



Review

Preconception health care interventions: A scoping review



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ABSTRACT

Pregnancy is often framed as a “window of opportunity” for intervening on a variety of health practices such as alcohol and tobacco use. However, there is evidence that interventions focusing solely on the time of pregnancy can be too narrow and potentially stigmatizing. Indeed, health risks observed in the preconception period often continue during pregnancy. Using a scoping review methodology, this study consolidates knowledge and information related to current preconception and interconception health care interventions published in the academic literature. We identified a total of 29 intervention evaluations, and summarized these narratively. Findings suggest that there has been some progress in intervening on preconception health, with the majority of interventions offering assessment or screening followed by brief intervention or counselling. Overall, these interventions demonstrated improvements in at least some of the outcomes measured. However, further preconception care research and intervention design is needed. In particular, the integration of gender transformative principles into preconception care is needed, along with further intervention design for partners/ men, and more investigation on how best to deliver preconception care.

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Introduction

Calls have been made for preconception care in which women and men are regularly counseled on sexual and reproductive health and planning during the reproductive years, and in which women's health is valued along with a focus on fetal health outcomes [1]. In the provision of prenatal care, women's health has often been underemphasized by health care professionals [2] and health interventions aimed at improving reproductive care implemented exclusively during pregnancy are often too narrow in scope. Among women who become pregnant, health risks experienced in the preconception period often continue during pregnancy, such as the use of alcohol, tobacco and other substances, nutritional deficiencies, and chronic health issues. In addition, the increasing prevalence of obesity and chronic conditions demand attention in the context of preconception care [3]. All of these health issues and risk factors are associated with negative health outcomes for the woman, her pregnancy and the fetus [4–6]. For example, maternal obesity and maternal diabetes are both associated with an increased risk of: gestational diabetes, pre-eclampsia, risk of obstetric interventions, and having a baby with congenital anomalies [3,7]. Tobacco, alcohol and illicit substance use during pregnancy can result in obstetric complications, preterm birth and

low birth-weight [8], and alcohol consumption during the periconception period is associated with Fetal Alcohol Spectrum Disorder (FASD) and birth defects [9]. Further, almost half of pregnancies are unplanned, and behaviours such as smoking and substance use are potentially stigmatizing and hence, not consistently disclosed [10]. Preconception care provides an opportunity to intervene with women and their partners early, and address such health risks that are of benefit to all women and men regardless of intention or desire to conceive. Preconception care is useful to improve both sperm and partner health which are also associated with pregnancy and birth outcomes [11]. Such care need not be pronatalist [12].

Current approaches to preconception care differ between countries. A systematic review of preconception policies, guidelines, services and recommendations in 6 European countries including: Belgium, Denmark, Italy, the Netherlands, Sweden and the United Kingdom (UK) [13] revealed that all countries had recommendations for women with chronic conditions, but recommendations for women and men in general were inconsistent, suggesting the need for the development of standard European guidelines. In Canada, the Public Health Agency of Canada included one chapter dedicated to preconception health in the report- *Family-Centred Maternity and Newborn Care: National Guidelines* in 2000, and updated this in 2016 [14]. However there is no evidence if and how the recommendations have been implemented [15].

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In contrast, the USA has had a national strategic plan and guidelines on preconception health, released in 2006 [16]. With leadership and funding from the Centre for Disease Control (CDC), a public–private partnership called the Preconception Health and Health Care (PCHHC) Initiative, made up of federal agencies and private sector organizations was developed to support implementation of the recommendations outlined in the report [17]. There have been many achievements, including: the development of strategic plans, national summit meetings, increased federal funding for preconception health programs, the development of the PCHHC resource centre and the publication of multiple reports and articles [18]. Yet, despite clear progress achieved by the PCHHC initiative, there is evidence that further work is required, particularly in designing, implementing and evaluating preconception health approaches. Floyd et al. [19] note the need for: studies evaluating holistic preconception care and counseling, further research to address health disparities in preconception health and birth outcomes, and ongoing evaluation and monitoring of the PCHHC initiative [19].

Multiple systematic reviews have examined preconception care interventions and reported improvements in maternal and child outcomes [20,21], although some reported that effects were minimal or non-significant [22,23]. However, these reviews differ in research question and types of studies included, are narrow in scope, and tend to report a lack of methodologically robust evidence. In response, we conducted a scoping review of preconception care interventions to identify the breadth of current preconception health care interventions, and further understand how preconception health care can be improved. The purpose of this scoping review is to map current evidence on preconception health care interventions, and identify gaps and future research priorities. The research question is: What is the extent and nature of the published academic literature on preconception health interventions, including: how preconception health is being addressed (the type and format of interventions being used, which dimensions of preconception health are being addressed, and how are these dimensions of preconception health impacted), who interventions are aimed at, and in what settings?

Methods

We followed a scoping review methodology as presented by Arksey and O'Malley [24]. We searched for intervention studies on preconception health published between January 2005 and June 2016 in the following academic databases: Medline full text; CINAHL complete; Studies of Women and Gender Abstracts; Social Services Abstracts; Social Sciences Citation Index; Health and Psychosocial Instruments; The Cochrane Library; and the Native Health Database. We used the following search terms: preconception health, interconception health, family planning, reproductive health; and program, intervention, care, approach, guidelines, assessment, and tool. All peer-reviewed articles published in English which described or evaluated a preconception health intervention were included.

We excluded the broader literature describing the prevalence of preconception health risk factors. Literature reviews, policy papers and commentaries were also excluded, but are used to contextualize the rationale and discussion of findings. We did not exclude studies based on: study design, intervention type, outcomes measured, setting, or population (i.e. women, men and couples of all socio-demographics were included). Interventions delivered during pregnancy were excluded; however, retrospective studies that asked pregnant or postpartum women or their partners about the preconception care they received prior to pregnancy were included.

A total of 1326 search returns were imported into Endnote reference management software. Manual searching of the reference lists of key articles resulted in an additional 23 studies. Titles were read and screened by one researcher, and were organized into two Endnote databases: one with included studies and one with excluded studies. These Endnote databases were then checked by a second researcher to ensure relevant studies were not excluded. Following removal of duplicates and title screening, 235 studies were included. Abstract and full text screening was again conducted by one researcher, and checked by a second researcher, reducing the number of included studies to 57. If there was ambiguity regarding the eligibility of an article for inclusion, the research team discussed the study and made a decision regarding inclusion or exclusion. A total of 29 preconception health intervention studies were identified. A flow diagram detailing the number of studies included and excluded at each stage is provided in Fig. 1.

We then extracted data from the 29 included studies in Microsoft Excel, including information on: location and setting, study design, number of participants and characteristics, the preconception health factors addressed, methodology, the aim of the study, key findings, and study limitations. As is typical in scoping reviews, we did not quality assess included studies [25], but rather focused on identifying the current state and breadth of preconception intervention research, and identifying patterns and gaps to inform the development of recommendations for future research and interventions. The research team met to review, discuss and define the themes of the collected studies. Themes were chosen by grouping similar intervention studies, based on the: risk factors addressed, the population or type of intervention. The data extracted were then narratively summarized within this thematic outline.

Results

Studies are summarized within the following categories: interventions addressing multiple risk factors; interventions addressing dual risk factors; technology-assisted interventions; counselling for women/couples with pre-existing health conditions; group health education; community-based social marketing interventions; and interconception interventions. Details on the: study design, country and setting, preconception risk factors addressed, intervention approach, participants and key findings are presented in Table 1.

Interventions addressing multiple risk factors

Three interventions addressed multiple preconception health risks through risk assessment followed by advice or motivational interviewing (MI). These were all delivered in clinical settings, primarily in primary care clinics. The interventions ranged in intensity and duration, from brief advice [26] to more lengthy consultations and counseling [27,28].

Two of these studies evaluated behaviour change among women who received preconception care and subsequently conceived; both demonstrated improvements in at least one risk factor. One of these studies, conducted in Australia, evaluated a 45-min risk assessment delivered by a midwife. The advice was based on the US Centre for Disease Control (CDC) categories of preconception health, with tailored follow-up provided by an obstetrician [27]. Evaluation of this intervention revealed that pregnant women who received preconception care prior to conception were more likely to: supplement with folate, be vaccinated, consult with a specialist regarding any pre-existing health condition, report less weight gain prior to conception, and report fewer preterm births and hypertensive disorders. Yet women who received preconcep-

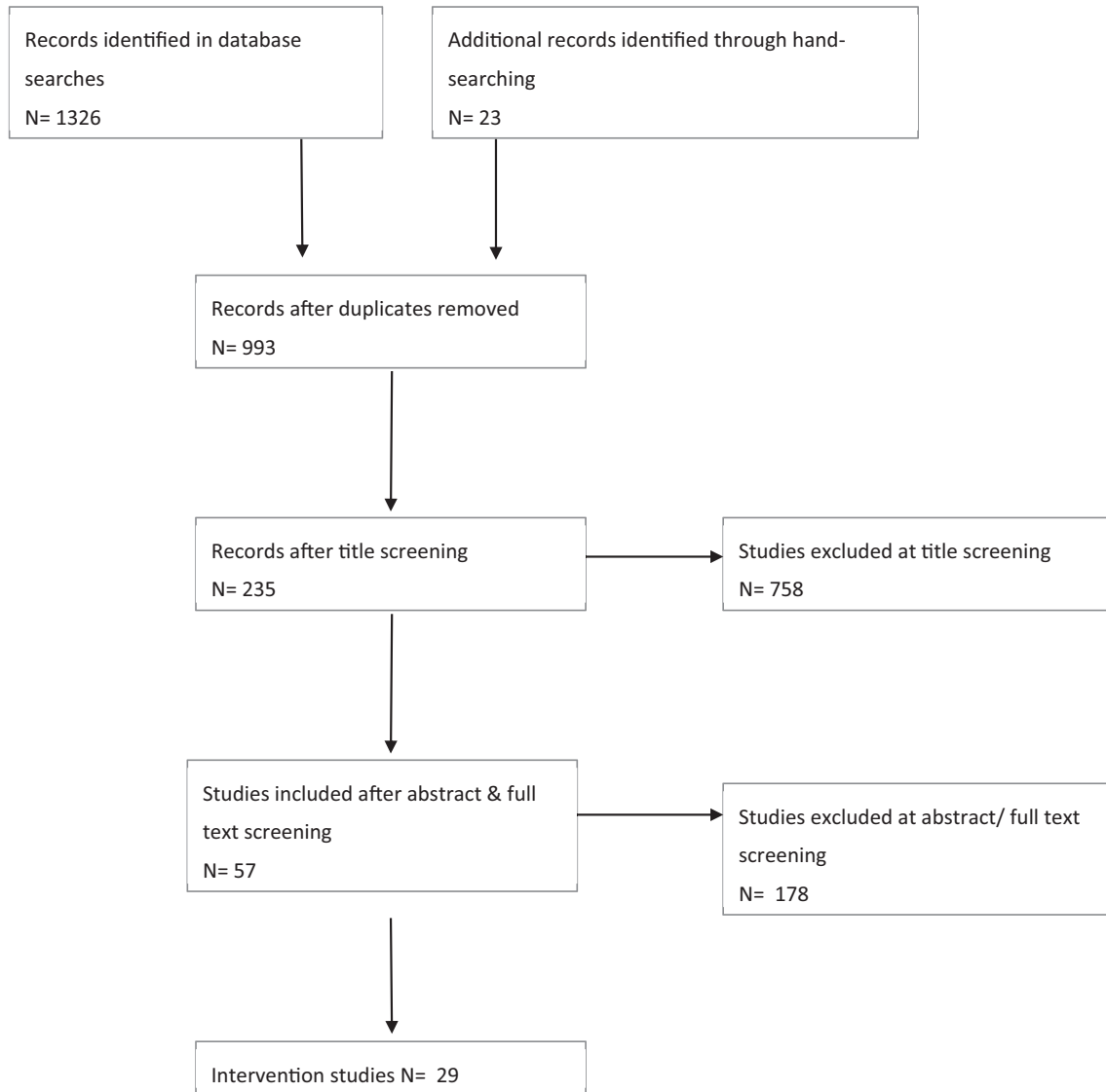


Fig. 1. Flow diagram for scoping review.

tion care reported no differences in smoking, or alcohol consumption in the preconception period. Similarly, in a study from the Netherlands, women's risk behaviours were measured following a screening and counseling intervention delivered in a family practice setting [28]. Intervention participants reported significant improvements in folic acid use, reduced alcohol use in the first 3 months of pregnancy, and lower adverse pregnancy outcomes (16% vs 20%) compared to women who received standard care. Finally, one study included African American women of reproductive age, but unlike the previously described studies was not limited to women who later conceived or who were trying to conceive. This study did not measure behaviour change, but reported improvements in women's knowledge of preconception health risks following a risk assessment and brief intervention [26].

Dual risk factor interventions

Five studies evaluated interventions to address both alcohol and contraception use to reduce alcohol exposed pregnancies (AEP). These interventions were all US-based and delivered to women of reproductive age identified as being at risk for an AEP, and included risk assessment followed by brief counseling/ motivational interviewing.

In a study involving a mail and telephone based brief MI intervention, women reported a significant decrease in risk for AEP (risky drinking and lack of/inadequate contraception use) between baseline and 6 month follow-up (100–68.8%) [29]. Another study, which examined the same intervention, found that a single session format was less effective than a multi-session intervention [30].

An evaluation of Project CHOICES, a 4-session intervention using MI, revealed significant improvements in reduced risk of AEP up to 9 months post-intervention [31]. Project CHOICES has also been delivered to American Indian women, revealing a decrease in the amount of alcohol consumed post-intervention (with average number of drinks on any one occasion decreasing from 6.8 to 3.4) and an increase in contraception use [32]. Finally, an evaluation of project CHOICES in six high risk settings found that 68.5% of women had a reduced risk of AEP at 6 month post-intervention (32.9% reduced drinking and used contraception, 12.5% reduced drinking only, and 23.1% used contraception only) [33].

Technology assisted interventions

Six technology assisted risk assessment and follow-up interventions were identified. Several US-based studies evaluated "Gabby",

Table 1
Description of included studies.

Author	Study type	Setting	Risk factors addressed	Study/intervention overview	Participants	Key findings
Agricola et al. 2014	Cohort study	Italy, clinic	Weight, smoking, alcohol, genetic diseases, chronic diseases, medication, vaccines, folic acid	Web-based knowledge & risk factor assessment and tailored recommendations. Post-assessment invite to follow-up with GP or OB/GYN	Women of reproductive age (18–44 years) planning a pregnancy in the next year. Total n = 508, completers n = 282	Decrease in alcohol consumption; increase in folic acid; improved knowledge regarding preconception care (PCC) behaviours
Beckman et al. 2014	Case control study	Australia, hospital	Folic acid, vaccines, healthy eating, exercise, smoking, alcohol	Assessed risk factors in women who received 45 min PCC consult with midwife and follow-up with OB/GYN with women who did not	n = 56 women who had conceived and reported planning their pregnancy	Women who received PCC were more likely to: use folic acid, be vaccinated, consult with specialist regarding pre-existing health condition. No differences in smoking or alcohol use
Chaarafedine et al. 2014	Before and after	Lebanon, school based	Weight; infectious diseases, chronic conditions, smoking, alcohol and recreational drug use	Assessed preconception health awareness among adolescents and tested the effectiveness of a 20 min one-time preconception health educational session	n = 7, 290 high school students in grades 10 to 12 (18.9% of participants were male)	Mean knowledge of preconception health increased. Female students scored significantly higher than males at post-test. Grade 12 students scored significantly higher than lower grade students
Dejoy 2014	Pilot study, before and after	USA, college setting	Safe sex, HIV, STDs, reproductive planning	Pilot-tested a multi-week health education program for college women. 6 hours of education over 4 weeks in interactive, participant-led format	n = 26 college women; n = 20 completers	Increase in knowledge of preconception health and perceived importance. No significant change in preconception health behaviours
Delrahim Howlett et al. 2011	RCT	USA, clinic setting	Alcohol	Tested the effectiveness of a web-based alcohol assessment and intervention. Women received either personalized feedback intervention or general health information regarding alcohol and FASD risk	n = 150 low-income, non-pregnant women of reproductive age engaged in risky drinking (intervention n = 75; control n = 75)	Overall reduction in the number of risky drinking occasions, but no difference between treatment and control
Dixon-Gray et al. 2013	Non-experimental; social marketing project	USA, radio, social media	Multiple risks based on CDC preconception health indicators	A radionovela, Amor y Salud, featuring a Latina and her fiance' preparing for marriage and family (and addressing preconception health concepts) was aired for 12 weeks	Young Latinas (18–29 years old) born in the United States of immigrant parents in five Oregon counties, and their family members	Facebook page viewed 11,000 times; radionovela episodes played 776 times. Positive comments from community members and local media; however, no conclusive evaluation regarding knowledge or behaviour changes
Delgado 2008	Cross-sectional	USA, college	Multiple risks: substance use, STDs, folic acid, prenatal develop., pregnancy spacing	Assessed undergraduate students understanding of preconception health and gender differences, and differences for those who had studied information on pregnancy or child development vs. not	n = 241 undergrad students (n = 137 females; n = 104 males)	Students who had taken a course with information on pregnancy and/or child development scored higher on preconception health knowledge
Elsinga et al. 2008	RCT	Holland, clinic	Substance use, smoking, nutrition, exercise, disease	Risk assessment and personalized counselling by a GP, compared to standard care. Assessed knowledge on risk factors and behaviour change	Women aged 18–40 who were planning a pregnancy in one year (intervention n = 211, control n = 422)	Intervention = increased preconception health knowledge, increased folic acid and decreased alcohol use
Farrell Carnahan 2013	Prospective pilot intervention study	USA, community setting	Alcohol	Feasibility of a one-session, remote-delivered, preconception, motivational interviewing-based intervention to prevent alcohol exposed pregnancy (AEP)	n = 46 women of reproductive age at risk for AEP who were not trying to get pregnant	Feasible; participants were engaged and rated it as credible. Risky drinking and rate of unreliable contraception decreased significantly over time
Fischl et al. 2010	RCT	USA, clinic	Diabetes and reproductive health risks	Evaluated the impact of a nurse-delivered preconception counseling program tailored for teens with type 1 diabetes on cognitive, psychosocial, and behavioral outcomes	n = 88 teen girls with type 1 diabetes (intervention n = 43; control n = 45)	Significant improvements in perceived benefit and knowledge of PCC content and reproductive health
Floyd et al. 2007	RCT	USA, six diverse settings	Alcohol	Project CHOICES: 4 counselling sessions with personalized feedback and goal setting to prevent AEP. Control received written information on alcohol and women's health	n = 593 completers; women of reproductive age, not planning pregnancy, engaged in risky drinking (intervention n = 291; control n = 302)	Reduced risk of AEP in intervention group
Gardiner et al. 2013	Pilot test, before and after	USA, delivered in a hospital and university	Multiple risks	Development and testing of a web-based, virtual-agent delivered risk assessment and PCC advice	n = 31 young women aged 15–22 years, African American, non-pregnant	Majority of risks identified by participants were addressed/enacted on

Table 1 (continued)

Author	Study type	Setting	Risk factors addressed	Study/intervention overview	Participants	Key findings
Hammiche et al. 2011	Before and after	Holland, fertility clinic	Diet, folic acid, substance use, physical activity	Evaluated impact of tailored preconception counselling on preconception health risks.	n = 110 couples trying to get pregnant, majority subfertile (93.8%)	Improved nutrition, decreased alcohol use, increased folic acid, increased physical activity
Gordon et al. 2010	Before and after	USA, community	Obesity, nutrition and physical activity	Tested a peer education PCC intervention for obese adolescents	n = 267 adolescents	Increased awareness about obesity and preconception health. Increased self-esteem
Gough et al. 2015	Before and after	Northern Ireland, clinic	Diabetes	Educational DVD on diabetes and preconception health delivered to women with diabetes	n = 97 women with diabetes	Increased knowledge regarding preconception care; high acceptability
Handler et al. 2013	Longitudinal, multi-methods	USA, varied (health centres)	Based on individual interconception care needs	Evaluation of a pilot interconception care program (ICCP); nurse-led case management	n = 220 low-income African-American women with a prior adverse pregnancy outcome	Majority of women developed a reproductive health goal. Women's socioeconomic needs were perceived as more pressing
Hanson et al. 2013	Before and after	USA, remote (via telephone and mail)	Alcohol	Project CHOICES, a 4 session MI-based telephone-delivered intervention to prevent AEP	n = 231 non-pregnant American Indian women. Excluded if trying to conceive	Significant reduction in risky drinking
Homan & Norman 2012	Prospective cohort pilot study	Australia, fertility clinic	Exercise, diet, caffeine, alcohol, smoking, stress	Comprehensive risk assessment and personalized counselling, using MI-techniques. One in-person (60 min) session with follow-up telephone counselling	n = 23 infertile couples, planning a pregnancy	Reductions in alcohol and caffeine use by women and men
Hussaini et al. 2013	Before and after	USA, community	Substance use, vaccines, folic acid, genetics, chronic disease, STIs, maternity care, nutrition, exercise, stress	Evaluation of a preconception social marketing campaign including radio, billboards, community presentations, grand rounds	African American men (n = 24) and women (n = 27) aged 18–30 years	Increased perception of health risks and benefits. Greater effect for women than men
Ingersoll et al. 2013	Before and after	USA	Alcohol	Tested a one-session motivational interviewing AEP- prevention intervention for community women	n = 217 women at risk for AEP	Reduction in AEP risk; one session less effective than multiple sessions
Jack et al. 2015	RCT	USA, online	Multiple risks	Developed and tested "Gabby," an online preconception conversational agent system.	n = 100 never-pregnant African American women age 18–34 (intervention n = 36; control n = 41)	Greater reduction in number of risks in the intervention compared to the control. Rated positively, as "easy to talk to" by participants
Mittal et al. 2014	Before and after	USA, primary care clinics	Multiple risk factors, focusing on the chronic disease of the patient	Tested the use of a reproductive life plan developed with/ delivered by physicians, to improve preconception health knowledge in women with chronic diseases	n = 27 women of reproductive age (age 18–40) with obesity, diabetes or hypertension	Increase in knowledge of risks and social support
Mitchell et al. 2012	Cross-sectional	USA, secondary analysis of survey data	Multiple risks, access to PCC	Secondary analysis of survey data to understand awareness, planning, and conversations around PCH	n = 2736 women and men of reproductive age	Women more aware of preconception health risks and reported more PCC conversations than men
Ren et al. 2014	RCT	USA, web-based	Multiple risks (Gabby intervention)	Examined which health issues women are willing to discuss with a virtual agent	Reports on the n = 42 African American women of reproductive age randomized to the intervention group	Women discussed 6.3 of 23.2 health risks; reported feeling comfortable and willing to discuss risks with the virtual agent
Richards & Mousseau 2012	Before and after	USA, community based	Multiple risk factors- alcohol, obesity, diet	Examined the effectiveness of a preconception health educational intervention (15 sessions) for American Indian high school students	American Indian North Plains girls (age 11–14 years) not planning a pregnancy; intervention (n = 39) and non-intervention (n = 38)	Significantly greater preconception health knowledge and obesity knowledge in intervention group
Schiavo et al. 2011	Before and after	USA, college based	Stress, African American health disparities, preconception health (substance use, exercise, nutrition, folic acid, weight, chronic disease, medications)	Preliminary evaluation of the preconception peer educator (PPE) program for African American women	n = 156 students trained in PPE program (93.6% female)	Improvements in preconception health knowledge; program deemed acceptable

Table 1 (continued)

Author	Study type	Setting	Risk factors addressed	Study/intervention overview	Participants	Key findings
Tenkku et al. 2011	Before and after	USA, community based	Alcohol	Evaluated a web-based, self-guided change intervention designed to address risk for AEPs in a community sample of women. Compared a mail-based and web-based version.	n = 458 women, between the ages of 18 and 44 years and at risk for an AEP	Reduction in AEP risk; women in both groups quit drinking.
Wade et al. 2012	Before and after	USA, college	Chronic and genetic conditions, medications, substance abuse, folic acid, obesity, STDs, vaccines, and social determinants of health including domestic violence	Pilot peer education preconception health program for college women	n = 53 college women in a sophomore health promotion nursing course	Increased knowledge and awareness of preconception health
Velasquez et al. 2013	Review of project outcomes, including before and after testing in 6 sites	USA-six diverse high-risk settings	Alcohol	Project CHOICES, a 4 session MI-based intervention to prevent alcohol exposed pregnancy	n = 190 women of childbearing age (18–44) engaged in risky drinking	Reduction in AEP risk

an online interactive animated character that assesses individual women's preconception health risks and then engages women over one year on how to address and reduce identified risks [34]. Following the initial survey, women can choose the content of each session, with recommended engagement of one weekly session for one year. Initial testing with African American women has revealed that women are willing to share and discuss a range of health risks with Gabby, including topics that are often associated with a high degree of stigma such as drug abuse and domestic violence [34]. African American women who participated in the Gabby intervention reported a greater reduction in both the number (8.3 vs. 5.5 risks, $p < 0.05$) and proportion (27.8% vs 20.5%, $p < 0.01$) of risks compared to the control group [35]. The majority of participants (78%) reported finding it "easy to talk to Gabby" and reported using information from the Gabby intervention to improve their health (64%). In a small pilot of the Gabby intervention with non-pregnant African American women, 83% of the identified risks were addressed by participants, and 73% of the risks identified as "contemplative" advanced to the "action" or "maintenance" stages [36].

Another example of a technology-assisted intervention is an Italian web-based intervention tailored to address women's knowledge and risk behaviours [37]. Based on data on women's health status, lifestyles and knowledge of risk factors, a tailored set of information and recommendations was generated that addressed: folic acid supplementation, weight/ obesity, smoking, alcohol use, vaccinations, chronic disease, genetic risks, and medication use. The authors reported a reduction in alcohol consumption, increased folic acid supplementation, and increased knowledge of preconception behaviours at 6 month follow-up.

Two US studies evaluated web-based interventions, comparing tailored versus general advice, and web versus mail formats. A brief web-based intervention to address alcohol use in the preconception period provided either generalized or tailored health information regarding alcohol use and fetal alcohol syndrome following a web-based assessment [38]. They observed no difference between treatment conditions, but reported a decrease in risky drinking overall (among 70% of participants), suggesting that assessment alone may serve as an intervention. Comparison of a web-based versus mail-delivered intervention using MI for women at risk of AEP [39], which consisted of four self-paced modules along with tailored messaging based on a pre-intervention assessment, revealed no significant difference in quit rates between the mail (22%) and web-based groups (23.1%). At four-month follow-up, 58% of women who participated in the intervention were no longer at risk for an AEP.

Counselling for women/couples with pre-existing health conditions

Women with chronic conditions

Three studies evaluated counseling interventions for women with pre-existing chronic conditions, which integrated advice into health visits related to the chronic condition. A US study evaluated the use of a reproductive life plan to support preconception health awareness in women with chronic diseases. Following assessment, women met with their family doctor to develop a reproductive life plan, which focused on how their chronic condition may impact pregnancy and birth outcomes [7]. They reported significant increases in knowledge of pregnancy risks and reproductive planning.

A brief individual preconception counseling program (READY-Girls) for teen girls with diabetes reported significant improvements in perceived benefit and knowledge of preconception counseling content and reproductive health at 9-months follow-up [40]. In a UK study, focus groups were held with women and health care providers to inform the development of a preconception counseling

resource, using a DVD and website format to educate women with diabetes regarding the need to plan for pregnancy and prevent poor health outcomes [41]. Women who viewed the resource reported feeling better prepared for pregnancy. However, they found that women with type 2 diabetes were difficult to reach, which inspired the development of an e-learning continuing education module to support all providers who intervene with women with diabetes to provide preconception counseling at each appointment.

Couples with fertility issues

Two studies evaluated risk assessment and counseling for couples experiencing fertility issues. These are the only primary studies included in the review that measured men's behaviours following an intervention. An Australian study examined an assessment and MI intervention for couples seeking fertility treatment [42]. Risk factors addressed included: physical activity, diet, caffeine, alcohol, smoking and stress. Couples received ongoing telephone support following face to face counseling. At follow-up, half of all women had stopped drinking alcohol, and all but one of the men reduced alcohol and caffeine consumption to the recommended national guidelines. A study from the Netherlands examined a lifestyle counseling intervention delivered to couples in a fertility clinic setting. Following two counseling sessions tailored to address the risks identified during a preconception health assessment, they reported an increase in fruit and fish intake and a decrease in alcohol use among both women and men; and an increase in physical activity and folic acid use among women [43]. However, the authors note that this sample was particularly motivated due to an interest in conception.

Group health education

Six studies evaluated group health education programming. These interventions were delivered in college and high school settings, and ranged in intensity from a single session to a full term course. In general, these interventions reported improvements in knowledge, but did not measure or demonstrate effectiveness in shifting risk behaviours.

Four interventions were delivered in US colleges. In a four week interactive group educational intervention on reproductive health and family planning and HIV and STIs prevention, women reported increased knowledge and interest in preconception health, but no significant difference in health behaviours [44]. Evaluation of a college course on preconception health delivered to women and men revealed low knowledge of preconception health messages prior to the course (13%), which increased following the course (the majority reported awareness of positive factors (89%) and negative factors (93%) affecting pregnancy) [45,46]. In addition, two pilot studies demonstrated improvements in preconception health knowledge [47] and acceptability of an education intervention [48] for female college students.

Two interventions were delivered to high school students. A single session preconception health education intervention in Lebanon addressed weight, diseases and chronic conditions, smoking and substance use, and was associated with increased preconception health knowledge, particularly among females (although only 18.9% of the sample was male) [49]. A community-based group health education intervention, developed to be culturally appropriate for American Indian high school girls, reported significant improvements in preconception health knowledge overall, and in obesity and diabetes knowledge specifically, but no significant change in alcohol or smoking related knowledge [50].

Community-based social marketing interventions

Three studies described or evaluated community-based social marketing interventions. These studies did not measure behaviour

change, but reported changes in knowledge of preconception health behaviours.

Two studies evaluated social marketing interventions for youth. Following *Amor y Salud*, a radionovela developed to introduce a range of preconception health information to Latina girls in the US, the community sample reported high levels of viewer-ship and positive feedback [51]. *Healthy From Birth For Life*, a youth driven social marketing campaign in which adolescents at risk of poor birth outcomes due to obesity and diabetes led community education on preconception risks [52], revealed increased knowledge, and improved self-esteem among participants.

A preconception social marketing campaign targeting African American women and men in the USA included radio and billboard advertisements, community presentations, presentations for health professionals and training of barbers and beauticians regarding preconception care [53]. One-third of participants interviewed recalled seeing campaign materials, and of these, most reported sharing information with family or friends. The campaign appeared to be more effective for women, with female participants in both the community presentations and presentations for health professionals reporting greater preconception health knowledge.

Interconception interventions

The evidence on interconception interventions (offered between pregnancies) is limited to one pilot study which evaluated a case management intervention for low-income African American women with a prior adverse pregnancy outcome [54]. A case management team coordinated a range of services for women, including: social services, family planning and medical care. They reported an increase in women's reproductive health goals (66% vs 55%), but the authors noted that women prioritized efforts to improve their socioeconomic status.

Discussion

There has been progress in intervening on preconception health. The majority of interventions offered assessment or screening followed by brief intervention or counselling. In general, these interventions have demonstrated improvements in some of the outcomes measured. Technology assisted risk assessment interventions reach a wide range of women and men and offer privacy when disclosing risk behaviours. The "Gabby" intervention has been identified as a promising approach by the CDC [55]. Further development, implementation and evaluation of the use of social media, mobile phone apps and other innovative technology based formats for delivering preconception care is warranted.

Most of the interventions included women who were either planning to become pregnant, or who were identified as "at risk" of poor maternal or child health outcomes, including: ethnic minority women, women at risk of AEP, or women with pre-existing chronic diseases. While only one interconception intervention was identified, it also focused on women identified as high risk (African American women with a previous adverse birth outcome). However, rather than creating a new service or silo for preconception care [12], risk assessment, preconception and interconception advice should be provided to all women and men, and not just those identified as being at-risk.

Including partners in preconception care is a priority identified by the CDC preconception health care initiative in the USA, but relatively few interventions specifically for (male or female) partners are reported in the academic literature. In our review, the only interventions that included men were those delivered to couples in fertility clinic settings, and health education and awareness-raising interventions. Evaluation of broad preconception approaches are needed that engage men in family planning,

improve men's health and the health of their partner, and prepare men for parenting [11]. Addressing men's preconception health has the potential to improve: reproductive health for men and their partner/s, sperm health, partner support in the event of a pregnancy, education on reproductive planning/ pregnancy intention, and overall wellness [12].

Preconception care for women, men and couples with chronic diseases is another important area of intervention development and research. Focus groups held with non-pregnant women with chronic health conditions, including obesity, diabetes and hypertension, revealed that women were often not aware of pregnancy related risks and were not intending to engage in preconception health promotion [56]. Similarly, in a US study with pregnant women with type 2 diabetes who had delivered between 2002 and 2010, only a small minority of women (4%) reported receiving preconception care [57]. However, the limited amount of evidence we identified for this sub-group suggests that preconception health interventions may improve knowledge of risks and reproductive life planning. Given that women and men with chronic diseases interface more often with the health-care system, health care providers should be trained to regularly engage with these patients regarding preconception health.

Overall, interventions tend to be clinical and focus on individual level behaviour change (i.e. counselling women not to engage in risk behaviours) rather than examining social, structural and environmental factors that shape preconception health. Calls have been made for integrating a life-course approach to preconception health, recognizing health as a continuum from birth through to pregnancy and delivery, and how the accumulation of risks and social determinants impact health [58,59]. This is echoed in the most recent strategic plan released by the CDC, which (under goal 2) notes the need "to create health equity and eliminate disparities in adverse maternal, fetal, and infant outcomes" [60].

The promise of preconception care is that it avoids gender-exploitative prenatal health promotion that focus narrowly on fetal health and shaming women about the impact of their actions on the health of the fetus or child [61]. Prenatal messages that focus on women's individual responsibility to ensure fetal health have the potential to stigmatize women who are burdened with multiple forms of disadvantage and who may lack the support and resources to make changes during pregnancy [62]. To avoid the perpetuation of gender based inequities, future research, program development and policy-making should be mindful of these issues and concerns. Indeed, preconception care interventions, policies and initiatives would benefit greatly from utilizing gender transformative principles that address and challenge harmful gender norms and stereotypes and promote health *and* equity among all women, girls, men and boys, within the same interventions [62]. In this context, gender transformative approaches would question existing roles and attitudes, and widen the options for reproduction, contraception and parenting for both women and men.

Conclusion

Preconception health care has the potential for substantial public health benefit given the large number of unplanned pregnancies, the gap between conception and pregnancy confirmation where health can be compromised, and the continuity of health risks before and beyond pregnancy. While the interventions reviewed report positive improvements in some risk factors, or increased knowledge of preconception care, there is appreciable room for further research and intervention development to expand the health benefits to all women and men. Specifically, additional research is required to understand: how service systems can support the provision of preconception care and the integration of

gender transformative principles; what interventions are effective for training and engaging providers to deliver preconception care; women and men's preferences for preconception care (health issues/ topics, and provision of care); the effectiveness of virtual assessment and technology assisted interventions; how best to deliver interconception care; how to engage partners/men in preconception care; and how preconception care can be empowering for, and inclusive of, all women, men, girls and boys.

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