



Addressing reproductive health needs across the life course: an integrated, community-based model combining contraception and preconception care

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Prevention of pregnancy (contraception) and preparation for pregnancy (preconception care) are services that most people need during their reproductive life course. Despite increased attention, and growing recognition that health before pregnancy is crucial to addressing disparities in maternity outcomes, service provision is far from routine. We bring together evidence from the literature, new quantitative and qualitative data on women's preferences, and case studies of existing practice, to develop an integrated, community-based model that synthesises reproductive life planning, contraception, and preconception care. Our model provides a holistic, life course approach, encompassing school-based education, social media, and national campaigns, and highlights the need for training and system-level support for the range of health-care professionals who can deliver it. This high-level model can be adapted across settings, leading to a step change in the provision of preconception care in the community with consequent improvements in health and wellbeing, and reductions in inequalities at population level.

Introduction

Preparation for a healthy pregnancy, through preconception care and the prevention of unplanned pregnancies has attracted academic and policy attention in recent years¹⁻⁴ but still falls far short of being provided routinely. The aim of preconception care is to intervene before pregnancy to improve short-term and long-term health and wellbeing outcomes for people of reproductive age, and for any future children they might have. Previous studies have found evidence for a range of preconception exposures on fertility, including physical health, mental health, social and psychological wellbeing, and how they increase risk of adverse outcomes such as pre-eclampsia, gestational diabetes, and infant admission to hospital for injury.⁵⁻⁷ However, pregnancy planning and preparation remains more of a concept than a reality. This could be due to two key policy challenges in promoting preconception health: the whole of reproductive life is a very wide time window; and interventions to support preconception health can be hard to distinguish from broader public health goals around healthy lifestyles.⁸ Yet 90% of women of reproductive age have at least one modifiable risk factor that can affect pregnancy,³ making preconception health an important factor in maternal deaths and inequalities in maternal outcomes,^{9,10} as identified by the UK Government's Maternity Disparities Taskforce.¹¹

The *Lancet* Series on preconception health was published in 2018,^{2,12,13} at the same time that Public Health England produced a suite of resources making the case for preconception care.¹ These reports and resources emphasised the need to address inequalities and upgrade prevention efforts through embedding universal (ie, population-level) and targeted (ie, individual-level) preconception care in a life course framework. WHO recommends action for preconception care by leveraging existing public health programmes, including community-based health care, and by exploring

innovative channels.¹⁴ Community-based health care covers primary care services, including all health-care professionals in general practice and in sexual and reproductive health services, midwives, health visitors, and community pharmacies. Innovative channels covers digital interventions, school-based education, and social media campaigns that do not rely on contact with health services. We build on these resources by summarising the evidence for components of effective and acceptable preconception and interconception care interventions, and by considering opportunities for integration of these interventions in community-based care. In taking a life course perspective we highlight the need to consider pregnancy prevention and preparation simultaneously,¹⁵ and develop an adaptable community-based model that bridges the gap between contraception and preconception care using available opportunities across the life course, so that a more integrated approach to address reproductive health needs can be embedded within existing services.

Development of a community-based model combining contraception and preconception care

Overview of our approach

We took a mixed-methods approach, including reviewing the literature, incorporating the findings of a parallel review on interconception care,¹⁶ analysis of existing survey data, reviewing case studies of current practice, and discussion with women of reproductive age, to collate and synthesise the evidence. Further details on the methods are provided in the appendix (pp 2–3).

In the absence of an existing model, the findings from these workstreams were then integrated to develop a model of universal community-based preconception care, including contraception, and consider its application. We based the initial model of preconception intervention around the recommendations of de Weerd

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See Online for appendix

and colleagues,¹⁷ that an ideal preconception visit should include risk identification, education, and intervention, as required, building on a previous model of preconception care delivery through attendance at primary care.¹⁸ Given the more extensive evidence base on the provision of contraception service, our model concentrates on illuminating the components of effective preconception care. We first drew on the consistencies identified by the studies found in the scoping review (appendix pp 4–11) to populate the three components of a preconception intervention. We identified themes based on setting and method of delivery, and considered feasibility, acceptability, and cost-effectiveness where available. Second, we incorporated reproductive health-care needs across the life course,¹⁹ bringing pregnancy prevention and pregnancy preparation together,¹⁵ clarifying the need for an entry point to the model to determine needs at that point in time. Recognising that most people will need both contraception and preconception advice across their reproductive life course, and at times might be undecided or ambivalent about conception, and in line with the desire expressed by women in the online discussion for tailored follow-up advice, we therefore included contraception services in our model. Based on preferences from the data analysis, we discussed entry points with women through online discussions, which, in combination with the literature on reproductive life planning, were used to determine how and when individuals could be approached, and in what way. Third, we included all possible points of contact, either within primary care or outside the health service, per WHO recommendations,¹⁴ and in line with women's preferences from the data analysis and online discussions. We incorporated the increasing availability and use of digital health interventions and social media to raise awareness among the public and health-care professionals. Finally, we highlighted the range of health-care professionals who could be involved based on the literature, women's preferences, case studies, and Making Every Contact Count.²⁰

Existing evidence for community-based models of preconception care

Our search found no universal model of integrated community-based preconception care; therefore, we explored studies on targeted community-based models or standalone preconception services, highlighting relevant features. We found 52 studies, of which half were in the USA ($n=26$), 20 were in Europe, four of which in the UK, and two were in Australia. Full details on the search can be found in the appendix (p 4) as can the studies included in the review (appendix pp 5–11). We summarised studies into the themes related to intervention, delivery method, or setting. The seven themes were: technology-assisted interventions; clinic-based counselling; motivational interviewing; education; campaigns and social media-based interventions; provision of supplements; and

interconception interventions. Only four studies provided information relating to costs, cost saving, or comparison of cost with potential adverse outcomes reported.

Technology-assisted interventions

We identified 19 studies of 15 technology-assisted interventions, ranging from educational videos to conversational agents, based in the UK, the USA, the Netherlands, and Italy.^{21–39} These studies largely used web-based methods to assess baseline risk factors and aimed to provide tailored information to participants. Women were followed up for behaviour changes such as folic acid uptake, alcohol consumption, smoking, nutrition, and engagement with health-care providers. Two studies found increased engagement with health-care providers after tailored web-based intervention within a 6-month period.^{21,22} Gabby, an online conversational agent that identifies individual risk factors, assesses degree of progress and readiness to change, and subsequently provides counselling, showed effectiveness in changing African American women's behaviours.^{30,31} Changes in behaviours were also observed in web-based interventions that contained non-tailored, generic preconception health information.^{25,29–31} The majority of users appear to have a positive attitude to, and greater compliance with, web-based provision, enjoying its usability and demonstrating its feasibility.^{25,30,31,37,38} Generally, studies with a longer period of intervention or frequent interventions, or both, found greater maintenance of effects, and a greater effect was seen in couples who participated together.³⁸

Clinic-based counselling

We found eight studies of six community clinic-based interventions in Hungary,^{40,41} Sweden,⁴² the Netherlands,⁴³ the UK,^{32,33} and the USA.^{44,45} In Hungary, a standalone preconception service was established in primary care across 32 centres, and showed improvements in health behaviours and in fetal outcomes, including reduction in preterm births and congenital abnormalities seen at 10-year and 27-year evaluation; however, secular effects cannot be ruled out.^{40,41}

In the UK, a community-based integrated model for women with diabetes who were planning pregnancy was shown to be feasible and to improve glycaemic control and folic acid uptake, and reduce fetal congenital abnormalities and stillbirths.^{32,33} Randomised control trials delivering aspects of preconception care to controlled populations in primary care clinics in the USA and the Netherlands showed reduced alcohol intake and reduced smoking, increased folic acid consumption,^{43,44} and a lower—although non-significant—percentage of adverse pregnancy outcomes.⁴³

Opportunistic preconception care counselling was investigated at family planning clinics in Sweden and the USA, resulting in greater likelihood of planning pregnancies.^{42,45} Although diverse, these studies show

that clinic-based intervention, whether opportunistic or standardised, can be effective.

Motivational interviewing

Five studies focused on reducing the risk of alcohol-exposed pregnancies through motivational interviewing, all based in the USA.^{26,28,46–49} Overall, motivational interviewing was shown to be effective at creating substantial reductions in alcohol drinking and increased effective contraception use with effects sustained at 9-month follow-up. Motivational interviewing was found to be effective in demographic groups that included college students, minority ethnic, and lower socioeconomic statuses.^{26,28,46,47}

Education

Education about preconception care was explored in eight studies, one each in the UK and the Netherlands, and six in the USA.^{23,24,39,50–54} The UK study focused on education for women with diabetes, through leaflets, local and regional educational events, and education and support to health-care professionals, which showed greater folic acid uptake, improved glycaemic control, and overall higher levels of optimal pregnancy.³⁹ In the Netherlands, a similar dual approach of a local campaign, to raise awareness in couples wishing to conceive, and simultaneous development of a preconception care pathway for health-care providers showed a substantial reduction in alcohol consumption and non-significant improvements in other behaviours.⁵⁰ One-to-one and small group sessions have both been shown to be an effective method for education and counselling, with long-term sustained behavioural changes, including during the interconception period.^{23,24,51–54}

Campaigns and social media-based interventions

Local and national campaigns to raise awareness of preconception health have been explored in 13 studies based in countries including the Netherlands, Australia, the USA, Norway, Belgium, Germany, and Denmark.^{50,55–66} Campaign delivery via posters, flyers, billboards, and social media feeds such as Twitter, news items, magazines, and television spots have been conducted. Generally, television spots were found to be the least effective.⁵⁵ One-off national campaigns showed positive behavioural changes, although most campaigns were evaluated shortly after their implementation.^{56,58–62,66} Although the national campaign in the Netherlands remained effective for promotion of folic acid at 10 years, studies consistently found a large and growing gap in uptake between women of different socioeconomic statuses, as measured through the proxy of low, middle and high education level.^{58–62}

Provision of supplements

Although focused on a narrow part of preconception health, brief counselling and supplement provision

resulted in greater uptake than supplement provision alone at up to 12 months in the USA,^{35,67–70} as did computer-assisted counselling software.³⁵ In the Netherlands, folic acid use was also increased where information was given on collection of oral contraception from a pharmacy.⁷¹ In some studies, effectiveness was limited by poor engagement by health-care professionals, highlighting the challenge of adding additional responsibilities to already over-burdened staff.⁶⁸

Interconception interventions

Effective interconception interventions included risk assessments that lead to tailored care, and multiple intervention and education components, such as counselling, multivitamin supplementation, peer support groups, contraception support, mental health support, and substance support.¹⁶ Outcomes including post-partum weight retention and glycaemic control after gestational diabetes are potential proxy measures for health in any future pregnancies, and post-partum interventions that address these risk factors show promise. One review of interventions in the post-partum period found that interventions using a synchronised diet and physical activity approach were most likely to result in weight reduction in mothers. The review also found that higher health literacy, use of behaviour change strategies, and digital interventions were associated with effectiveness.¹⁶

Cost-effectiveness

Around 45% of pregnancies in the UK are unplanned,⁷² costing the National Health Service £193.2 million in 2010.⁷³ Formal cost-effectiveness data are scarce, but preconception care is likely to be highly cost-effective by reducing adverse outcomes that carry a high financial burden, including preterm births, congenital abnormalities, and extended maternal and neonatal admissions. One costed preconception care model for women with diabetes in the UK estimated the cost of providing care at £49 476 per annum,³⁹ another study estimated savings of £68 000.^{32,33} These figures can be contrasted with the cost of managing one neural tube defect of £666 098.³⁹ Preconception care has also been shown to be cost-effective in the USA, where preventing 0.6 unplanned pregnancies offset the cost of the READY-Girls programme,²³ and reduced hospital stays resulted in cost savings of US\$34 000 per annum,⁵³ and in South Australia, where a AU\$40 000 programme showed substantial uptake of folic acid and reduction in neural tube defects.⁵⁵

Women's preferences

In quantitative data from the P3 Study (n=994; appendix pp 12–14), most women (80%) wanted to be asked about their pregnancy preferences online and receive links to online advice based on their answers. The next most popular preference was to be asked online and then

For more on the P3 Study see <https://p3-study-ucl.co.uk>

discuss with a health professional, followed by being asked in person. A small number (<1%) said they did not want to be asked. Preferences did not differ by age, ethnicity, or number of previous pregnancies. However, both younger women and those who had not been pregnant before more frequently selected options involving in-person advice. A large proportion of women (39%) expressed no preference regarding which health professional they spoke to. When a health professional was specified, general practitioner was most popular, followed by a doctor or nurse at a sexual and reproductive health clinic. Less than 1% did not feel that they needed to be asked by anyone. Younger women and those who had never been pregnant before were more likely to declare a preference for the sexual and reproductive health clinic. Women who had been pregnant before were more likely to suggest both midwives and health visitors. Preferences are likely to reflect patterns of health care use and familiarity. More detail is shown in the appendix (pp 12–14). These findings are in line with those of the SOPHIE study.⁷⁴

Among 12 women who participated in online discussions, 11 had been pregnant before, several were currently pregnant, and two had at least one child. Women were mostly aged in their 20s and 30s, were a mixture of ethnicities, and were from across the UK. Women were open to discussions about future pregnancies with health-care professionals, under certain conditions. These conditions included to have a clear rationale for asking, assumptions not being made based on age or marital status, to have a good rapport with the health professional, privacy, and the provision of tailored follow-up advice.

Various entry points were considered acceptable; namely, posters or leaflets in a variety of settings (health care and non-health care), or a women's health information pack that included information on general health issues and other health promotion information as well as contraception and preconception health. Women found it more acceptable if they did not feel personally targeted, but saw it as information that should be available for everyone of reproductive age. They felt that this accessibility would normalise the topic, trigger conversations both internally to the person (and the couple) and externally (with friends and health-care professionals) and would help shift the focus from pregnancy being the woman's sole responsibility.

In the discussions there were clear examples of missed opportunities. Women talked about having their coil taken out with no mention of folic acid or being given no advice on what to expect next when trying to become pregnant after miscarriage. Although most women had not considered seeing their general practitioner for preconception advice, one had and was met with the response that “[the general practitioner] had never been asked for advice on how to plan pregnancy before”. As

another woman said, “You're either on contraception or you're pregnant, and that middle step is missing” highlighting the gap between services.

Case studies

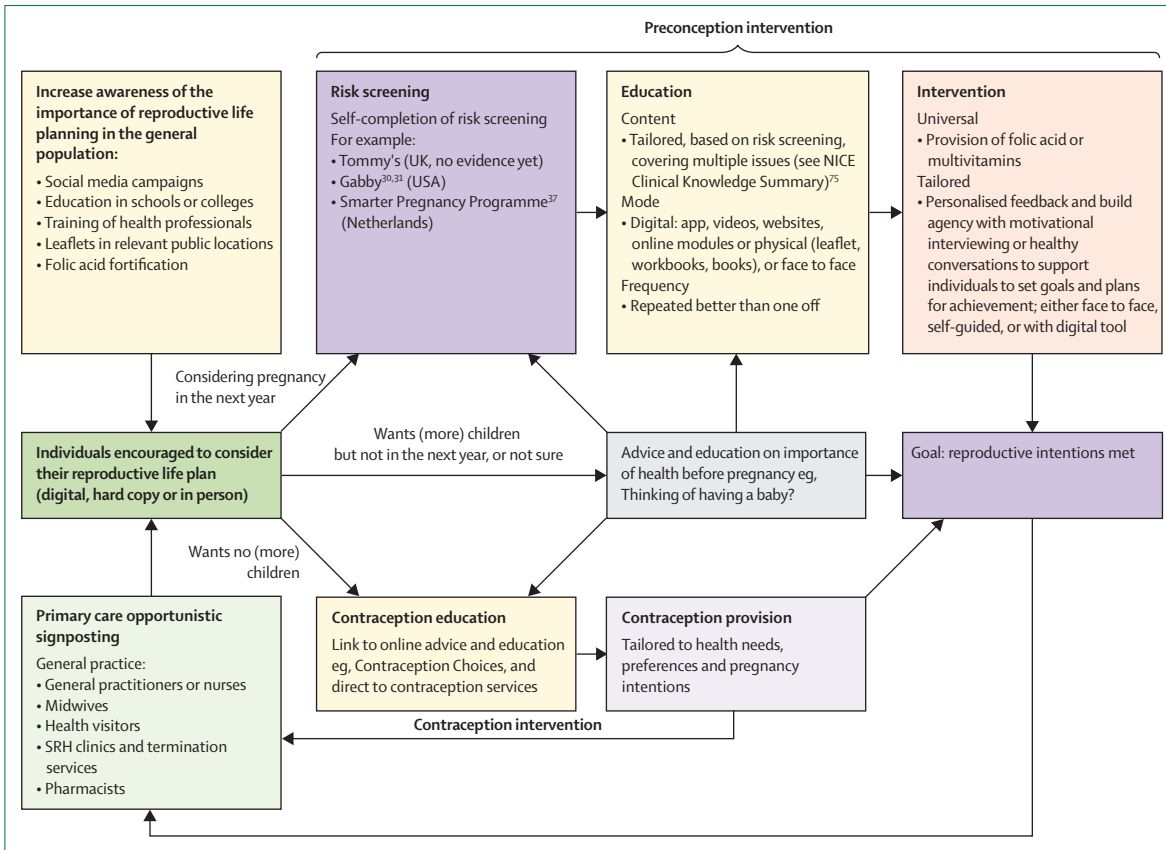
Preconception care in various forms is currently being developed or delivered in England. Some examples of this are social media campaigns: #ReadyforPregnancy by the Southeast Clinical Delivery and Network, and Tommy's #AreYouReady; health visitor training: the Institute of Health Visiting; general practice: Bevan Healthcare, Bradford; and local maternity systems: West Yorkshire & Harrogate. Further information on the case studies can be found in the appendix (pp 15–20).

Using this evidence base we developed the model, shown in the figure. The model has been presented confidentially at national and international forums, and has been well received, suggesting good face validity.

Application of the model

To determine what people want and need at any given point in time, and to fill the gap between contraception and antenatal services, there needs to be an entry point, which could be a simple inquiry, a set of screening questions, or a more structured reproductive life plan, which has been associated with more planned pregnancies.^{42,45} A reproductive life plan is a set of personal goals about having (or not having) children, including the means by which the goals will be met, all while emphasising personal values and resources available to the individual.⁷⁶ Any health-care professional could discuss reproductive life planning with people of reproductive age at any contact, in line with Making Every Contact Count,²⁰ although women's preference was for consultations relating to women's health, or women could complete a reproductive life plan themselves digitally. At other health-care contacts, asking about pregnancy preferences should be considered, but it is important to preface it with a rationale. Further work is ongoing with women and health-care professionals to explore how best to do this; incorporation into the wider prevention agenda—eg, for obesity and mental health—could enhance both acceptability and success.⁷⁷

Our model recommends a community-level increase in awareness of reproductive life planning and the importance of health before pregnancy in the general public through societal and school-based interventions, which will help to normalise these discussions. This increase in awareness was found to be effective,^{50,55–66} and is in line with WHO and other recommendations.^{14,76} Although such bottom-up mobilisation of communities and individuals is important in improving preconception health, such efforts will have limited effectiveness unless complemented by a top-down approach to create an enabling environment.^{78,79} This top-down approach could include focused policy initiatives (eg, folic acid



For more on **Tommy's** see www.tommys.org/pregnancy-information/planning-pregnancy/planning-for-pregnancy-tool

For more on **Thinking about having a baby** see <https://www.contraceptionchoices.org/did-you-know/thinking-having-baby>

For more on **Contraception Choices** see <https://www.contraceptionchoices.org>

Figure: Proposed integrated, community-based model combining contraception and preconception care to address reproductive health needs across the life course
 NICE=National Institute for Health and Care Excellence. SRH=sexual and reproductive health.

fortification), as well as addressing wider determinants of health and inequalities.

Once the person's needs and desires have been assessed, individualised advice and information on contraception or preconception health should follow. It is unrealistic to expect health-care professionals to undertake face-to-face reproductive life planning with everyone of reproductive age every year; most people could be signposted to online sources or apps, which are effective and highly acceptable,^{22,31,33} through general social media, NHS campaigns, school-based education, or by any health-care professional. Non-digital platforms should also be available for people who cannot access or do not like digital interventions, or the health-care professional could use the online tool with patients in face-to-face encounters. This approach might be particularly suitable for individuals who speak English as a second language, people with learning disabilities, or those who may otherwise struggle to access care.

Having expressed their desire for, or to avoid, pregnancy, the person would then be directed to further resources as applicable. If they do not want any children, or do not want to have more children, they would be referred to a source of information on contraception and

on to how to access it. If they want children, or want more children, but not in the next year, they would be directed to a source of information on the importance of health before pregnancy, and then on to information on contraception. At each contraception review, the health-care professional should check whether the person's view on pregnancy has changed and support them accordingly. For individuals who are considering a pregnancy in the next year, they could be directed to an online tool or app to self-complete a risk screening for tailored advice on how to improve their health before pregnancy.

Based on any identified risks, people should then be guided to appropriate interventions. This referral could be to specialised services for people with pre-existing conditions, or through social prescribing to a link worker who can provide support across health, housing, financial, and other social issues. In the UK, the content of preconception care provided is outlined in a National Institute for Health and Care Excellence (NICE) Clinical Knowledge Summary.⁷⁵ A 2022 review⁸⁰ found 11 freely available clinical practice guidelines for preconception care from the USA, Canada, Australia, and India, demonstrating the global relevance of preconception care.

The interventions that have been most effective are those that have had repeated contact (either virtual or in person), have sought to reduce barriers (eg, providing supplements rather than just advising people to take them),^{35,67–70} and that include the partner, if there is one.³⁸ In line with the empowering approach of reproductive life planning, interventions that include motivational interviewing or an interactive component,^{30,31} which encourage people to take ownership of developing their own plan to address issues that have arisen, are more effective than those that do not include such a component.^{26,28,46–49} Our findings suggest that a digital intervention that addresses related issues together (eg, diet and physical activity), incorporates behaviour change strategies, and that could, in the case of interconception care, be delivered soon after birth, would probably be most effective and acceptable.¹⁶

During pregnancy, the benefits of timing pregnancies such that there is at least 18 months between delivery and conception should be explained by the midwife or obstetrician, postnatal contraception should be discussed, and a plan made before delivery; discussions regarding contraception are often not wanted in the immediate post-partum period. A range of methods of contraception should be made available on discharge from midwifery care (either in the hospital or at home). This approach will require discussions with commissioners, a review of commissioning pathways, and training or retraining of midwives. Health visitors should confirm clients are using contraception in line with their wishes, and support the delivery of interconception care to prepare for the next pregnancy if or when it is desired. Health visitors should support clients to reflect on and review their reproductive life plan during at least two of their visits at months 6, 12, 18, and 24 post partum, drawing on their knowledge of the family to determine when is most appropriate, and direct them to the preconception risk screening tool if and when needed. The application of the model is further illuminated by the vignettes in the appendix (pp 21–23).

Delivery

Greater clarity is needed on who should deliver preconception care. A 2016 review⁸¹ found consensus among health-care professionals that primary care is the right location for preconception care, but no agreement on with which professional group the responsibility should lie. This was evident in our women's accounts of missed opportunities and unsuccessful efforts to seek advice for pregnancy planning. Existing time and resource pressures are further barriers. We contend that there is not one right health-care professional; it depends on where the person is in their reproductive life course, which services they access, and how the health system is structured, but health-care professionals in primary care are key. The preconception period is a crucial time and an opportunity that has not yet been fully realised.¹⁶

To deliver this programme of work, health-care professionals need to have suitable training.⁸² A recent

assessment of the preconception content of various undergraduate and postgraduate medical curricula showed that this training was lacking (Hanson M, University College London Elizabeth Garrett Anderson Institute for Women's Health, personal communication). It will be important to engage with health professionals to understand the perceived barriers and facilitators of integrating preconception and interconception care into routine practice. However, the health visitor case study shows that suitable training can be developed and provided.

In terms of outcomes, assessing the level of unplanned pregnancy will provide evidence for the effectiveness of the overall programme. This should be done using the London Measure of Unplanned Pregnancy, a validated measure of the degree of pregnancy intention,⁸³ at both antenatal booking appointments and in termination services, or through regular nationally representative surveys. Improvements in indicators such as key health behaviours at antenatal bookings and increased uptake of long-acting reversible contraception will also demonstrate effectiveness. At a population level, preconception health should be monitored through annual reporting of key indicators using metrics from multiple routine data sources.^{4,84} Long-term outcomes, such as the impact on child health and development, will require sustained implementation of the model at scale.⁷⁶

Limitations

We limited our search to studies published in English and in high-income country settings which might limit the generalisability of the model. However, our initial scoping reviews were not limited in such a way, and most studies that would have been excluded on setting were not relevant. All relevant studies had an English translation available, although having not searched in multiple languages, it is possible that other studies were missed. Wider considerations of health-care systems for the delivery of preconception care, stakeholders involved, and sociocultural practices that influence health behaviours in the preconception period might need to be taken into account when considering the translation of this model to low-income and middle-income countries.

The literature on preconception care has grown in recent years, yet there is still an absence of evidence on the impact of preconception interventions on outcomes such as preterm birth or child health and development. Instead, most studies are small-scale before and after studies, cross-sectional surveys, prospective cohorts that look at behaviour change only, or randomised controlled trials of individual interventions. This scarcity of data limits our ability to quantify potential effectiveness and cost-effectiveness, and highlights the need for large-scale comprehensive interventions with sufficient duration of follow-up. Some studies experience selection bias, with wealthier and more highly experienced participants, but

others focus on women from more deprived areas or with lower education levels.

Conclusion

We have developed an evidence-based model of universal integrated community-based preconception care that includes contraception. This model is deliberately high level, offering a framework that should be contextualised in different settings and adapted to the health system, rather than being prescriptive in content. This, combined with the international literature underpinning it, means that it could be applicable to other settings.

The model looks beyond health care to wider policy, schools, and social media and can be implemented across the reproductive lifecourse and by a range of health-care professionals. This model could only be provided within a supportive health economy, which values reproductive health and rights for all, and is structured to enable individuals to develop and achieve their own goals. This individualistic approach needs to be balanced with top-down policies that address the structural determinants of preconception health and inequalities,¹ and that embed preconception health within the preventive agenda and align health service provision to provide holistic care rather than the current fragmented, disease-oriented model that inefficiently requires patients to access multiple services while still leaving gaps in care provision. Although preconception care is gaining a higher policy profile, it is not yet established in the minds of most health-care providers, their training, or service delivery plans, nor is it normalised for the public. Charities such as Tommy's and First Steps Nutrition advocate and support the preconception agenda, yet more accountability is required from local and national governments, and other stakeholders who have influence, including insurance companies, the food and drink industry, and marketing agencies.

Our model should be piloted and evaluated to develop and test the specific elements and connections that are likely to work in each context; implementation strategies are likely to differ across groups and settings. Evaluation of the model should include a range of relevant indicators (ie, process, behavioural, and biological). Models that are successful should be extended through the relevant professional networks (for example in the UK, the Royal Colleges, NICE, and the Office for Health Improvement and Disparities); be supported through commissioning networks and pathways; and will also contribute to evidence of what works. Some interventions have been ineffective due to the barriers faced by health-care professionals, such as lack of time, training, or reimbursement, despite recognition of the importance of providing preconception care.^{68,81} Implementation research can be useful for understanding why some interventions have been ineffective and improving intervention design. It is key that health-care professionals receive training on how to raise the topic and the advice to

give, and are supported by the system to implement it, such as having sufficient time within routine appointments or via a separate mechanism. This should be a recognised activity, and could be made a pay for performance indicator.

The review of evidence and model put forward here show how preconception health care in the community can shift from concept to reality, and how the gap between contraception and antenatal services can be bridged to holistically support women's needs across their reproductive life course.

Contributors

JH conceptualised the study. JH, MC, DW, CMJ, GB, and DS curated the data. JH, MC, DW, CMJ, and DS did formal analysis. JH, GB, DS, and JS acquired funding. JH, MC, DW, CMJ, GB, and DS conducted the investigation. JH designed the method. JH, AC, and JS supervised the study. JH and MC visualised data. All authors contributed to writing the original manuscript. All authors contributed to reviewing and editing the manuscript.

Declaration of interests

AC has received payment for providing consultancy for Bayer, MSD, Gedeon Richter, and HRA Pharma, and has received payment from Bayer, MSD, Pfizer, Gedeon Richter, and Consilient for lectures to health-care professionals on provision of contraception. All other authors declare no competing interests.

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