women during the first trimester	363	LRB
Asefa et al. [42]	Ethiopia	C	FB	Pregnant women	369	LRB
Kassa et al. [43]	Ethiopia	CS	FB	Delivered mother	370	LRB
Demeke and Bayu [44]	Ethiopia	CS	CB	Pregnant women	374	LRB
Jonathan [45]	South Africa	CS	FB	Women attending the ante-natal	379	LRB
Chaidinma et al. [46]	Nigeria	CS	FB	Women attending ANC	380	LRB
Accrombessi et al. [47]	Benin	C	CB	Women intend to conceive	387	LRB
Wegeneet al. [48]	Ethiopia	CS	FB	Pregnant women	400	LRB
Mekonnen et al. [49]	Ethiopia	CC	FB	Delivered women	409	LRB
Demisse et al. [50]	Ethiopia	CS	CB	Women reproductive age	410	LRB
Manfred Accrombessi et al. [51]	Benin	C	CB	Women intention to conceive	411	LRB
Lemma [52]	Ethiopia	CS	CB	Women reproductive age	414	LRB
Dessie et al. [53]	Ethiopia	CS	FB	Pregnant women attending the ANC	417	LRB
Abubakari et al. [54]	Ghana	CS	FB	Mother	419	LRB
Agiresaasi et al. [55]	Uganda	CS	FB	Women attending ANC	420	LRB
Ayalew et al. [56]	Ethiopia	CS	CB	Women reproductive age	422	LRB
Goshu et al. [57]	Ethiopia	CS	CB	Women reproductive age	422	LRB
Setegn [58]	Ethiopia	CS	CB	Women reproductive age	427	LRB
Lokken Em et al. [59]	Kenya	C	FB	Women planning to conceive	458	LRB
Lokken Em et al. [60]	Kenya	C	CB	Women planning to conceive	458	LRB
Fouelifack et al. [61]	Cameroon	C	FB	Deliveries mother	462	LRB
Sania et al. [62]	South African	C	FB	HIV-positive pregnant women	467	LRB
Mamo [63]	Ethiopia	CS	CB	Uniparous Pregnant women	496	LRB
Tsega et al. [64]	Ethiopia	CS	FB	Pregnant women	507	LRB
Fetene et al. [65]	Ethiopia	CS	FB	Women attending ANC	510	LRB
Kassahun Tesema et al. [66]	Ethiopia	CS	CB	Women reproductive age	513	LRB
Fikadu et al. [67]	Ethiopia	CS	FB	Pregnant women	519	LRB
Fikadu et al. [68]	Ethiopia	CS	CB	Married women	337	LRB
Amani Kikula et al. [69]	Tanzania	CS	FB	Women attending antenatal care	524	LRB

Table 1 (continued)

First Author &year	Country	Study design	Study setting	Participants	Sample size	Quality assessment
Feyisa et al. [70]	Ethiopia	CS	FB	Women attending ANC	534	LRB
Abetew et al. [26] (gray literature)	Ethiopia	CS	CB	Pregnant women	555	LRB
Abrha et al. [71]	Ethiopia	CS	CB	Delivered mothers	561	LRB
Asresu et al. [72]	Ethiopia	CS	CB	Delivered mothers	561	LRB
Tsegaye and Kassa [73]	Ethiopia	CS	FB	A woman who came to deliver	580	LRB
Tesfaye et al. [74]	Ethiopia	CS	FB	Women attending ANC	585	LRB
Habte et al. [75]	Ethiopia	CS	CB	Delivered mothers	591	LRB
Setegn Alie [76]	Ethiopia	CS	CB	Delivered mothers	605	LRB
O'Connor et al. [77]	South African	CS	CB	Pregnant women	619	LRB
Gonfa et al. [78]	Ethiopia	CS	CB	Pregnant women	623	LRB
Teshome et al. [79]	Ethiopia	CS	CB	Pregnant women	636	LRB
Oyaro et al. [80]	Kenya	CS	FB	Women planning to conceive	647	LRB
Mekuriaw et al. [81]	Ethiopia	CS	CB	Pregnant women	718	LRB
Djossinou et al. [82]	Benin	C	CB	No pregnant WRA	897	LRB
Misgina et al. [83]	Ethiopia	C	CB	Married Women in the first trimester	934	LRB
Mayondi et al. [84]	Botswana	CS	CB	Women with the intention of conceiving	941	LRB
Bengtson et al. [85]	South Africa	C	FB	Pregnant women	978	LRB
Misgina [86]	Ethiopia	C	CB	Married Women in the first trimester	991	LRB
Misgina [87]	Ethiopia	C	CB	Married Women in the first trimester	991	LRB
Abigail Harper [88]	South Africa	CS	CB	Women who became pregnant	1016	LRB
Mekonnen et al. [89]	Ethiopia	CS	CB	Married Women of reproductive age	1050	LRB
Accrombessi et al. [90]	Benin	C	CB	Women intend to conceive	1144	LRB
Isha Berry et al. [91]	Burkina Faso	RCT	CB	Nulliparous, no pregnant adolescents	1230	LRB
Rachel Jewkes [92]	South Africa	CS	CB	Women reproductive age	1279	Moderate
Dunkle et al. [93]	South Africa	CS	FB	Women attending ANC	1,395	LRB
Alemu Earsido Addila et al. [94]	Ethiopia	C	FB	Women attending ANC	1669	LRB
Adeoye [95]	Nigeria	C	FB	Pregnant women	1745	LRB
Barthélémy Tandu-Umba [96]	DR Congo	CS	FB	Women in first trimester	2086	LRB
Tandu-Umba [97]	DR Congo	CS	FB	Delivered women	412	LRB
Adebowale and Martin [98]	Malawi	CS	CB	Women reproductive age	2144	LRB
Chigbu [99]	Nigeria	CS	FB	Women in the first trimester	3167	LRB
Mwase-Musicha et al. [100]	Malawi	C	CB	Delivered the mother's intention to conceive	4221	LRB
Catalao et al. [101]	Malawi	C	CB	Pregnant women	4244	LRB
Habimana et al. [102]	Rwanda	CS	CB	Women Reproductive age	5,001	LRB
Mohammed Ahmed [103]	Ethiopia	CS	CB	Women reproductive age	10,074	LRB
Nance et al. [104]	Zimbabwe	CS	CB	Delivered mother	10,223	LRB
Mrema et al. [105]	Tanzania	C	FB	Pregnant women	17,738	LRB
Isaksen et al. [106]	Tanzania	CS	FB	Pregnant women	25,417	LRB

CB community-based, *FB* facility-based, *CSS* cross-sectional, *CC* case control, *C* cohort, *LRB* low risk of bias

distress, intimate partner violence, and sexually transmitted infections were reported in Southern Africa. Western Africa reported the highest proportions of malaria and anemia. However, no preconception health risks were reported with the highest proportions from Central Africa (Fig. 4).

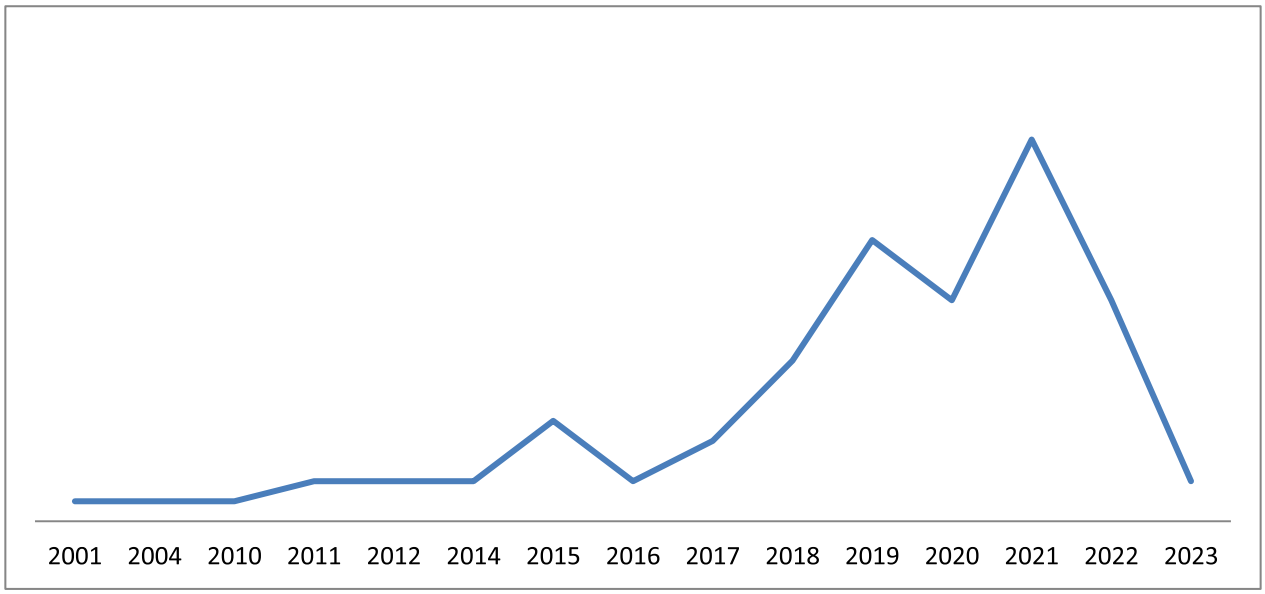

Fig. 3 Trend of papers included in the review

In this review, studies reporting on preconception health risks such as alcohol intake, overweight, sexually transmitted infections, underweight, and abnormal birth intervals were mostly published before 2015. In contrast, the majority of studies on other preconception health risks have been published since 2016(Fig. 5).

Systematic review

Nutrition related risks: This review classifies weight status as a preconception risk when BMI indicates underweight, overweight, or obesity. In this study, researchers evaluated the weight status of 72,591 participants.

Underweight: The review included 26 papers in the underweight group [28, 30, 31, 33, 35–37, 40–42, 47, 51, 54, 59, 61, 62, 67, 82, 85, 87–90, 95, 99, 105, 106], with the proportion of underweight individuals ranging from 0.64% to 36.2%. A study from Ethiopia [87] reported the highest prevalence of underweight.

Overweigh: The systematic review included 29 papers in the overweight group [28, 30, 31, 33, 35–37, 40–42, 47, 51, 54, 59, 61, 62, 67, 82, 85, 88–90, 95–97, 99, 103, 105, 106] [80], with the proportion of overweight individuals ranging from 8.3% to 76.7%. A review revealed that South Africa [62] had the highest prevalence of overweight.

Anemia: The ten studies [30, 33, 34, 36, 37, 47, 51, 90, 97] [41] included in the systematic review all employed a prospective cohort study design, five of which were conducted in Benin. The prevalence of preconception anemia ranges from 36.7% to 58.1%, with Benin reporting the highest burden [34].

Physical activity: A single community-based cohort study from Ethiopia revealed that 53.2% of the study participants self-reported poor physical activity [87].

History of reproductive health and obstetrics related risks

Unintended pregnancy: The review included 26 studies, [25, 35, 38, 43, 45, 56, 65, 84, 85, 94, 98] [32, 48, 53, 58, 63, 69, 73, 74, 76, 78, 79, 83, 100, 101, 104], revealing that the proportion of unintended pregnancies in SSA ranged from 4.2% to 94.3%. Among these studies, 19 were cross-sectional, 5 were cohort studies, and 1 was a case–control study. A facility-based study in Tanzania, which used exits and self-interviews with pregnant women, reported the highest rate of unintended pregnancy, at 94.3% [69].

Inter-pregnancy interval (IPI): The review included seven studies [34, 48, 63, 69, 94, 100, 102] involving a total of 13,554 women to assess short birth intervals. The prevalence of short birth intervals ranged from 7.5% to 53.1%. Rwanda [102] reported the highest rate of short birth intervals, whereas Ethiopia [48] reported the lowest.

The review of long birth intervals included three studies [39, 63, 102] involving a total of 7,117 women. Among these studies, two were cross-sectional, and one was a case–control study. The proportion of long birth intervals ranged from 5.6% to 20.8%, with Ethiopia [39] reporting the highest estimate.

Infertility and/or sub infertility: This review included four studies [21, 57, 63, 70] with 1,638 women and reported infertility or subinfertility rates ranging from 1.9% to 65%. South Africa [21] reported the highest prevalence of HIV-positive couples who failed

Table 2 Summary of preconception health risks from the included studies

First Author &year	Preconception risks measure	Proportion of preconception risks
Nutrition related risks		
Underweight & overweight		
Isaksen et al. [106]	WHO classification	Underweight (5.2%), Overweight (38%)
Adeoye [95]	WHO classification	Underweight (3%), Overweight (46%)
Sania et al. [62]	WHO classification	Underweight (0.64%), Overweight (76.7%)
Fouelifack et al. [61]	WHO classification	Underweight (3.7%), Overweight (50%)
Djossinou et al. [82]	WHO classification	Underweight (7.5%), Overweight (34%)
Mohammed Ahmed [103]	WHO classification	Overweight (9.7%)
Woldeamanuel et al. [40]	WHO classification	Underweight (8.6%), Overweight (8.3%)
Abigail Harper [88]	WHO classification	Underweight (9.6%), Overweight (47.3%)
Patrick et al. [37]	WHO classification	Underweight (1.9%), Overweight (29.4%)
Abubakari et al. [54]	WHO classification	Underweight (3.8%), Overweight (38.4%)
Chigbu [99]	WHO classification	Underweight (3%), Overweight (24.7%)
Asefa et al. [42]	WHO classification	Underweight (18.4%), Overweight (17.6%)
Schmiegelow et al. [30]	WHO classification	Underweight (6.3%), Overweight (32%)
Msollo et al. [31]	WHO classification	Underweight (6.5%), Overweight (46%)
Mrema et al. [105]	WHO classification	Underweight (6.6%), Overweight (31.3%)
Tandu-Umba [96]	WHO classification	Overweight (51.4%)
Fikadu et al. [67]	WHO classification	Underweight (7.7%), Overweight (28.7%)
Barthélémy [96]	WHO classification (Overweight/obesity was specially defined as postpartum body mass index (BMI) ≥ 28 kg/m2)	Overweight (21.9%)
Lokken Em et al. [59]	WHO classification	Underweight (1.8%), Overweight (60.7%)
Bengtson et al. [85]	WHO classification	Underweight (4.4%), Overweight (67.7%)
Nsereko et al. [41]	WHO classification	Underweight (3.6%), Overweight (24.5%)
Accrombessi et al. [90]	WHO classification	Underweight (8.3%), Overweight (30%)
Manfred et al. [51]	WHO classification	Underweight (19.2%), Overweight (55%)
Misgina et al. [87]	WHO classification	Underweight (36.2%)
Accrombessi et al. [47]	WHO classification	Underweight (10.1%), Overweight (25.6%)
Mekonnen et al. [89]	WHO classification	Underweight (7.8%), Overweight (33.3%)
Oyaro et al. [80]	WHO classification	Obese (24.1%)
Davies et al. [36]	WHO classification	Underweight (9.2%), Overweight (24%)
Agbota et al. [28]	WHO classification	Underweight (10.2%), Overweight (23%)
Alemu et al. [35]	WHO classification	underweight 8%, overweight 22.6%
Anemia		
Tandu-Umba [97]	Hemoglobin < 10 g/dl	Anemia (53.4%
Msemo et al. [33]	Hemoglobin < 12 g/dl	Anemia (36.7%)
Patrick et al. [37]	Hemoglobin < 11.5 g/dl	Anemia (41.5%)
Gino Agbota [34]	Hemoglobin < 12 g/dl	Anemia (58.1%)
Schmiegelow et al. [30]	Hemoglobin < 12 g/dl	Anemia (46.5%)
Nsereko et al. [41]	Hemoglobin < 11 g/dl	Anemia (33%)
Accrombessi et al. [90]	Hemoglobin < 12 g/dl	Anemia (49.1%)
Manfred et al. [51]	Hemoglobin < 12 g/dl	Anemia (54.3%)
Accrombessi et al. [47]	Hemoglobin < 12 g/dl	Anemia (55.7%)
Davies et al. [36]	Hemoglobin < 12 g/dl	Anemia (57.9%)
History of reproductive health and obstetrics related risks		
History of APOs		
Misgina et al. [87]	Self-report history	History of APOs (21%)
Msemo et al. [33]	History from document	History of APOs (34.1%)

Table 2 (continued)

First Author &year	Preconception risks measure	Proportion of preconception risks
Dessie et al. [53]	Self-report history	History of APOs (19.4%)
Misgina [83]	Self-report history &document	History of APOs (20%)
Tandu-Umba [97]	Assessment checkup &self-report	History of APOs (19.9%)
Asresu et al. [72]	Self-report history	History of APOs (21%)
Setegn Alie [76]	Self-report history	History of APOs (17.5%)
Barthélémy [96]	Assessment checkup	History of APOs (33.2%)
Tsegaye and Kassa [73]	Self-report history	History of APOs (18.3%)
Wegene et al. [48]	Self-report history	History of APOs (14%)
Setegn [58]	Self-report history	History of APOs (11%)
Amani Kikula et al. [69]	Exit self-interview	History of APOs (15.3%)
Accrombessi et al. [89]	Assessment checkup	History of APOs (29.5%)
Manfred et al. [51]	Assessment checkup &self-report	History of APOs (29.7%)
Habte et al. [75]	Self-report history	History of APOs (25.2%)
Jonathan [45]	Self-report history	History of APOs (42.2%)
Mekonnen et al. [89]	Self-report history	History of APOs (51.9%)
Abrha et al. [71]	Self-report history	History of APOs (21%)
Unintended pregnancy		
Tesfayeet al. [74]	Self-report history	Unintended pregnancy (16.1%)
Teshome et al. [79]	Self-report unplanned	Unintended pregnancy (31.4%)
Dessie et al. [53]	Self-report history	Unintended pregnancy (29%)
Misgina [83]	Self-report & document	Unintended pregnancy (40.6%)
Catalao et al. [101]	Self-report history	Unintended pregnancy (52.2%)
Setegn Alie [76]	Self-report history	Unintended pregnancy (55.2%)
Gonfa et al. [78]	Self-report history	Unintended pregnancy (32.1%)
Tsegaye and Kassa [73]	Self-report history	Unintended pregnancy (10.3%)
Gashaw [32]	Assessment & self-report	Unintended pregnancy (20.6%)
Wegene et al. [48]	Self-report history	Unintended pregnancy (6.2%)
Mwase-Musicha et al. [100]	Self-report history	Unintended pregnancy (63.9%)
Setegn [58]	Self-report history	Unintended pregnancy (58.5%)
Mamo [63]	Self-report history	Unintended pregnancy (21.8%)
Amani Kikula et al. [69]	Exit self-interview	Unintended pregnancy (94.3%)
Nance et al. [104]	LMUP	Unintended pregnancy (31%)
Mayondi et al. [84]	Mistimed and unwanted	Unintended pregnancy (4.2%)
Ayalew et al. [56]	Self-report unintended	Unintended pregnancy (9%)
Bengtson et al. [85]	Self-report history	Unplanned pregnancy (69.4%)
Fetene et al. [65]	Self-report history	Unplanned pregnancy (17.6%)
Alemu Addila e tal [94]	Self-report history	Unplanned pregnancy (13.1%)
Firoza Haffejee et al. [38]	Chart review	Unintended pregnancy (64.3%)
Alemu et al. [35]	Mistimed & unwanted	Unintended pregnancy (28.7%)
Aychew et al. [25]	Self-report history	Unplanned pregnancy (31.7%)
Kassa et al. [43]	Self-report unplanned	Unplanned pregnancy (20%)
Adebowale [98]	Mistimed & unwanted	Unintended pregnancy (43%)
Jonathan [45]	Self-report history	Unplanned pregnancy (55.1%)
Abnormal birth interval		
Kahsay et al. [39]	IPI ≥ 60 months	LBI (20.8%),
Habimana et al. [102]	IPI < 24 months, IPI ≥ 60 months	SBI (53.1%), LBI (16.3%)
Mamo [63]	IPI < 24 months, IPI ≥ 60 months	SBI (41.3%), LBI (17.3%)
Amani Kikula et al. [69]	IPI < 24 months	SBI (22.14%)
Alemu Addila et al. [94]	IPI < 24 months,	SBI (18%)

Table 2 (continued)

First Author &year	Preconception risks measure	Proportion of preconception risks
Gino Agbota [34]	IPI < 24 months,	SBI (43%)
Wegene et al. [48]	IPI < 24 months,	SBI (7.5%)
Infertility/sub infertility		
Goshu et al. [57]	Self-report of history of infertility	Infertility (1.9%)
Mamo [63]	Self-report of history of infertility	Infertility (5.24%)
Iyer et al. [21]	Failure to conceive within 6 months	Infertility (65%)
Feyisa et al. [70]	Failure to conceive within12 months	Infertility (17.8%)
Substance use		
Alcohol intake		
Abetew et al. [26]	AUDIT	Alcohol intake (68.6%)
Adeoye [95]	Self-report history	Alcohol intake (31.6%)
Mekuriaw et al. [81]	AUDIT-C	Alcohol intake (19.8%)
Moise [29]	T-ACE alcohol-screening	Alcohol intake (20.7%)
Demeke and Bayu [44]	Self-report history	Alcohol intake (68.7%)
Sania et al. [62]	AUDIT	Alcohol intake (25.4%)
O'Connor et al. [77]	AUDIT-C (post conception and prior to pregnancy recognition)	Alcohol intake (27%)
Tesfaye et al. [74]	AUDIT	Alcohol intake (32%)
Odendaal [27]	AUDIT	Alcohol intake (55.7%)
Agiresaasi et al. [55]	AUDIT	Alcohol intake (53.8%)
Mohammed Ahmed [103]	Self-report history	Alcohol intake (35.2%)
Abigail Harper [88]	Self-report history	Alcohol intake (10.8%)
Gashaw [32]	Self-report history	Alcohol intake (29.2%)
Fikadu et al. [68]	Self-report history	Alcohol intake (5.3%)
Lokken Em et al. [59]	Self-report history	Alcohol intake (14.2%)
Nsereko et al. [41]	Self-report history	Alcohol intake (23%)
Kassahun Tesema et al. [66]	Self-report history	Alcohol intake (5.6%)
Fetene et al. [65]	Self-report history	Alcohol intake (12.5%)
Feyisa et al. [70]	Self-report history	Alcohol intake (17.2%)
Rachel Jewkes [92]	Self-report history	Alcohol intake (11.3%)
Alemu Addila et al. [94]	AUDIT-C	Alcohol intake (52.4%)
Firoza Haffejee et al. [38]	Self-report history	Alcohol intake (14.94%)
Oyaro et al. [80]	AUDIT	Alcohol intake (13.4%)
Chaidinma et al. [46]	Self-report history	Alcohol intake (33.4%)
Lokken Em et al. [60]	Self-report history	Alcohol intake (14.2%)
Smoking		
Adeoye [95]	Self-report smoking	Smoking (1.9%)
O'Connor et al. [77]	Self-report smoking	Smoking (4.5%)
Tesfaye et al. [74]	Self-report smoking	Smoking (20.3%)
Fouelifack et al. [61]	Self-report smoking	Smoking (6.7%)
Abigail Harper [88]	Self-report smoking	Smoking (7.6%)
Fikadu et al. [67]	Self-report smoking	Smoking (2.1%)
Fikadu et al. [68]	Self-report smoking	Smoking (2.4%)
Iyer et al. [21]	Self-report smoking	Smoking (5.7%)
Kassahun Tesema et al. [66]	Self-report smoking	Smoking (3.3%)
Fetene et al. [65]	Self-report smoking	Smoking (5.1%)
Feyisa et al. [70]	Self-report smoking	Smoking (1.1%)
Rachel Jewke s [92]	Self-report smoking	Smoking (8.2%)
Coffee intake		
Gashaw [32]	Self-report regardless of the amount	Coffee intake (68.7%)

Table 2 (continued)

First Author &year	Preconception risks measure	Proportion of preconception risks
Feyisa et al. [70]	Coffee drinking > 4 cups per day	Coffee intake 64(12%)
Chat chewing		
Mekonnen et al. [49]	Self-report	Khat chewing (12.7%)
Fetene et al. [65]	Self-report	Khat chewing (27.6%)
Feyisa et al. [70]	Self-report	Khat chewing (9.9%)
History of chronic medical condition		
Teshome et al. [79]	Self-report chronic health problem	Chronic disease (7.4%)
Abubakari et al. [54]	Self-report chronic health problem	Chronic disease (4.3%)
Lemma [52]	Self-report chronic health problem	Chronic disease (15.2%)
Asresu et al. [72]	Self-report chronic health problem	Chronic disease (7%)
Setegn Alie [76]	Self-report chronic health problem	Chronic disease (15.5%)
Gonfa et al.[78]	Self-report chronic health problem	Chronic disease (7.4%)
Gashaw [32]	Self-report chronic health problem	Chronic disease (5.8%)
Demisse et al. [50]	Self-report chronic health problem	Chronic disease (12.2%)
Wegene et al. [48]	Self-report chronic health problem	Chronic disease (2.2%)
Goshu et al. [57]	Self-report chronic health problem	Chronic disease (8.3%)
Fikadu et al. [68]	Self-report chronic health problem	Chronic disease (16.6%)
Ayalew et al. [56]	Self-report chronic health problem	Chronic disease (8.3%)
Kassahun Tesema et al. [66]	Self-report chronic health problem	Chronic disease (12.7%)
Feyisa et al. [70]	Self-report chronic health problem	Chronic disease (2.8%)
Oyaro et al. [80]	Self-report chronic health problem	Chronic disease (3.4%)
Abrha et al. [71]	Self-report chronic health problem	Chronic disease (7%)
Alemu et al. [35]	Self-report chronic health problem	Chronic disease (13.8%)
Infectious diseases (STI, HIV and Malaria		
HIV		
O'Connor et al. [77]	Screened HIV	HIV (25.8%)
Msemo et al. [33]	Screened HIV	HIV (5.7%)
Fouelifack et al. [61]	obstetric records card	HIV (7%)
Lemma [52]	Self-report	HIV (3.6%)
Asresu et al. [72]	Self-report	HIV (2.5%)
Setegn Alie [76]	Self-report	HIV (4.8%)
Goshu et al. [57]	Self-report	HIV (1.7%)
Nance et al. [104]	Self-report	HIV (9.4%)
Manfred et al. [51]	screened HIV	HIV (1.5%)
Accrombessi et al. [47]	screened HIV	HIV (2%)
Kassahun Tetal [66]	Self-report	HIV (1.6%)
Feyisa et al. [70]	Self-report	HIV (0.4%)
Sexual transmitted infection		
O'Connor et al. [77]	Self-report history	STIs (29.2%
Iyer et al. [21]	screened for STIs	STIs (5.4%)
Lokken Em et al. [59]	Tested using laboratory	STIs (7.4%)
Nsereko et al. [41]	Tested using laboratory	STIs (21.5%)
Tsega et al. [64]	Self-report history	STIs (7.3%)
Lokken Em et al. [60]	Tested using laboratory	STIs (1.3%)
Malaria		
Tandu-Umba [96]	Not reported	Malaria (19%)
Msemo et al. [33]	Microscopy blood film	Malaria (8.1%)
Patrick et al. [37]	Microscopy blood film	Malaria (1.9%)
Accrombessi et al. [90]	Microscopy blood film	Malaria (5.3%)

Table 2 (continued)

First Author &year	Preconception risks measure	Proportion of preconception risks
Manfred et al. [51]	Microscopy blood film	Malaria (6.3%)
Accrombessi et al [47]	Microscopy blood film	Malaria (20.8%)
Isha Berry et al. [91]	Rapid Diagnostic Tests	Malaria (47%)
Agbota et al. [28]	Microscopy blood film	Malaria (14.7%)
Psychosocial related risks		
Psychosocial distress		
Tesfaye et al. [74]	KPDS score > 20	Psychosocial distress (27.5%)
Misgina [87]	PSS,EPDS & 7- item anxiety subscale	Psychosocial distress (44.5%)
O'Connor et al. [77]	EPDS > 13	Depression (60%)
Abigail Harper [88]	CES-D a cutoff of 12	Depression (16.1%)
Mwase-Musicha et al. [100]	Episode of one or more depression, > 2wks	Depression (29.4%)
Catalao et al. [101]	SRQ 20, a score of ≥ 8	Depression (13.9%)
Sania et al. [62]	IPV using the WHO tool during PCC	IPV (20.14%),
O'Connor et al. [77]	Any violence from the partner past year	IPV (43.5%)
Intimate partner violence		
Tesfaye et al. [74]	HITS screening tool ≥ 10	IPV (6.7%)
Misgina [87]	HITS screening tool ≥ 10	IPV (16.24%)
Misgina [86]	HITS screening tool ≥ 10	IPV (14.7%)
Nsereko et al. [41]	Self-report history	IPV (3.82%)
Fetene et al. [65]	IPV considered even one " yes from the list	IPV (29.4%)
Dunkle et al. [93]	GBV WHO tool	IPV (22.5%)
Rachel Jewkes [92]	GBV WHO tool	IPV (46.8%)
Others risks (low physical activity, environmental exposure, dental problems and female genital mutilation)		
Misgina [87]	Self-report	Low physical activity (53.2%)
Gashaw [32]	Self-report exposure	X-ray (2.9%), Chemical exposure (10.7%)
Oyaro et al. [80]	Physical examination & history taking	Gingivitis (88.6%)
Mekonnen et al. [89]	Self-report history	Female genital mutilation (90.4%)

* Weight status based on WHO classification: underweight (BMI < 18.5), overweight (BMI > 25), obese (BMI > 30), *Anemia hg < 12 g/dl, *Chronic medical condition includes a history of hypertension, diabetes mellitus, and asthma

APOs histories of adverse pregnancy outcomes, *IPI* inter-pregnancy interval, *SBI* short birth interval, *LBI* long birth interval, *LMUP* London measure of unplanned pregnancy, *PSS* perceived stress scale, *IPV* intimate partner violence, *GBV* gender-based violence, *HITS* hurt, insult, threaten and scream, *CES-D* Center for Epidemiologic Studies Depression Scale, *AUDIT-C* alcohol use disorders identification test, *p* physical violence, *S* sexual violence, Emotional/psychological violence

to conceive after six months of regular intercourse, whereas Ethiopia [57] reported the lowest prevalence.

History of Adverse pregnancy outcomes: Eighteen studies [33, 45, 48, 51, 53, 58, 69, 71–73, 75, 76, 83, 87, 89, 90, 96, 97] that included four cohort studies and 14 cross-sectional studies with a total of 11,247 women were included. Self-reports [12 studies], assessment checkups and self-reported histories [2 studies], assessment checkups (two studies), self-reported histories and documents (one study), and histories from documents (one study) were used to measure the history of adverse pregnancy outcomes. The proportion of participants with a history of APOs ranged from 11% [58] to 51.9% [89], and both the highest and lowest reports were from Ethiopia.

Substance use

Alcohol intake: The systematic review included 25 papers [26, 27, 29, 32, 38, 41, 44, 46, 55, 59, 60, 62, 65, 66, 68, 70, 74, 77, 80, 81, 88, 92, 94, 95, 103] with a total of 25,027 women of reproductive age. Seventeen of these studies were cross-sectional, 6 were cohort studies, and 2 were case–control studies. To measure alcohol intake, 15 papers used self-reported history, 6 used AUDIT scores, 3 used AUDIT-C scores, and 1 used the T-ACE screening tool. Alcohol intake estimates range from 5.3% to 68.7% among women of childbearing age, with Ethiopia reporting both the lowest and highest alcohol intake levels [44, 68].

Smoking: The review included 12 papers [21, 61, 65–68, 70, 74, 77, 88, 92, 95] with a total of 8,542 women, all

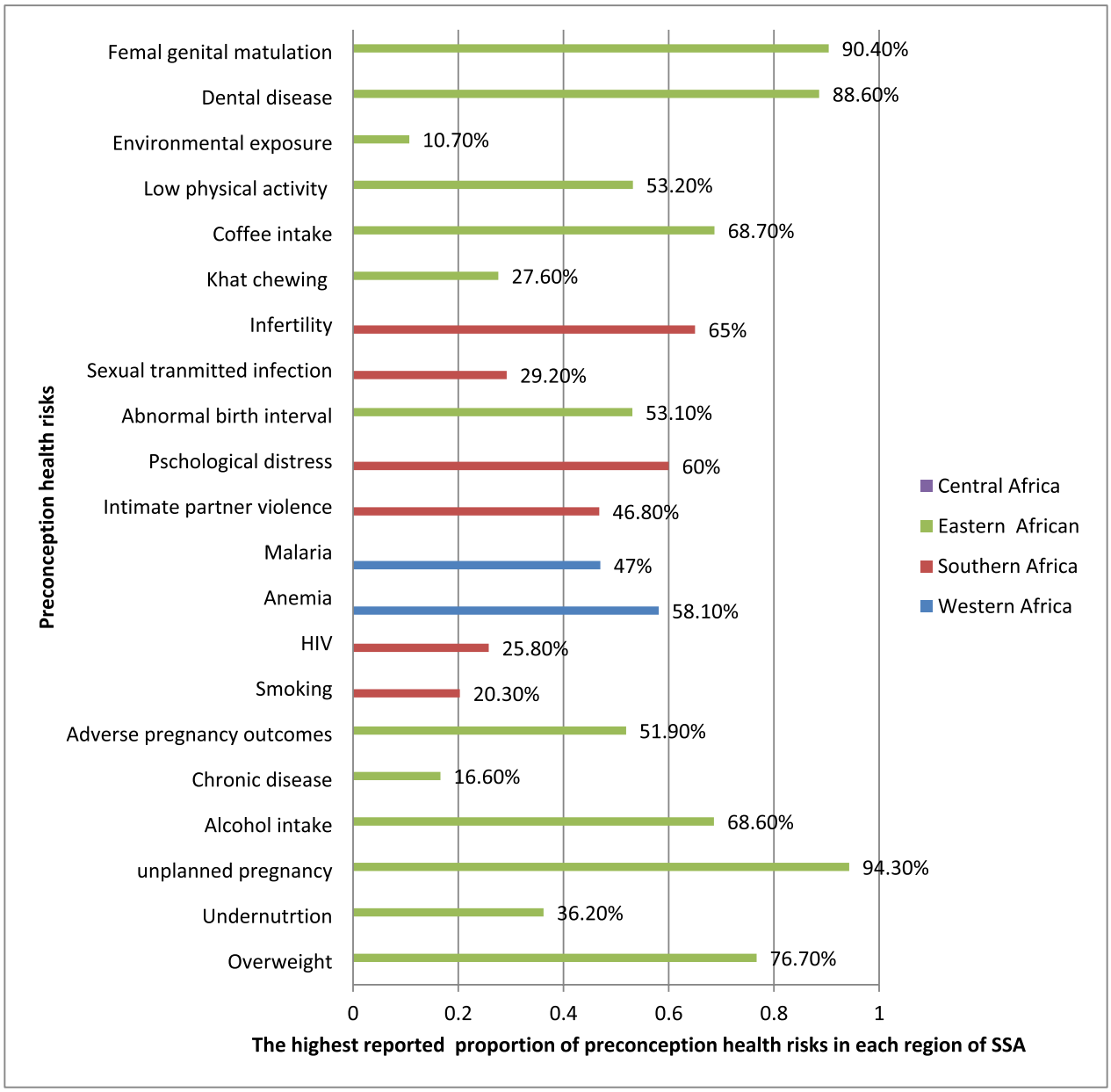

Fig. 4 Distribution of the highest reported proportions of preconception health risks by region

of which measured smoking status through self-reports. Among these, 8 studies were cross-sectional, 3 were cohort studies, and 1 was a case–control study. The prevalence of smoking ranges from 1.1% to 20.3%, with Ethiopia reporting both the highest and lowest prevalence rates [70, 74].

Khat chewing: People often chew khat, a green leafy plant commonly grown in Eastern Africa, for its euphoric effects, which come from its ability to increase dopamine activity in the brain [107, 108]. It can negatively impact pregnancy outcomes, including sexual difficulties, reduced utero–placental blood flow, impaired fetal growth, and low birth weight [109, 110].

The review included three articles [49, 65, 70] from Ethiopia on khat chewing among 1,453 women. Researchers have measured khat use through self-reported history at the facility level. Among these studies, two were cross-sectional, and one was a case–control study, with khat chewing prevalence ranging from 9.9% to 27.6% [65, 70].

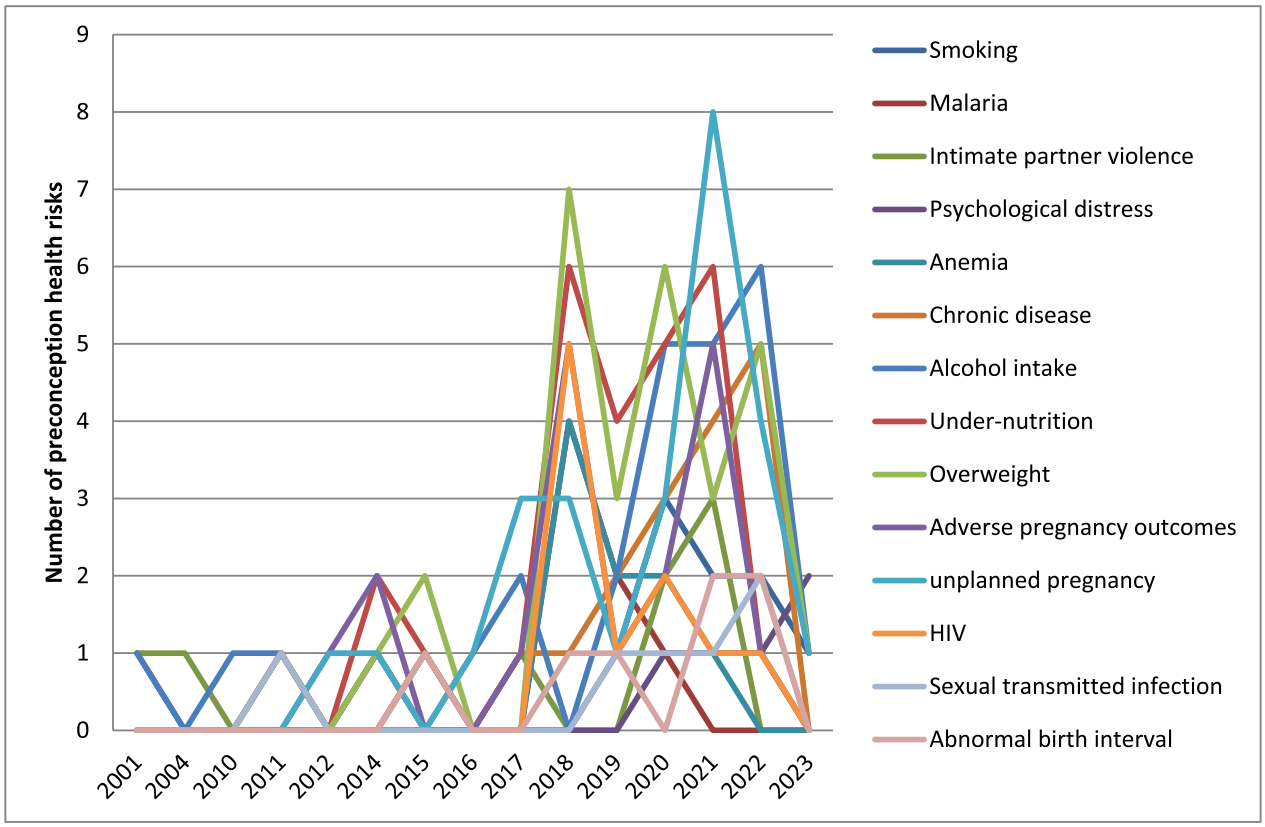

Fig. 5 Trend of the common list of preconception health risks in SSA

Chronic medical conditions

Seventeen studies [32, 35, 48, 50, 52, 54, 56, 57, 66, 68, 70–72, 76, 78–80] examined chronic medical conditions among 7,996 women. Fifteen studies were from Ethiopia, one from Ghana, and one from Kenya. Most studies were cross-sectional, with only one case–control. The study used self-reported history to measure chronic conditions, with 11 studies conducted at the community level and 6 at the facility level. Commonly reported conditions include hypertension, diabetes mellitus, and asthma. The prevalence of chronic medical conditions ranged from 2.2% to 16.6%, with both the highest [68] and lowest [48] prevalence reported in Ethiopia.

Infectious disease

HIV: Twelve studies [33, 47, 51, 52, 57, 61, 66, 70, 72, 76, 77, 104] examined HIV status among 15,910 women of reproductive age. Among these studies, nine were cross-sectional, and three were cohort studies. Ten studies were community-based, whereas two were facility-based. HIV status was measured through direct screening (four studies), obstetrics card documents (one study), and self-reported histories (seven studies). The reported proportion of HIV ranged from 0.4% to 25.8%, with the highest prevalence reported in South Africa [77] and the highest and lowest reported in Ethiopia [70].

Sexual transmitted infections: Six papers [21, 41, 59, 60, 64, 77] reported on preconception STIs. Two studies measured the risks self-reported histories from pregnant women; three studies tested the risks laboratory samples from women trying to conceive; and one study screened for STIs from HIV-positive couples who intended to conceive. Four papers were prospective cohorts, and two were cross-sectional, with a total of 2770 women of reproductive age. The proportion of STI cases ranged from 1.3% to 29.2%. South Africa [77] reported the highest number of cases, whereas Kenya [60] reported the lowest.

Malaria: Of the eight papers [28, 33, 37, 47, 51, 90, 91, 96] reporting on preconception malaria, five were prospective cohort follow-ups, one was a second analysis from an RCT, and two were cross-sectional. Seven studies were community-based, and one was facility-based. Malaria was tested using microscopic blood films in six studies and rapid diagnostic tests in one, with one study not reporting the testing method [96]. Five studies focused on women trying to conceive, one on nulliparous women of reproductive age, one

on nulliparous no pregnant adolescents, and one on no delivered mothers, for a total of 5,227 women. The prevalence of malaria among these women ranged from 1.9% to 47%, with Burkina [91] reporting the highest burden.

Psychosocial related risks

Psychosocial distress: Six studies [74, 77, 86, 88, 100, 101] examined psychosocial distress among 12,352 women. Five of these studies were community-based, whereas one was facility-based. Three studies used a prospective cohort design, and the other three were cross-sectional.

Various tools were used to measure psychosocial distress across the studies: the perceived stress scale, 10-item EPDS, and 7-item anxiety subscale in one study; the SRQ-20 in another; the KPDS, with a score above 20 in one; the EPDS, with a score above 13 in another; the CES-D, with a cutoff score of 12 in one; and one study, which recorded episodes of depression lasting more than two weeks. These studies, which were conducted in South Africa, Ethiopia, and Malawi, reported prevalence rates ranging from 13.9% to 60%. In South Africa [77], women of reproductive age who scored above 13 on the EPDS were more susceptible to psychosocial distress during the preconception period.

Intimate partner violence (IPV): Nine studies [41, 62, 65, 74, 77, 84, 87, 92, 93] reported IPV, using various tools: two employed the WHO gender-based violence tool, three used the HITS screening tool (score > 10), and others focused on recent partner violence or self-reported histories among 7,018 women. One study [92] categorized IPV as physical (24.6%), sexual (5.6%), or psychological (46.8%). The incidence of IPV ranges from 6.7% to 46.8%, with the highest prevalence in South Africa [92] and the lowest prevalence in Ethiopia [74].

Others: Two studies [32] [70] from Ethiopia examined coffee intake. Gashaw et al. [32] reported a 68.7% intake rate among 243 mothers on the basis of self-reported history, regardless of quantity. The second study [70] reported a 12% prevalence of coffee consumption, defined as drinking more than four cups per day.

A community-based study in Ethiopia [89] reported a 90.4% self-reported rate of female genital mutilation among 1,050 married women of reproductive age. In Kenya, a facility-based study [80] revealed that 88.6% of 647 women planning to conceive had gingivitis, as assessed through physical exams and history-taking. Another Ethiopian study [32] reported that, among 243 mothers, 2.9% had X-ray exposure and 10.7% had chemical exposure on the basis of self-reported data.

Discussion

Although preconception health risks are strongly linked to adverse pregnancy outcomes [13], the CDC/ATSDR Preconception Care Work Group emphasizes the importance of identifying these risk factors as a priority in its ten comprehensive recommendations for improving women's health [3]. However, to our knowledge, there has been no summarized evidence on preconception health risks in the region. Overall, this review revealed a high proportion of preconception health risks among the participants which includes anemia (36.7% to 58.1%), underweight (0.64% to 36.2%), overweight (8.3% to 76.7%), unintended pregnancy (4.2% to 94.3%), alcohol intake (5.3% to 68.7%), smoking (1.1% to 20.3%), khat chewing (9.9% to 27.6%), history of chronic medical conditions (2% to 16.6%), a history of adverse pregnancy outcomes (11% to 51.9%), sexually transmitted infections (1.3% to 29.2%), psychosocial distress (13.9% to 60%), and intimate partner violence (6.7% to 43.7%).

The double burden of under-nutrition and over-nutrition within the same population throughout the life course remains a significant concern for global public health. Nearly one-third of the global population has experienced at least one form of malnutrition [111]. In LMICs, the double burden of malnutrition is increasing [112]. Maternal malnutrition increases the risk of adverse pregnancy outcomes, including maternal and newborn morbidity, mortality, low birth weight, and preterm birth [113]. Overweight and obesity also contribute significantly to morbidity and mortality from NCDs. This review reported a higher prevalence of underweight during preconception than the 15.2% reported among women of reproductive age in LMICs [114]. Similarly, the prevalence of underweight was 6.6% in Latin America and the Caribbean, 5.3% in Europe and Central Asia, and18.3% in South Asia [114].

In this review, the majority of overweight cases, including obesity, ranged between 20 and 40% [28, 30, 31, 35–37, 41, 47, 51, 54, 61, 67, 80, 82, 88–90, 95, 96, 99, 105, 106].

The overall prevalence of overweight and obesity among women of reproductive age in LMICs are 19.0% and 9.1%, respectively [114], which are lower than the findings of this review. This is lower than that reported in the review. This aligns with the concept of the double burden of malnutrition under nutrition and over nutrition coexisting in the same population throughout the life course. Notably, the double burden of nutritional issues in developing countries has tripled over the past 20 years [111]. The high burden of overweight in this review likely stems from the epidemiological shift from underweight to overweight, driven by preconception risk factors such as unhealthy diets, physical inactivity, and substance

use, including alcohol and cigarette smoking [111]. The region should adapt integrated policies that address both under-nutrition and obesity, combining food security programme and nutrient supplementation for the undernourished with education on diet and lifestyle modifications to combat overweight issues.

Malnutrition increases vulnerability to substance abuse by impairing cognitive function and stress management. It also elevates the risk of chronic conditions such as diabetes, hypertension, and cardiovascular diseases, particularly when key nutrients like iron, folic acid, and vitamin D are deficient. Combined with other preconception health risks, malnutrition creates a vicious cycle that negatively affects fertility, pregnancy outcomes, and overall reproductive health. Addressing malnutrition through preconception nutrition programs, dietary interventions, and improved healthcare access can help reduce health risks and improve outcomes. The complex interaction of preconception risk factors can negatively impact fertility, pregnancy, and the long-term health of mothers and children, often triggering a cycle of poor health and complications [115].

Based on the World Health Organization classification, our review identified five studies from Eastern and Western Africa that reported a double burden of malnutrition. These studies showed underweight prevalence ranging from 10.1% to 36.2%, and overweight prevalence from 25.6% to 76.7%, indicating a very high coexistence of both conditions. This classification reflects a serious or critical public health situation in the affected in the continent. However, there is no double burden of malnutrition because of very low underweight in developed countries [116]. This is because due to variation in socioeconomic, employment status, and educational level.

In the present review, the range of anemia among women of reproductive age was very high compared with the global WHO's 2019 report, where the prevalence of anemia in non-pregnant women of reproductive age was 29.6% [117]. Evidence from Africa shows that approximately 84% of women of reproductive age have low red blood cell folate levels [118], and the incidence of neural tube defects is 131 per 10,000 live births [119]. Although one of the global nutrition targets is to reduce the prevalence of anemia in women of reproductive age by 50% by 2025 [120], the burden of in SSA will continue to be prioritized.

Unintended pregnancy is a risk factor for unsafe abortion, miscarriage, and unplanned births, all of which contribute to maternal morbidity and mortality [121]. In the review, 11 studies reported unintended pregnancy rates of over 40%, 9 studies reported rates between 20 and 40%, and only 6 studies reported rates below 20%. Across 61 countries, the pooled prevalence of unintended pregnancy in LMICs was 26.46%, ranging from 19.25% in Egypt to 61.71% in Bolivia [122]. This systematic review revealed a much wider range of unintended pregnancies than LMICs did. Variations in health systems, particularly the availability and accessibility of maternal health services, including family planning, as well as differing sociocultural factors, likely cause this discrepancy.

On the basis of WHO recommendations, the optimal inter-pregnancy interval, which is within the range of 24 months to 59 months, can ensure the maximum health benefits for mothers and newborns [20].When a child is spaced at least two years apart, infant mortality decreases by 50% [123]. Short birth spacing has been linked to various adverse pregnancy outcomes, including low birth weight, preterm birth, small size for gestational age, neonatal mortality [124], and congenital anomalies [125].

Short birth intervals are a significant factor contributing to the high rates of adverse maternal and neonatal outcomes in low-income countries. This review revealed that the proportion of short birth intervals in the studied population was greater than that in LMICs, where the prevalence of short birth intervals ranges from 3 to 20% [126]. The discrepancy may be attributed to varying definitions of short birth intervals (< 18 months), differences in health systems, and sociocultural factors. This highlights the urgent need for focused efforts to address this preconception risk and improve maternal and neonatal outcomes in SSA. Additionally, this systematic review revealed that the proportion of long birth intervals was consistent with findings from LMICs [126] and other studies [127, 128], with a prevalence ranging from 6.6% to 17.3%.

PCC increases fertility awareness among healthy couples and can help prevent birth abnormalities while improving maternal outcomes [129]. A previous meta-analysis reported a 12.6% prevalence of 12-month infertility, with regional estimates ranging from 9.5% to 32% in Africa, 5% to 34% in Europe, and 1.6% to 28% in the Western Pacific [130]. In this review, however, the burden of sub-infertility and infertility was greater, likely because the six-month measurement period was shorter than the 12-month definition used in the previous analysis [130].

Alcohol consumption before or during pregnancy is well known to be associated with the development of serious health risks to fetuses and mothers. Evidence suggests that consuming ethanol (5%) two weeks before conception decreases the number of viable fetuses and impairs their development [131]. In cultures where alcohol is consumed [94] [132], raising awareness of its risks during pregnancy is crucial. Substance use, including high alcohol consumption and smoking, was more prevalent in Eastern and Southern Africa compared to other regions of SSA. This finding aligns with a review

on substance use among pregnant women in Africa [133]. The reason might be due to the cultural and social acceptance of alcohol in religious and traditional rituals. Additionally, high unemployment, and poverty contribute to its widespread use.

According to a Swedish study, 10% of women reported changing their alcohol consumption habits while planning their pregnancies [134]. Preconception alcohol intake in this review was consistent with a UK report, where nearly two-thirds of women consumed ≤ 2 units of alcohol per week prior to pregnancy [135]. However, the figure was lower than that reported in another Swedish study, where approximately 84% of women reported alcohol consumption during the year preceding pregnancy [136].

Smoking during pregnancy poses serious risks, including a greater chance of preterm birth. Encouraging women to quit smoking before pregnancy is essential, as many women continue smoking [137]. This review revealed lower preconception smoking rates than U.S. studies did [138], likely due to differences in lifestyle, socioeconomic factors, and urbanization between women in the U.S. and those in SSA.

In SSA, NCDs are increasingly becoming a leading cause of illness and death and are projected to surpass infectious diseases by 2035 [139]. In this review, the prevalence of chronic conditions ranged from 2% to 16.6%, with diabetes, hypertension, and asthma frequently reported. This aligns with an Australian population-based study, where chronic diseases ranged from 2.8% to 18%, and asthma and diabetes were also common [140].

APOs are vital for assessing maternal and child health programs [141]. In this review, the prevalence of APOs ranged from 11% to 51.9%, with abortion, preterm birth, and stillbirth commonly reported. Other studies similarly reported that the proportion of women with a history of APOs fell within this range, with abortion and stillbirth being the most frequently mentioned [4, 142].

Testing women of reproductive age for HIV is crucial to prevent mother-to-child transmission and address other pregnancy complications related to HIV/AIDS. Despite UNAIDS'95–95-95 target for 2025 [143], the HIV testing rate in SSA remains low, with an average of only 56.1%[144]. This low testing prevalence may lead to an underestimation of HIV-positive cases in the region, as observed in other studies [144, 145].

Women of reproductive age with STIs are at risk of negative pregnancy outcomes, such as preterm birth, stillbirth, and low birth weight [146]. Consistent with studies from India and Switzerland (8.6% to 39.2%), [147–149] STI screening, surveillance, and treatment programs in SSA remain inadequate, with most STIs being asymptomatic, potentially leading to underreported cases.

In SSA, malaria remains a significant public health issue, contributing to APOs such as intrauterine growth restriction, spontaneous abortion, preterm labor, and low birth weight [150–152]. The findings of the review were consistent with those of studies conducted on pregnant women [153, 154]. Owing to low health-seeking behavior and the lack of standardized diagnostic tests, malaria continues to pose a public health challenge in the region [154].

Psychological distress, which is more common in women, includes generalized symptoms of stress, anxiety, and depression [155]. It is a risk factor for infertility, preterm labor, low birth weight, delayed breastfeeding initiation, and negative outcomes in newborns and young children [156–158]. Studies have shown that 28.2% to 58.4% of women intending to become pregnant experience psychological distress [159–161], which is consistent with this review. This is in line with the findings of this review. Given that preconception risk identification is still emerging, healthcare providers should assess psychosocial risk during preconception and inter-conception care.

Intimate partner violence, before, during, or after pregnancy, is a global public health problem and a potential risk factor for adverse maternal and fetal outcomes [162, 163]. In the review, a high proportion of women were suffering from intimate partner violence. Women of reproductive age in the U.S. experienced 3.5% physical violence before or during pregnancy [164]. In addition, evidence suggests that one in three women in the United States experiences some form of violence by an intimate partner in their lifetime [165].

The review revealed that 12% to 68.7% of women consumed more than four cups of caffeine before conception. Evidence shows that consuming more than 300 mg of caffeine daily increases the risk of fetal loss by 31% and lowers birth weight [166]. Many men and women of reproductive age regularly consume coffee and alcohol, both of which are potential risk factors for poor pregnancy outcomes [166].

The review revealed that 88.6% of women had gingivitis during preconception. Maternal oral health issues, such as gingivitis, can affect birth outcomes, including preterm birth and preeclampsia [167]. The review did not emphasize this, but integrating dental care into preconception interventions is crucial in SSA, as endorsed by the WHO [168].

The review included only one study on environmental and occupational hazards, focusing on X-rays and chemical exposure risks. Evidence has shown that women using wood or coal for cooking or heating during the preconception period have an increased risk of having infants with neural tube defects (NTDs) [166].

Implication of the finding: Our systematic review provides a comprehensive analysis of preconception health risks across different SSA regions. According to the Health Belief Model, individuals are more likely to adopt health-related behaviors when they perceive a significant risk, which influences behaviors like screening and counseling [169]. Identifying the region in SSA with high proportion of preconception health risks presents allow policymakers to give emphasis and allocate resources more effectively, opportunities to enhance women's health, guide healthcare priorities, and plan effective interventions to address the disproportionate burden of poor pregnancy outcomes. Our findings can help policymakers design targeted interventions to prevent preconception health risks by developing context-specific approaches, such as PCC, guided by policies aligned with universal health coverage goals. Healthcare providers can implement reproductive life plans as a routine tool to enhance risk identification and promote the uptake of PCC services. Additionally, increasing awareness of risk factors can help design educational programs that encourage proactive health-seeking behavior.

This review also highlights gaps in research, as the true burden of preconception risks may be underestimated due to fragmented risk assessment methods and limited country coverage. Therefore, our study provides new insights into preconception health, emphasizing the need for targeted interventions and future research to strengthen PCC in SSA.

Socioeconomic and cultural factors can significantly affect the preconception health risks by hindering from access to PCC, affecting both maternal and child health outcomes. Barriers such as poverty, limited education, child marriage, female genital mutilation, gender-based violence, and inadequate social support reduce access and utilization. Additionally, cultural misconceptions and traditional beliefs can shape perceptions and lower the willingness to seek PCC [2]. Addressing those factors and promoting gender equality and addressing these can enhance access to PCC.

This systematic review have the following limitations: First, the risk assessment methods used in the included studies were not comprehensive, potentially leading to an underestimation of the overall burden of preconception risks. Second, some of the data indicating preconception risks was based on retrospective self-reporting, which may introduce recall bias. Third, the review only included studies published in English, which may have resulted in the exclusion of relevant research in other languages. Fourth, preconception health risks such as khat chewing, low physical activity, environmental exposure, dental disease, and female genital mutilation were reported only in Eastern Africa and may not represent the entire Sub-Saharan region. Therefore, the findings should be interpreted with caution.

Conclusion

This systematic review revealed a high prevalence of preconception health risks in SSA, with notable regional differences. Eastern Africa had the highest report of chronic diseases, unplanned pregnancies, abnormal birth intervals, and substance use. Southern Africa reported the highest prevalence of sexually transmitted infections, HIV, intimate partner violence, and infertility, while Western Africa had the highest anemia rates. Overall, most studies focused on Eastern Africa, with the least from Central Africa. Given the inadequate implementation of PCC in the region [12], the governments of respective countries need to give priority and adopt policies to integrate PCC into existing healthcare systems, ensuring the mobilization of financial and human resources. Additionally, policymakers should provide sufficient support for its implementation, equipping healthcare providers with the necessary tools and guidelines for seamless integration into routine practice to screen for preconception risks using the reproductive life plan tool and discuss them with women to improve seeking behavior. The review underscores regional disparities in researchers'focus on preconception health risks. It also highlights variations in studies on specific risks, suggesting the need for more comprehensive research. To address potential gaps, future studies should prioritize under-represented and underreported preconception health risk factors.

Abbreviations

ANC	Antenatal Care
APOs	Adverse pregnancy outcomes
BMI	Body mass index
DM	Diabetic mellitus
HIV	Human immune virus
IPI	Inter-pregnancy interval
IPV	Intimate partner violence
LMICs	Low- and Middle-Income Countries
MMR	Maternal Mortality Rate
NMR	Neonatal mortality rate
NCDs	Non-Communicable Diseases
NTD	Neural tube defect
PCC	Preconception Care
PC	Preconception
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SDGs	Sustainable development goals
SSA	Sub-Saharan Africa
SRHI	Self-related Habit Strength Index
STIs	Sexual Transmitted Infections
WRA	Women of reproductive age
WHO	World Health Originations

Supplementary Information

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Additional file 1.

Additional file 2.

Additional file 3.

Additional file 4.

Additional file 5.

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