Original Article

Does preconception care work?

Michael M. BECKMANN,[1] Tania WIDMER[2] and Elize BOLTON[1]

[1]*Obstetrics and Gynaecology, Mater Health Services, Brisbane, Qld, Australia and* [2]*Obstetrics and Gynaecology, Gold Coast University Hospital, Gold Coast, Qld, Australia*

Background: To date, there is a lack of evidence to suggest that a systematic and coordinated approach to prepregnancy care might make a difference.
Aims: To evaluate whether women who receive preconception care through a structured approach will be more likely to be healthy around the time of conception compared with women who plan their pregnancy but have not been exposed to preconception care.
Methods: A case control study was undertaken of women who attended the preconception care service and subsequently conceived, received maternity care and gave birth at Mater Health Services Brisbane between January 2010 and January 2013. Pregnancy information and birth outcomes for each woman who attended the service were matched with those of three women who reported that they had planned their pregnancy but did not attend the service. Records were matched for prepregnancy BMI, age, parity, prepregnancy smoking status and number of health conditions.
Results: Pregnant women who attended preconception care were more likely to have received adequate peri-conceptual folate, to report being vaccinated against influenza and hepatitis B, to have consulted with a specialist with the specific aim of optimising a pre-existing health condition and to report less weight gain up until booking. Preterm birth and hypertensive disorders of pregnancy were less common amongst women who had attended preconception care, and there were trends towards a decreased incidence of gestational diabetes, LGA and fetal anomalies.
Conclusion: These preliminary data provide some optimism that a comprehensive preconception care service may positively influence maternal and neonatal outcomes.

Key words: health behaviour, health promotion, preconception care.

Introduction

Preconception care aims to identify and modify biomedical and social risks to a woman's health and pregnancy outcome through a set of prevention and management strategies.[1] For many years, it has been recommended that women planning a pregnancy take folate supplementation to reduce the risk of neural tube defects. In women with diabetes, it is known that tight glycaemic control around the time of conception reduces the risks of miscarriage and structural abnormalities.[2] It is only in recent times that a structured preconception care strategy has been considered,[3–5] but to date, there is a lack of evidence to suggest that a systematic, coordinated and universal approach to prepregnancy care might make a difference.

Prepregnancy advice and assessment for women with medical conditions such as diabetes or epilepsy, or who are known to be at high risk, are provided in many countries. Such care has been offered much less frequently to women without identified risk factors, but where it has been provided, results have been encouraging. A large observational study carried out in Hungary[6] suggested that infertile couples were identified and treated sooner and women attending for prepregnancy care had early access to treatment for genito-urinary infections and genetic counselling. In addition, positive maternal behavioural modification (smoking cessation) was associated with increased infant birthweights and a reduction in congenital abnormalities.

Despite the fact that routine prepregnancy health promotion is generally not available, surveys of women of childbearing age have demonstrated that its introduction would be welcomed and potentially be of benefit. A study of women of childbearing age in the Netherlands[7] revealed that 70% would be interested in attending for prepregnancy care. An American study[8] reported that of those mothers surveyed who had both planned and unplanned pregnancies, more than one-third had at least one indication for prepregnancy advice. Surveys also suggest that there is consensus amongst healthcare professionals that prepregnancy health promotion may be

Correspondence: Dr Tania Widmer, Gold Coast University Hospital, Hospital Boulevard, Southport, QLD 4215, Australia.
Email: tania_widmer@health.qld.gov.au

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a worthwhile addition to routine maternal health care.[9,10] There is, similarly, agreement on the broad aims of such care: to promote optimum maternal health at the beginning of pregnancy, and to identify and attempt to modify risk factors associated with maternal and infant morbidity. However, there is less consensus on what type of care should be offered, when it should be offered, how care should be funded, who should provide care and how vulnerable groups might best be targeted.[8,10,11]

Since 2008, there have been numerous publications[4,5] advocating the establishment of a coordinated preconception model of care. Preconception models of care may benefit both women with pre-existing health conditions where optimisation of the disease process may reduce risk, and also women without pre-existing health conditions where strategies such as optimisation of weight, promoting vaccination and smoking cessation may similarly reduce risk. Based on the best available evidence, a pilot preconception care service was established in our hospital in 2009. In establishing this service, it was hypothesised that women who attended preconception care (with and without additional risk factors) would benefit from a coordinated approach to prepregnancy assessment and in turn be 'healthier' at the time of conception and experience less maternal and neonatal morbidity. This study aims to describe the impact of the introduction of a comprehensive preconception care service on maternal and neonatal outcomes.

Materials and Methods

A case control study was undertaken of women who attended the hospital preconception care service and subsequently conceived, received maternity care and gave birth at Mater Health Services Brisbane between January 2010 and January 2013. The pregnancy information and birth outcomes for each woman who attended the preconception care service were matched with those of three women who gave birth at Mater Health Services over the same period of time who reported that they had planned their pregnancy but did not attend the preconception care service. Records were matched for prepregnancy body mass index (BMI) (calculated from women's self-reporting of their weight six months prior to conception), age, parity, prepregnancy smoking status and number of prepregnancy health conditions. Consent from the women whose records were included in this study was not sought. The Mater Health Services Human Research Ethics Committee (HREC) assessed this research as meeting the conditions for low/negligible risk research (Reference: 2012-70).

Women attending the preconception care service included those with subfertility, women with pre-existing health conditions with a potential to impact pregnancy outcomes, as well as low-risk women seeking assessment and advice as to how best to maximise their chance of a healthy pregnancy outcome. Women participated in a 45-min consultation with a midwife who asked a series of prescribed questions pertaining to reproductive, medical, surgical, social and family histories; lifestyle; nutrition; home; work and social hazards, based on the recommendations of the Centers for Disease Control and Prevention Workgroup of Preconception Health and Health Care.[11] Women were provided with specific advice and written information regarding folic acid supplementation, vaccinations (for rubella, varicella zoster, hepatitis B, pertussis, influenza), healthy eating before and during pregnancy, exercise, smoking cessation and safe levels of alcohol intake. During their preconception care visit, all women consulted an obstetrician who specifically addressed the positive responses elicited during the midwife's consultation and undertook necessary examination, investigations and referrals as indicated.

The primary outcome of the study was the likelihood of being 'healthy' at the time of hospital maternity booking. Being 'healthy' was defined a priori as:

1 Early pregnancy weight in a healthy weight range (BMI 18.5-24.9)
2 Having ceased/reduced smoking and alcohol consumption
3 Having received folate supplementation for at least three months prior to conception and for the first three months of pregnancy
4 Being vaccinated against influenza, pertussis, varicella and hepatitis B
5 Having consulted with a specialist with the specific aim of optimising a pre-existing health condition prior to conception (where relevant)

Secondary outcome measures included gestation at birth, small for gestational age (SGA) or large for gestational age (LGA) by customised centiles,[12] gestational diabetes, hypertensive disorders of pregnancy, fetal anomaly and mode of birth.

The outcomes measures were collected as part of a 90-min face-to-face consultation with a midwife between 12 and 20 weeks gestation, and from routinely collected birth outcome data entered at the time of birth. Vaccination status at time of maternity booking, changes in weight/BMI over the six months prior to conception, consultation with a specialist to optimise health and recent lifestyle modifications were all self-reported, in response to a specific set of research questions that were developed a priori, and scripted for midwife to ask every women at the maternity booking visit. Gestational diabetes was screened for in low-risk women using a 50 g nonfasting glucose challenge test, with screen-positive women undergoing a diagnostic 75-g fasting glucose tolerance test. Data were extracted from the hospital's obstetric clinical reporting system, Matrix (Meridian Health Informatics, Surry Hills, NSW, Australia).

Categorical data were compared using chi-squared and Fisher's exact test, and continuous data compared using the student t-test if normally distributed or the Mann–Whitney U-test if not normally distributed. Data analysis was undertaken using StataSE version 10.1 (StataCorp, College Station, TX, USA); $P < 0.05$ was considered statistically significant.

Results

Between January 2010 and January 2013, 407 women attended the preconception care service, of whom, 56 subsequently conceived and booked for maternity care at Mater Health Services between 12 and 20 weeks gestation. The baseline characteristics were compared with a control group of women who reported having planned their pregnancy but did not receive preconception care, matched 3:1 for prepregnancy BMI, age, parity, prepregnancy smoking status and number of prepregnancy health conditions. Compared with controls, women who attended preconception care were less likely to consume alcohol prepregnancy, to receive private maternity care, or to be Australian born. Both cases and controls underwent their maternity booking visit at a similar gestation. The groups were similar with respect to marital status, level of education achieved and socioeconomic status (as measured by SEIFA quintiles where 1 represents the lowest socio-economic level). The proportion of women experiencing recurrent miscarriages and requiring artificial reproductive technology to conceive were also similar between the groups. Table 1 outlines all the baseline characteristics.

Pregnant women who attended preconception care were more likely to have received adequate peri-conceptual folate, to report being vaccinated against influenza and hepatitis B, to have consulted with a specialist with the specific aim of optimising a pre-existing health condition prior to conception and to report less weight gain (and a smaller increase in BMI) over the six months prior to conception until the booking visit. However, women attending preconception care were no more or less likely to have reduced or quit smoking, or alcohol consumption, prior to conception. All primary outcome measures are shown in Table 2.

Preterm birth (both iatrogenic and spontaneous) and hypertensive disorders of pregnancy were less common amongst women who had attended preconception care. Women attending preconception care gave birth almost 2 week later than controls. There were no differences in the rates of SGA or LGA babies, gestational diabetes or mode of birth. The secondary outcome measures are shown in Table 3.

Table 1 Baseline characteristics

Characteristic	Attended Preconception care $n = 56$ n (%)	Did not attend Preconception care $n = 168$ n (%)	P value
Nulliparous	31 (55.4)	94 (55.9)	0.938
Smoker prepregnancy	4 (7.1)	12 (7.1)	0.999
Alcohol prepregnancy	22 (39.3)	86 (60.6)	0.007*
Use of ART	9 (16.1)	26(15.5)	0.915
History of recurrent miscarriage	6 (10.7)	15 (8.9)	0.691
Public	45 (80.4)	64 (38.1)	<0.001*
Married/de facto	51 (91.1)	142 (84.5)	0.219
Born in Australia	28 (50.0)	116 (69.1)	0.010*
Caucasian	34(60.7)	128 (76.2)	0.025
Need interpreter	3 (5.4)	10 (5.9)	0.869
Completed Grade 12	45 (80.4)	140 (83.3)	0.611
SEIFA quintile			
1	3 (14.3)	9 (11.5)	
2	2 (9.5)	9 (11.5)	
3	3 (14.3)	15 (19.2)	
4	5 (23.8)	21 (26.9)	
5	8 (38.1)	24 (30.8)	0.973
Characteristic	Mean (SD)	Mean (SD)	P value
Age	32.1 (4.8)	32.4 (5.0)	0.638
Gestation at hospital booking (weeks)	13.7 (5.5)	14.1 (4.1)	0.732
Weight prepregnancy (kg)	72.2 (20.4)	71.2 (17.2)	0.731
BMI prepregnancy (kg/m^2)	26.8 (6.4)	26.3 (6.2)	0.617
Number of prepregnancy health conditions	0.54 (0.74)	0.54 (0.70)	0.914

ART, assisted reproductive technology; SEIFA, socio-economic indexes for areas; BMI, body mass index; SD, standard deviation. *$P < 0.05$.

Discussion

This case–control study demonstrates that women in early pregnancy who attend a preconception consultation are more likely to be healthy across several domains than women who plan their pregnancy but do not attend a preconception consultation. In addition, attendance at a preconception consultation may be associated with a lower likelihood of both iatrogenic and spontaneous preterm birth, and hypertensive disorders of pregnancy, with trends towards a decreased incidence of gestational diabetes, LGA and fetal anomalies.

Compared with nonattendees, women who attended a preconception consultation gained less than half as much weight prepregnancy and experienced less than half the numbers of preterm births, and over 80% reported taking adequate peri-conceptual folate. Recent Australian data[13] would suggest that less than one-quarter of pregnant women receive adequate folate supplement before pregnancy and during early pregnancy. Aside from fortification, very few effective strategies have been identified to increase compliance. Prepregnancy weight gain is one of the most predictive factors for the development of GDM and its associated health consequences,[14,15] yet there is currently very little evidence supporting interventions that assist women to limit weight gain.[16] There has also been little if any change in the incidence of preterm birth over the last 10 years.[17] Whilst cervical length measurement and progesterone administration have been the focus of much research interest, little attention has been given to measuring the impact of addressing lifestyle factors and maximising pre-existing health conditions prior to conception. These study findings offer some hope that a brief intervention, involving questions and scripted responses and prompts

Table 2 Primary outcome measures

Outcome	Attended Preconception care (n = 56)	Did not attend Preconception care (n = 168)	P value
Weight change (kg) mean (SD) *from six months prior to conception until hospital booking*	+3.1 (4.1)	+8.4 (5.6)	<0.001*
BMI change (kg/m^2) mean (SD) *from six months prior to conception until hospital booking*	+1.1 (1.4)	+2.7 (2.2)	<0.001*
Smokers who reduced/quit smoking n (%)	3 (75.0)	8 (75.0)	0.999
Consumers of alcohol who reported drinking alcohol near conception n (%)	0 (0)	3 (3.5)	0.314
Adequate folate supplementation n (%)	45 (80.4)	63 (37.5)	<0.001*
Currently vaccinated against n (%)			
Influenza	18 (40.0)	31 (19.6)	0.005*
Pertussis	12 (26.7)	38 (24.1)	0.719
Varicella	3 (6.7)	24 (15.2)	0.137
Hepatitis B	34 (75.6)	89 (56.3)	<0.001*
Consulted with a specialist preconception n (%) *with the specific aim of optimising health condition*	17 (37.0)	30 (17.9)	<0.020*

*P < 0.05.
SD, standard deviation; BMI, body mass index.

Table 3 Secondary outcome measures

Characteristic	Attended preconception care (n = 56)	Did not attend preconception care (n = 168)	P value
Gestation at birth (weeks) mean (SD)	38.5 (1.9)	36.7 (4.1)	0.002*
Preterm birth n (%)	7 (12.5)	51 (30.4)	0.008*
Iatrogenic preterm birth	0 (0)	45 (3.0)[a]	
Spontaneous preterm birth	7 (12.5)	46 (27.4)	
SGA baby (by customised centiles) n (%)	8 (14.8)	19 (11.3)	0.554
LGA baby (by customised centiles) n (%)	4 (7.4)	25 (16.6)	0.135
Gestational diabetes n (%)	1 (1.8)	9 (5.4)	0.262
Hypertensive disorder n (%)	0 (0)	11 (6.6)	0.050*
Fetal anomaly n (%)	0 (0)	5 (3.0)	0.335
Assisted and unassisted vaginal birth n (%)	28 (50.0)	78 (46.4)	0.643

*P < 0.05.
SD, standard deviation; SGA, small for gestational age; LGA, large for gestational age.
[a]Induction of labour for pre-eclampsia (n = 4); induction of labour for poorly controlled diabetes (n = 1).

for referrals and investigations, may lead to significantly better health outcomes for pregnant women and their babies, and substantial savings in healthcare expenditure.

Assuming preconception care is an effective strategy, there are a number of significant barriers to more widespread implementation of these services. A preconception consultation as described in this study is expensive, taking almost 90 min of clinicians' time. The structured and scripted nature of the assessment does facilitate the administration of the tool by a nurse or midwife at a reduced cost. The tool would also lend itself to development as a web application completed by the woman herself: assessing risk, summarising the woman's responses for later review by a clinician and 'pushing' relevant health and lifestyle information to women based on their responses. This service was piloted in a tertiary maternity hospital, but most women planning a pregnancy are not high risk and preconception care should be a primary healthcare initiative. Whilst we attempted to collaborate with our referring general practitioners and conducted training sessions for their practice nurses, only 2 of 407 preconception consultations using the tool were undertaken in general practice. In the absence of a specific and appropriately remunerated item number, widespread implementation of this preconception care model into general practice would not be financially sustainable.

As an observational cohort, this study is subject to selection bias, in that the women who attended preconception care may represent a healthier and more motivated population than women who did not attend. However, women in both groups reported that they had planned their pregnancy and the groups were matched for several surrogate markers of general health. In addition, there were no differences in the groups with respect to socioeconomic status or educational level, which are both key determinants of health literacy and positive health behaviours.[18,19] It is also acknowledged that women who had experienced recurrent miscarriage may have also been recruited to a randomised controlled trial of vaginal

progesterone versus placebo. It is plausible that progesterone administration in early pregnancy may explain some of the observed benefits of preconception care; however, the proportion of women in the preconception care group and control group who had experienced recurrent miscarriage (and therefore may have received progesterone) were very similar. Nevertheless, a sensitivity analysis was undertaken excluding all women with recurrent miscarriage from the analysis, and the results were unchanged. The observation that more women attending preconception care had less weight gain from prepregnancy until booking was calculated from women's baseline BMI, which was self-reported weight six months prior to pregnancy. Despite being unable to confirm the accuracy of this measurement, studies[20,21] demonstrate that the vast majority of pregnant women's self-reported prepregnancy weight is very closely correlated with measured weight. The CS rate was similar in both cases and controls, but is notably higher than the national average.[22] Whilst this may be somewhat explained by the particular characteristics of this population who weighed more, were older and experienced more recurrent miscarriages and difficulties conceiving than most women having a baby in Australia, these differences also limit the generalisability of the findings. Finally, whilst there are hospital processes to maintain data quality, the routinely collected data from which this analysis has been undertaken were entered by clinicians, and it remains subject to data entry error.

Further larger studies are needed to substantiate these initial positive findings. A randomised controlled trial would help overcome many of the biases associated with an observational cohort; however, ethics approval to randomise women not to receive preconception information may prove challenging. These preliminary data do provide some optimism that a comprehensive preconception care service may positively influence maternal and neonatal outcomes.

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