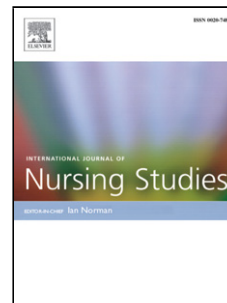


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## Barriers and facilitators to the provision of preconception care by healthcare providers: a systematic review

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### ABSTRACT

**Background:** Healthcare providers play an important role in providing preconception care to women and men of childbearing age. Yet, the provision of preconception care by healthcare providers remains low.

**Objectives:** To provide an overview of barriers and facilitators at multiple levels that influence the provision of preconception care by healthcare providers.

**Design:** A mixed-methods systematic review.

**Data sources:** PubMed, Web of Science, CINAHL, The Cochrane Library, and EMBASE were systematically searched up to April 27, 2017. The search strategy contained MeSH terms and key words related to preconception care and healthcare providers. Reference lists of included studies and systematic reviews on preconception care were screened.

**Review methods:** Publications were eligible if they reported on barriers and facilitators influencing the provision of preconception care by healthcare providers. Data were extracted by two independent reviewers using a data extraction form. Barriers and facilitators were organized based on the social ecological model. The methodological quality of included studies was evaluated using the Critical Appraisal Skills Programme Qualitative checklist for qualitative studies, the Quality Assessment Tool for quantitative studies, and the Mixed Methods Appraisal Tool for mixed methods studies.

**Results:** Thirty-one articles were included. Barriers were more reported than facilitators. These were situated at provider level (unfavourable attitude and lack of knowledge of preconception care, not working in the field of obstetrics and gynaecology, lack of clarity on the responsibility for providing preconception care) and client level (not contacting a healthcare provider in the preconception stage, negative attitude, and lack of knowledge of preconception care). Limited resources (lack of time, tools, guidelines, and reimbursement) were frequently reported at the organizational and societal level.

**Conclusions:** Healthcare providers reported more barriers than facilitators to provide preconception care, which might explain why the provision of preconception care is low. To overcome the different client, provider, organizational, and societal barriers, it is necessary to develop and implement multilevel interventions.

**Keywords:** ‘Health Knowledge, Attitudes, Practice’; ‘Health Personnel’; ‘Preconception Care’; ‘Review’; ‘Socio-Ecological Model (SEM)’.

## INTRODUCTION

The improvement of maternal health and the reduction of child mortality remain global health objectives, and are two health targets of the Sustainable Development Goals for 2030 that build on the Millennium Development Goals (United Nations, 2015). Despite a substantial reduction of the global maternal and child mortality between 1990 and 2015, efforts remain necessary to further improve maternal and newborn health, and reduce maternal mortality and preventable deaths of newborns (United Nations, 2015). One strategy towards ending preventable maternal and child mortality could be focusing on preconception care (PCC) as many adverse reproductive outcomes including pregnancy losses, congenital disorders, and low birth weight are associated with preventable preconception risk factors (Johnson et al., 2006; World Health Organization, 2012). Preconception care can be defined as “the provision of biomedical, behavioural and social health interventions to women and couples before conception occurs, aimed at improving maternal and child health outcomes in both the short and long term” (World Health Organization, 2012, p. 36). PCC is an umbrella term that refers to health promotion, risk assessment, and the initiation of interventions to target risk factors with a potential influence on pregnancy outcomes (Johnson et al., 2006). Key domains of PCC include family planning; nutrition and physical activity; tobacco, alcohol and substance use; occupational and environmental exposures; family history and genetic risks; infectious diseases and immunization; medical and psychosocial conditions; and medications (Johnson et al., 2006). Given the potential benefits of PCC to improve pregnancy outcomes, several prominent international organizations including the Centers for Disease Control and Prevention (CDC), American College of Obstetricians and Gynecologists (ACOG), and World Health Organization (WHO), recommend PCC for all women and men of childbearing age (Jack et al., 2008; Johnson et al., 2006; World Health Organization, 2012). Nevertheless, the use of PCC remains low in couples who are planning a pregnancy (Stephenson et al., 2014). To illustrate, a UK study of Stephenson et al. (2014) found that 63% of the

pregnant women with a planned pregnancy reported to take folic acid before pregnancy, and 48% of the smokers and 41% of the drinkers reduced or stopped before conceiving. In addition, research suggests that only 25% to 39% of the couples consulted a healthcare professional before conception (Poels et al., 2017). A systematic review of Poels et al. (2016) revealed several barriers to women's use of PCC, including lack of awareness and unfamiliarity with the concept of PCC, not fully planning their pregnancy, women's wish for secrecy, perceived absence of risks, and perceived sufficient knowledge. In addition, several provider characteristics were identified as possible influencing factors for PCC use, such as provider attitudes and communication with providers (Poels et al., 2016). This suggests that healthcare providers (HCPs) may have an important influence on couples' use of PCC. Yet, the provision of PCC by HCPs is low with mainly providing PCC on an opportunistically rather than on a routine basis (Shawe, 2014).

Given the role of HCPs in promoting and providing PCC, an exploration of associated factors and underlying processes of the provision of PCC is needed. Factors influencing the provision of PCC are often complex due to the multifactorial and multilevel character (Eldredge et al., 2016; McLeroy et al., 1988). Understanding facilitators and barriers to providing PCC is essential as it can inform intervention development and strategies to improve PCC uptake and delivery (Eldredge et al., 2016). A literature review is one of the first steps in the development of these interventions and strategies (Eldredge et al., 2016).

To the authors' knowledge, only few systematic reviews were conducted on the topic of PCC, including a literature review on the effectiveness of preconception care (Korenbrot et al., 2002), research regarding preconception health behaviours (Toivonen, 2017), and factors related to the use of preconception care by women (Delissaint and McKyer, 2011; Poels et al., 2016). Curtis et al. (2006) and Steel et al. (2016) performed a systematic review on clinical practice of HCPs with regard to PCC guidelines, and healthcare professionals' attitudes and experience of preconception care service delivery, respectively. Our study built on this previous work (Curtis et al., 2006; Steel, 2016), and aimed to provide an overview of factors identified as barriers and facilitators at multiple levels that influence the provision of PCC by HCPs.

## METHODS

A mixed-methods systematic review was conducted based on PRISMA guidelines (Moher et al., 2010).

### Search strategy

Five electronic databases were searched for studies published up to April 27, 2017: PubMed, Web of Science (WoS), Cumulative Index to Nursing and Allied Health Literature (CINAHL), The Cochrane Library, and EMBASE. The search strategy was developed based on literature scoping preconception care, and several discussions with methodological experts. The search strategy consisted of combining MeSH terms and key words for two concepts: “preconception care” AND “healthcare provider” (See Table 1). In order to improve the sensitivity of the search strategy, terms referring to nurses/midwives and physicians (physicians, GPs, Obstetricians, gynecologists) were added as synonyms of the concept “healthcare provider”. Reference lists of included studies and systematic reviews on preconception care (Curtis et al., 2006; Steel, 2016) were also screened to identify additional studies. Authors of relevant conference abstracts were also contacted to identify additional studies.

**Table 1** Search strategy with MeSH terms and key words

	Boolean operator ‘OR’ <sup>1</sup>	Boolean operator ‘OR’ <sup>1</sup>
<b>MeSH Terms</b>	Preconception Care	Health Personnel
		Nurses
		Midwifery
		General Practitioners
		Physicians
<b>Key words</b>	Pre conception*	Healthcare Provider*
	Preconception*	Health care Provider*
	Prepregnan*	Healthcare professional*
	Pre pregnancy	Health care professional*
	Pre-pregnancy	Nurse*

Periconception*	AND	Midwife*
Peri conception*		Midwives
Peri-conception		Physician*
Before pregnancy		Obstetrician*
Internatal*		Gynaecologist*
Interpregnan*		Gynecologist*
Inter pregnancy		General practitioner*
Inter-pregnancy		
Interconception*		
Inter conception*		
Inter-conception		
Pregestation*		
Pre gestation*		
Pre-gestation*		
Intergestation*		

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<sup>1</sup>All the MeSH terms and key words in this column were combined with Boolean operator 'OR'.

### **Eligibility criteria**

Studies written in English, French, German, and Dutch were included if they met the following eligibility criteria: (1) Participants: all healthcare providers including physicians, midwives, and nurses; (2) Outcomes: perceived barriers and facilitators to provide PCC in general or one aspect of PCC, such as folic acid supplementation or genetic carrier screening; (3) Design: quantitative, qualitative, and mixed methods research. Quantitative studies were excluded if only descriptive statistics were performed. Studies were also excluded if they only focused on barriers and enablers to implementing a nationwide PCC program, because these might be different from factors related to direct care provision.

### **Study selection**

Three reviewers (JG, RG, and MD) independently screened a selection of titles and abstracts. Differences in assessment were discussed between the reviewers until consensus was reached. In case of disagreement between reviewers, a fourth independent reviewer (DB) was involved. An interrater agreement of 99.7% between the reviewers on title and abstract screening was obtained. Two reviewers (JG and MD) screened the remaining references and full texts.

### **Quality assessment**

To assess the methodological quality of the included studies, we used the Critical Appraisal Skills Programme (CASP) Qualitative checklist developed by the Public Health team in Oxford for qualitative studies (Critical Appraisal Skills Programme, 2017, Milne et al., 1995), the Quality Assessment Tool developed by Vyncke et al. (2013) for quantitative studies, and the Mixed Methods Appraisal Tool (MMAT) – version 2011 developed by Pluye et al. (2009) for mixed methods studies. The methodological quality was assessed by one reviewer (MD) and 10% of the articles were double checked by a second reviewer (JG). Differences in assessment between the two reviewers were discussed until consensus was reached. No studies were excluded based on the methodological quality.

### **Data extraction and synthesis**

Data from each study was extracted by two independent reviewers (MD and JG). A data extraction form was used to extract data, which included study aim, content of PCC provision, study design, country and health setting, data collection methods, study population characteristics, and factors associated with providing PCC. The associated factors were classified into barriers (-) and facilitators (+) for the provision of preconception care, and were organized based on the social ecological model (SEM) (McLeroy et al., 1988). The SEM is a theory-based framework for understanding the dynamic and multifaceted interplay between individual and environmental factors that impact behaviours (McLeroy et al., 1988). The SEM acknowledges that individual behaviour is shaped through multilevel factors including the individual, interpersonal, organizational, community, and societal level (McLeroy et al., 1988). In the present study we included four levels of influence: provider



(individual characteristics and biologically determined factors), client (women's and couples' characteristics, and the characteristics of the provider-client relationship), organizational (policies, formal and informal structures, and rules in healthcare organizations), and societal (local and national laws and policies). Due to heterogeneity in methodology and content of PCC, results were synthesized descriptively and no meta-analysis was performed.

## **RESULTS**

### *Selection of articles*

A total of 14003 records were identified through database searching. Duplicates (n=1969) were excluded. The remaining articles (n=12034) were screened on title, abstract, and full text respectively, and assessed for eligibility according to the pre-determined selection criteria (n=117). Twenty-eight articles met all inclusion criteria, and the snowball method added three more articles (Fig. 1).

### *Study characteristics*

Table 2 presents an overview of the study characteristics, barriers and facilitators influencing the provision of PCC.

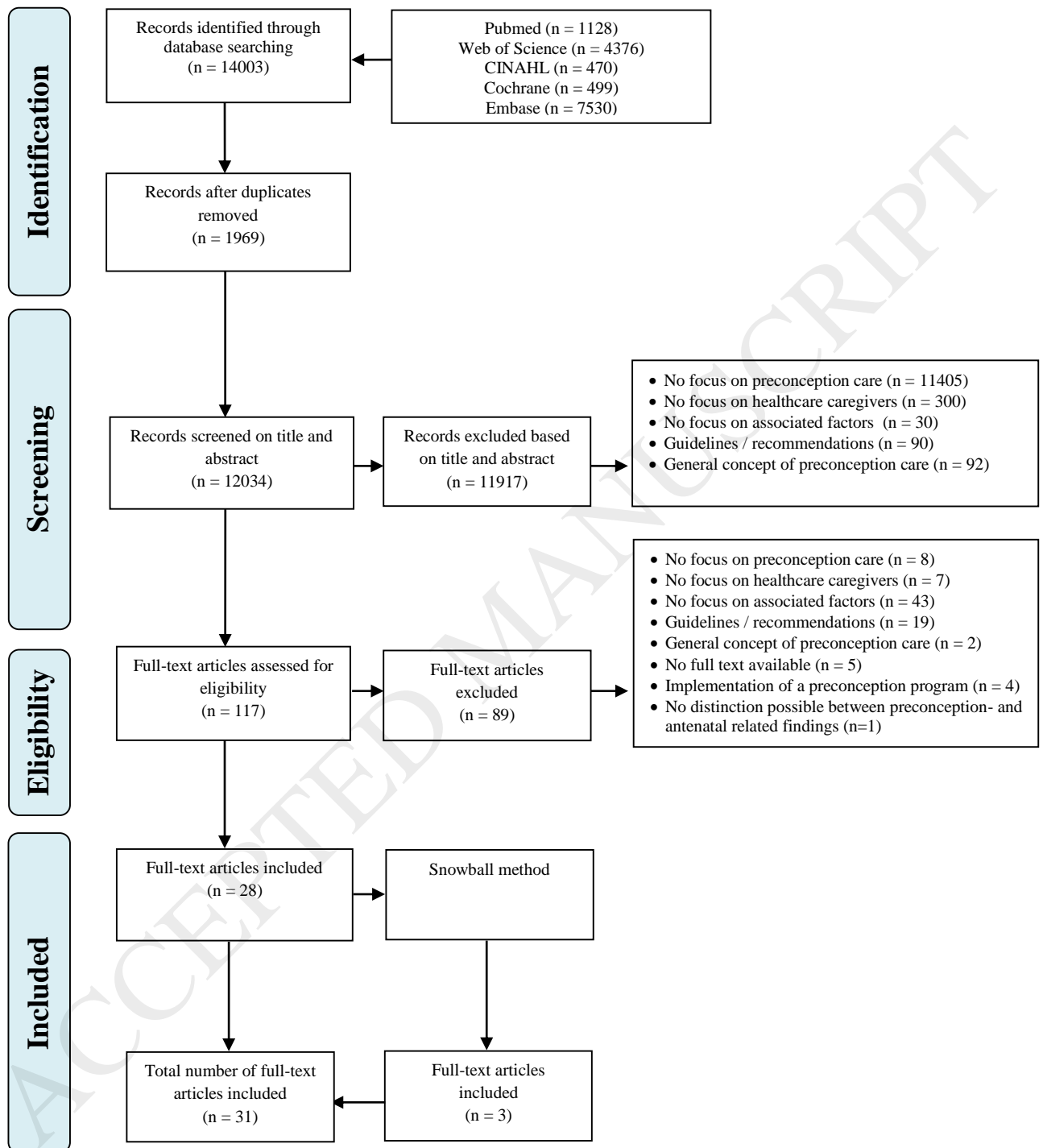


Figure I Decision flowchart for identified studies

**Table 2** Study characteristics, barriers and facilitators influencing the provision of preconception care

Study	(1) Study aim (2) Content of PCC	Study design	(1) Country (2) Health setting	Data collection methods	Study population Mean $\pm$ SD	Factors associated with providing (+) or not providing (-) PCC in relation to level within socio-ecological model
Miranda et al. (2003)	(1) To evaluate the knowledge of primary physicians about FA supplementation for the prevention of NTD (2) PC FA supplementation	Transverse-correlational, quantitative	(1) Puerto Rico (2) One private and one public hospital	Self-administered questionnaire (not validated)	$n=66$ primary physicians; 42.2% female Age: $46y \pm 9.3$ Years in practice: /	<b>Client:</b> / <b>Provider:</b> • Level of knowledge (+ -) <b>Organizational:</b> / <b>Societal:</b> /
Baars et al. (2004)	(1) To examine the opinion of physicians on PC genetic testing & to examine which factors are associated with a positive opinion (2) PC Cystic fibrosis carrier screening	Cross-sectional, quantitative	(1) the Netherlands (2) General or university hospital	Self-administered validated questionnaire	$n=497$ paediatricians, GPs gynaecologists; 28% female Age: 68% aged 40-54y Years in practice: 14y	<b>Client:</b> / <b>Provider:</b> • Considering the test sensitivity less important (+) • High perceived risk of having a child with CF (+) • Reassurance when both partners test negative (+) <b>Organizational:</b> • Providing genetic counselling in own practice (+) <b>Societal:</b> /
Heyes et al. (2004)	(1) To describe the current practice of PCC in Barnsley and to assess the beliefs and attitudes of primary healthcare practitioners (2) General PCC	Cross-sectional, quantitative	(1) UK (2) Primary care setting	Self-administered questionnaire (not validated), consisting of closed- and open-ended questions	$n=163$ GPs, practice nurses, health visitors and midwives; / Age: / Years in practice: /	<b>Client:</b> • Client's perception of the importance of PCC (+ -) • Contact with primary care teams after conception (-): unplanned pregnancies (-), no communication about pregnancy plans (-) <b>Provider:</b> • Attitude: priority given to PCC (+ -) • Professional responsibility/role: confusion over who should deliver PCC (-) • Lack of training (-) <b>Organizational:</b> • Lack of resources (-): money, space, manpower, time • Added workload (-) <b>Societal:</b> • Need for evidence-based guidelines • Need for client information
Morgan et al. (2004)	(1) To assess practices of ObGyns regarding carrier screening for Cystic Fibrosis (2) PC cystic fibrosis carrier screening	Cross-sectional, quantitative	(1) USA (2) ObGyn practices	Self-administered questionnaire (not validated)	$n=632$ ObGyns; 42.4% female Age: $47.1y \pm 0.39$ Years in practice: / Years since residency: $15.4y \pm 0.38$	<b>Client:</b> • Attempting pregnancy (+) (descriptive result) • Health status: family history of CF, having partner who has CF or is known carrier (+) (descriptive result) • Client request (descriptive result) <b>Provider:</b> • More experience (+) • Profession/specialty: ObGyns > Gyns Only (+)

						<b>Organizational:</b> / <b>Societal:</b> /
Poppelaars et al. (2004)	(1) To determine the attitudes of potential providers towards PC cystic fibrosis carrier screening (2) PC cystic fibrosis carrier screening	Cross-sectional, quantitative	(1) the Netherlands (2) Community Health Service (CHS), General practice	Self-administered questionnaire (not validated)	<i>n</i> =215 GPs and CHS workers; 43% female Age: 45y (29–63) Years in practice: /	<b>Client:</b> / <b>Provider:</b> <ul style="list-style-type: none"> <li>High perceived severity of cystic fibrosis (+)</li> <li>being nonreligious compared to reformed (+)</li> <li>Low perceived barriers (+)</li> <li>High perceived test sensitivity (+)</li> </ul> <b>Organizational:</b> / <b>Societal:</b> /
Tough et al. (2004)	(1) To describe characteristics of physicians who recommend alcohol abstinence during pregnancy with regard to knowledge of FAS and PC counselling strategies (2) PC alcohol abstinence	Cross-sectional, quantitative	(1) Canada (2) Family practice, obstetrics/ gynaecology practices, midwifery nationwide	Self-administered questionnaire (not validated)	<i>n</i> =1090 ObGyns, family physicians and midwives; 51,8% female Age: / Years in practice: /	<b>Client:</b> <ul style="list-style-type: none"> <li>Perceived lack of client interest (-)</li> <li>Believing that clients are interested in discussing alcohol use (+)</li> </ul> <b>Provider:</b> <ul style="list-style-type: none"> <li>Profession/speciality: FamPhys (+) &gt; midwives and obstetricians</li> <li>Role: believing in having a role to manage clients in the area of alcohol use (+ -)</li> <li>Knowledge (+)</li> <li>Obtaining information from medical journals (+)</li> <li>Awareness: believing that there is solid information about alcohol use (+)</li> </ul> <b>Organizational:</b> / <b>Societal:</b> /
Morgan et al. (2006)	(1) To describe ObGyns' opinions of PCC (2) PCC in general	Cross-sectional, quantitative	(1) USA (2) ObGyn practices	Self-administered questionnaire (not validated)	<i>n</i> =579 ObGyns; 46.1% female Age: 47.3y ± 0.39 Years in practice: 15.22y ± 0.41	<b>Client:</b> <ul style="list-style-type: none"> <li>Frequency with which clients reportedly present for PCC (+)</li> </ul> <b>Provider:</b> <ul style="list-style-type: none"> <li>Opinions regarding PCC: defining PCC as routine (+) ⇔ defining PCC as specialized (-), agree that PCC is important/ positive/ high priority (+)</li> </ul> <b>Organizational:</b> / <b>Societal:</b> /
Tough et al. (2006)	(1) To determine the PC practices among ObGyns and family physicians in Canada (2) General PCC	Cross-sectional, quantitative	(1) Canada (2) Family practice, obstetrics & gynaecology nationwide	Self-administered questionnaire (not validated)	<i>n</i> =965 family physicians & ObGyns; 50.6% female Years in practice: / Years graduated: ≥22y: 27.4%, 12 – 21y: 31.6%, ≤11 y: 41.0%	<b>Client:</b> / <b>Provider:</b> <ul style="list-style-type: none"> <li>Profession/speciality: ObGyns (+) &gt; FamPhys for discussing Pap testing &amp; pregnancy related issues including folic acid, smoking, drug use, sexual abuse); FamPhys &gt; ObGyns to discuss mental health, depression, workplace stress</li> <li>Gender: female (+) &gt; male physicians to discuss 9 or more</li> </ul>

						PC and health promotion topics <b>Organizational:</b> / <b>Societal:</b> /
Williams et al. (2006)	(1) To assess healthcare providers knowledge and practices regarding FA use for neural tube defect prevention (2) PC FA use	Cross-sectional, quantitative	(1) USA (2) ObGyn and Fam/Gen practice settings	Telephone survey (not validated)	<i>n</i> =1111 physicians (ObGyns and Fam/Gen) and non-physicians (physician assistants, nurse practitioner, certified nurse midwives and registered nurses); 60% female <i>Age:</i> 76% <55y <i>Years in practice:</i> 39% over 20y in practice	<b>Client:</b> / <b>Provider:</b> <ul style="list-style-type: none"> <li>• Profession/speciality: providers in ObGyn settings (+) &gt; Fam/Gen settings; nurse practitioners in ObGyn setting (+) were most likely to talk about FA and fam/gen physicians least likely</li> <li>• Provider personally took multivitamin (+)</li> <li>• Lower income clients (+)</li> <li>• Practices consisted of at least 10% minorities (+)</li> <li>• Gender: female provider (+)</li> </ul> <b>Organizational:</b> / <b>Societal:</b> /
Tough et al. (2007)	(1) To examine if physician knowledge and practices related to FASD and its prevention vary based on the proportion of Native/Aboriginal patients served  (2) PC FASD prevention	Cross-sectional, quantitative	(1) Canada (2) Family practice, ObGyn practices, paediatrics nationwide	Self-administered questionnaire (not validated)	<i>n</i> =1700 ObGyns, family physicians, paediatrician; / <i>Age:</i> / <i>Years in practice:</i> /	<b>Client:</b> <ul style="list-style-type: none"> <li>• Ethnicity (+ -): physicians caring for a greater proportion of Native/Aboriginal clients were less likely to discuss folic acid, but more likely to routinely inquire about drinking prior to pregnancy awareness</li> </ul> <b>Provider:</b> / <b>Organizational:</b> <ul style="list-style-type: none"> <li>• Lack of time (-) (descriptive result)</li> <li>• Poorly formatted information (-) (descriptive result)</li> </ul> <b>Societal:</b> /
Abu-Hammad et al. (2008)	(1) To evaluate primary care physicians' knowledge and attitudes regarding FA supplementation for childbearing women (2) PC FA supplementation	Cross-sectional, quantitative	(1) Israel (2) The largest healthcare provider organization in Israel	Self-administered questionnaire (not validated)	<i>n</i> =87 primary care physicians; 61.5% <i>Age:</i> 47.3y ±7.8y <i>Years in practice:</i> 18.7y ±8.7	<b>Client:</b> <ul style="list-style-type: none"> <li>• Ethnicity: Jewish &gt; Bedouin (+ -)</li> </ul> <b>Provider:</b> <ul style="list-style-type: none"> <li>• Certification: uncertified &gt; board-certified (+ -)</li> </ul> <b>Organizational:</b> / <b>Societal:</b> /
McClaren et al. (2008)	(1) To explore perspectives of the Victorian community regarding carrier screening for cystic fibrosis prior to offering screening (2) PC genetic carrier screening for cystic fibrosis	Cross-sectional, qualitative	(1) Australia (2) GPs of practices in the local metropolitan Melbourne area, hospital, prenatal clinics, University of Melbourne	Semi-structured focus group interviews & individual interviews	<i>n</i> =12 health providers (midwives, social worker physiotherapists, genetic counsellor, obstetricians GPs); / <i>Age:</i> / <i>Years in practice:</i> /	<b>Client:</b> <ul style="list-style-type: none"> <li>• The potential psychosocial impact for clients: stigma and stress on relationships (-)</li> <li>• Not thinking about having children (-)</li> </ul> <b>Provider:</b> <ul style="list-style-type: none"> <li>• Personal attitude towards offering carrier screening to clients (+ -)</li> <li>• Having experience with discussing potential impact and acceptability of a screening programme for their clients (+)</li> </ul> <b>Organizational:</b> <ul style="list-style-type: none"> <li>• Time constraints already present in consultations (-)</li> </ul> <b>Societal:</b> /

Tough et al. (2008)	(1) To determine whether differences exist between rural and urban healthcare providers in knowledge of, attitudes about and awareness of FASD disorders and PC counselling (2) FASD prevention	Cross-sectional, quantitative	(1) Canada (2) Family practice, obstetrics & gynaecology, paediatrics, psychiatry, midwifery nationwide	Self-administered questionnaire (not validated)	<i>n</i> =2101 ObGyns, family physicians, psychiatrists paediatricians, midwives; 49.0% female Age: <40y: 31%, 40-49y: 34%, 50-57y: 25%, ≥60y: 10% Years in practice: / Years graduated: ≥42y: 2%; 22-41y: 39%; 12-21y: 31%; ≤11y: 28%	<b>Client:</b> / <b>Provider:</b> <ul style="list-style-type: none"> <li>Belief that clients already had good information on alcohol use (-) (descriptive result)</li> <li>Profession/speciality: urban providers were more likely to discuss folic acid (+) &gt; rural providers; no differences regarding other PC topics</li> </ul> <b>Organizational:</b> <ul style="list-style-type: none"> <li>Lack of time (-) (descriptive result)</li> <li>Information not in a useful format (-) (descriptive result)</li> </ul> <b>Societal:</b> /
Schwarz et al. (2009)	(1) To identify what primary care providers perceive as barriers to and potential facilitators of providing counselling to women of childbearing age when teratogenic medications are prescribed (2) Teratogenic medications	Cross-sectional, qualitative	(1) USA (2) 4 clinical settings in Pittsburgh, Pennsylvania	Focus group interviews	<i>n</i> =48 primary care providers (academic and community-based clinicians, pharmacists, nurses, physicians, clinical faculty and trainees); 88% female Age: 49y ± 9 Years in practice: /	<b>Client:</b> <ul style="list-style-type: none"> <li>Concern that clients anxiety related to information about teratogenic risk will lead to medication non-use (-)</li> <li>Women having difficulty of volunteering information about their pregnancy intention (-)</li> </ul> <b>Provider:</b> <ul style="list-style-type: none"> <li>Professional responsibility/role (+)</li> <li>Difficulty identifying clients' pregnancy intentions / not routinely asking clients' pregnancy intentions (-)</li> </ul> <b>Organizational:</b> <ul style="list-style-type: none"> <li>Limited clinical time &amp; competing medical priorities. Discussions about teratogenic risks of medication are complex, and thus, time consuming (-)</li> <li>Difficulty finding clinically relevant information on medications' teratogenicity (-)</li> <li>Assistance in identifying medications that pose teratogenic risks (+) (e.g. online references, computerized decision support)</li> <li>Assistance in identifying women's pregnancy intentions (+)</li> </ul> <b>Societal:</b> <ul style="list-style-type: none"> <li>Lack of reimbursement for time spent counselling (-)</li> <li>Access to educational materials for clients (+)</li> </ul>
Bonham et al. (2010)	(1) To assess the influence of patient characteristics on decisions to offer preconception genetic screening (2) PC genetic screening	Cross-sectional, quantitative	(1) USA (2) General practice	Self-administered questionnaire (not validated)	<i>n</i> =968 family physicians; 32.7% female Age: 45.6y Years in practice: / Years since residency completion: <5y: 19%, 5y-15y: 36%, >15y: 45%	<b>Client:</b> <ul style="list-style-type: none"> <li>Race: being black (+)</li> <li>Female gender (+) (black client)</li> <li>Age (+) (descriptive result)</li> </ul> <b>Provider:</b> <ul style="list-style-type: none"> <li>Work experience: completing residency less than 15 years earlier (+) (black client)</li> <li>Working in a university, teaching, or residency training environment (+) (black client)</li> </ul>

						<b>Organizational:</b> / <b>Societal:</b> /
Parker et al. (2010)	(1) To assess perceptions of the importance of PCC and factors affecting the willingness of STD counsellors to integrate PCC in STD clinics. (2) General PCC	Cross-sectional, quantitative	(1) USA (2) STD clinics	Self-administered questionnaire (not validated)	<i>n</i> =140 STD counsellors; / Age: / <i>Years in practice:</i> 2-5y: 21%, 6-10y: 48%, ≥ 10y: 31%	<b>Client:</b> / <b>Provider:</b> <ul style="list-style-type: none"> <li>• Good or excellent knowledge of PCC (+)</li> <li>• Higher level of responsibility (+)</li> <li>• More years of work experience (+)</li> <li>• Coming from areas with high levels of morbidity (+)</li> </ul> <b>Organizational:</b> / <b>Societal:</b> /
Mortagy et al. (2010)	(1) To explore the perspective of GPs and secondary care health professionals on the role of GPs in delivering PC to women with diabetes (2) General PC to women with diabetes	Cross-sectional, qualitative	(1) UK (2) Diverse set of GP practices and 1 London teaching hospital	Semi-structured interviews	<i>n</i> =15 GPs and secondary healthcare professionals; / Age: / <i>Years in practice:</i> /	<b>Client:</b> / <b>Provider:</b> <ul style="list-style-type: none"> <li>• Interest in diabetes care (+)</li> <li>• Professional responsibility/role: lack of a defined GP role in PCC (-)</li> <li>• Awareness through ongoing education and training (+)</li> </ul> <b>Organizational:</b> <ul style="list-style-type: none"> <li>• Lack of clear division of responsibility and -labour regarding diabetes care practices between primary and secondary care (-)</li> <li>• Practice protocols regarding PCC (+)</li> </ul> <b>Societal:</b> <ul style="list-style-type: none"> <li>• Lack of clear guidelines on how to provide PCC and when to make referrals (-)</li> <li>• Evidence-based information on PC benefits (+)</li> <li>• Access to client information leaflets (+)</li> </ul>
Burris et al. (2011)	(1) To determine whether medical providers order folic acid or folic acid-containing multivitamins for their non-pregnant female patients of childbearing age (2) PC FA and multivitamins	Cross-sectional, quantitative	(1) USA (2) Non-federally office based physician practice and non-federal hospitals	Analysis of data from two data sources NAMCS and NHAMCS	<i>n</i> =4634 preventive visits of non-pregnant women  Age: / <i>Years in practice:</i> /	<b>Client:</b> <ul style="list-style-type: none"> <li>• Age (+); women ages 30-34 &gt; women aged 15-19 or 40-44</li> <li>• Race/ethnicity (+): race other than white, black or Hispanic</li> <li>• Insurance status (+): Medicaid &gt; private insurance or other</li> </ul> <b>Provider:</b> <ul style="list-style-type: none"> <li>• Profession/speciality: (+): ObGyns &gt; non-ObGyns</li> </ul> <b>Organizational:</b> / <b>Societal:</b> /
Chuang et al. (2012)	(1) To examine primary care physicians' perceptions of barriers to preventive reproductive healthcare (2) General PCC	Cross-sectional, qualitative	(1) USA (2) Solo private practices and hospital-owned multispecialty groups in rural central Pennsylvania	Semi-structured telephone and face-to-face interviews	<i>n</i> =19 rural primary care physicians; 47.4% female Age: / <i>Years in practice:</i> 21y (1-38)	<b>Client</b> <ul style="list-style-type: none"> <li>• Not initiating discussions about pregnancy planning because of indifference to family planning (-)</li> </ul> <b>Provider:</b> <ul style="list-style-type: none"> <li>• Professional responsibility/role: belief that it is not the primary care physician's role to initiate and discuss pregnancy planning and PCC (-)</li> <li>• PCC is no priority (-)</li> </ul>

						<ul style="list-style-type: none"> <li>Feeling uncertain what they could offer (-)</li> </ul> <p><b>Organizational</b></p> <ul style="list-style-type: none"> <li>Lack of time (-)</li> <li>A lack of local specialists: lack of access to obstetricians with training in managing high-risk pregnancies who may assist PCC, or endocrinologists who may assist with management of diabetes (-)</li> </ul> <p><b>Societal</b></p> <ul style="list-style-type: none"> <li>Rural community norms (-): e.g. accepting unintended pregnancies, early childbearing, large families...</li> </ul>
Mazza et al. (2013)	(1) To examine the barriers and enablers to the delivery and uptake of PCC guidelines from GPs' perspective using theoretical domains related to behaviour change (2) General PCC	Cross-sectional, qualitative	(1) Australia (2) Diverse practice settings	Focus group interviews	n=22 GPs; 59.1% female Age: / Years in practice: /	<p><b>Client:</b></p> <ul style="list-style-type: none"> <li>Not presenting at PC stage (-): unaware of availability and importance of PCC (-)</li> <li>Not willing to spend more time and money for multiple consultations (-)</li> </ul> <p><b>Provider:</b></p> <ul style="list-style-type: none"> <li>Perception of having no opportunity to deliver PCC (-)</li> <li>Beliefs about effectiveness PCC: doubts regarding effectiveness of folic acid in preventing NTD's (-)</li> <li>Other competing preventive care priorities (believing in a potential increase in burden on clinics if the number of PCC consultations was increased (-)</li> </ul> <p><b>Organizational:</b></p> <ul style="list-style-type: none"> <li>Time limits on consultation (-)</li> <li>GP and client resources for PCC: Lack of resources (-); availability of PCC resources (e.g. checklists/ client brochures/ handouts/ waiting room posters) (+)</li> <li>Limited access to individual GPs (e.g. long waiting list) (-)</li> <li>Limited number of GPs willing to deliver PCC (-): potential delay for clients</li> <li>Potential burden on clinics if PCC consultations increased (-)</li> </ul> <p><b>Societal:</b></p> <ul style="list-style-type: none"> <li>Lack of GP &amp; client resources (e.g. evidence based websites) for PCC (-)</li> </ul>
Power et al. (2013)	(1) To assess barriers to and quality of preconception, prenatal and postnatal care for diabetic women by obstetrician-gynaecologists (2) General PCC	Cross-sectional, quantitative	(1) USA (2) Private group, private solo, academic, hospital-owned settings	Self-administered questionnaire (not validated)	n=510 ObGyns, / Age: / Years in practice: 17.5 ± 1.5 y.	<p><b>Client:</b></p> <ul style="list-style-type: none"> <li>Health status: if a client had diabetes, physicians were more likely to ask about pregnancy plans (+) (descriptive result)</li> <li>Active desire for children (+) (descriptive result)</li> </ul> <p><b>Provider:</b></p> <ul style="list-style-type: none"> <li>Profession/speciality: Maternal-foetal medicine specialist (+) &gt; non-Maternal-foetal medicine specialist</li> </ul> <p><b>Organizational:</b> /</p> <p><b>Societal:</b> /</p>



Stephenson et al. (2014)	(1) To assess the views and engagement of health professionals with PCC (2) General PCC	Cross-sectional, qualitative	(1) UK (2) All settings related to general practice, obstetrics & gynaecology, midwifery, sexual & reproductive health	Telephone interviews	<i>n</i> =21 consultants in ObGyn, midwives, GPs, community based consultants (or clinical leads) in sexual and reproductive health, sexual health specialist nurse; / Age: <30y: 28%, 30-34y: 41%, 35+y: 31% Years in practice: /	<b>Client:</b> <ul style="list-style-type: none"> <li>Unplanned pregnancies (-)</li> <li>Awareness (+)</li> </ul> <b>Provider:</b> <ul style="list-style-type: none"> <li>Professional responsibility/role: PCC is someone else's responsibility (-)</li> <li>Knowledge (+ -)</li> <li>Confidence (+)</li> <li>Lack of interest (-)</li> </ul> <b>Organizational: /</b> <b>Societal:</b> <ul style="list-style-type: none"> <li>Constrained resources (-)</li> <li>Financial incentives for delivery of PCC (+)</li> </ul>
Archibald et al. (2016)	(1) To explore stakeholder views about offering population-based genetic carrier screening for fragile X syndrome (2) PC genetic carrier screening for fragile X syndrome	Cross-sectional, qualitative	(1) Australia (2) /	Semi-structured interviews & focus groups	<i>n</i> =81 health providers (GPs, physiotherapists nurses, midwives, speech pathologists, ObGyns, psychologists, support workers, paediatricians, clinical geneticists and counsellors, medical scientists, occupational therapists); / Age: / Years in practice: /	<b>Client:</b> <ul style="list-style-type: none"> <li>Lack of knowledge and awareness (-)</li> <li>The potential to increase anxiety at a stressful time (-)</li> </ul> <b>Provider:</b> <ul style="list-style-type: none"> <li>Lack of knowledge and awareness (-)</li> <li>Support from healthcare providers (+)</li> </ul> <b>Organizational:</b> <ul style="list-style-type: none"> <li>Reduced time for decision-making (-)</li> <li>Limited reproductive options (-)</li> <li>Limited time available to provide pretest counselling (-)</li> <li>A selective approach to offering screening (-)</li> <li>Trained and qualified care providers to offer the test (+)</li> <li>Sufficient resources for managing test-positive results (+)</li> </ul> <b>Societal:</b> <ul style="list-style-type: none"> <li>Development of protocols and guidelines (+)</li> <li>Economic evaluations (+)</li> </ul>
Coll et al. (2016)	(1) Exploring knowledge, attitude and practices among healthcare providers regarding PCC, safer conception and pregnancy among HIV-infected women (2) PCC among HIV-infected women	Cross-sectional, qualitative	(1) USA (2) Urban South Florida – public and private hospitals	Key informant interviews	<i>n</i> =14 nurse practitioners physicians, physician assistants, and providing ObGyn and HIV care; / Age: / Years in practice: /	<b>Client:</b> <ul style="list-style-type: none"> <li>Lack of knowledge (-)</li> <li>Women do not bring up the topic due to stigmas surround HIV-infected women's desires for children (-) and unplanned pregnancy (-)</li> </ul> <b>Provider:</b> <ul style="list-style-type: none"> <li>Competing medical priorities (-)</li> <li>Failure to address fertility desires (-)</li> <li>Limited knowledge/understanding of PC issues (-)</li> </ul> <b>Organizational:</b> <ul style="list-style-type: none"> <li>Time constraints (-)</li> </ul>

						<ul style="list-style-type: none"> <li>Lack of provider resources for HIV-infected women (-)</li> </ul> <b>Societal:</b> /
McPhie et al. (2016)	<p>(1) To identify barriers to providing preconception weight management</p> <p>(2) PC weight management</p>	Cross-sectional, qualitative	<p>(1) Australia</p> <p>(2) /</p>	Semi-structured phone interview	<p><i>n</i>=20 health providers with expertise in maternal and child health (primary health practitioners, midwives, stakeholders working in health policy, healthcare management, preventive health); /</p> <p><i>Age:</i> /</p> <p><i>Years in practice:</i> /</p>	<b>Client:</b> <ul style="list-style-type: none"> <li>Lack of awareness of the importance of PC health and weight: especially women who are not planning on becoming pregnant (-)</li> <li>Unplanned pregnancies (-)</li> </ul> <b>Provider:</b> <ul style="list-style-type: none"> <li>Professional responsibility/role: conflicting ideas about who should be responsible for providing PCC (-)</li> <li>Sensitive nature of the topic (-)</li> <li>Lack of confidence to handle sensitive conversations (-)</li> <li>Limited access to women of childbearing age who plan to conceive: misconception about prevalence of unplanned pregnancies and impossible to determine which women will become pregnant and when (-)</li> </ul> <b>Organizational:</b> <ul style="list-style-type: none"> <li>No scope in their role or the current healthcare system (e.g. due to time constraints) (-)</li> </ul> <b>Societal:</b> <ul style="list-style-type: none"> <li>No scope in their role or the current healthcare system (e.g. due to time constraints) (-)</li> </ul>
Ojukwu et al. (2016)	<p>(1) To examine GPs knowledge, attitudes, and views towards preconception health and care in the general practice setting</p> <p>(2) General PCC</p>	Cross-sectional, qualitative	<p>(1) UK</p> <p>(2) General practices</p>	Individual semi-structured interviews	<p><i>N</i>=7 GPs; 42.8% female</p> <p><i>Age:</i> /</p> <p><i>years in practice:</i> 13.7y</p>	<b>Client:</b> <ul style="list-style-type: none"> <li>Lack of attendance for healthcare before pregnancy (-): unplanned pregnancies, ethnic populations</li> <li>Lack of knowledge (-)</li> <li>Lack of perceived need (-)</li> </ul> <b>Provider:</b> <ul style="list-style-type: none"> <li>Lack of motivation (-)</li> <li>'Nanny state' indicating personal behaviour (-)</li> </ul> <b>Organizational:</b> <ul style="list-style-type: none"> <li>Lack of time (-)</li> <li>Financial constraints (-)</li> </ul> <b>Societal:</b> /

van Voorst et al. (2016)	(1) To assess current activities, perceptions and prerequisites for delivery of PCC (2) General PCC	Cross-sectional, quantitative	(1) the Netherlands (2) primary care setting	Self-administered questionnaire (not validated)	<i>n</i> =699 GPs and midwives; 69.6% female Age: 41y (23–66) Years in practice: /	<p><b>Client:</b></p> <ul style="list-style-type: none"> <li>• Mentioning desire to become pregnant (+) (descriptive result)</li> <li>• After miscarriage (+) (descriptive result)</li> <li>• Apparent risk for adverse reproductive outcomes (+) (descriptive result)</li> <li>• Postnatal check-up (+) (midwives – descriptive result)</li> <li>• Prescription medication, discussing contraception and follow-up chronic disease (+) (GPs – descriptive result)</li> </ul> <p><b>Provider :</b></p> <ul style="list-style-type: none"> <li>• Profession/speciality: GPs (+) &gt; midwives in performing PCC consultation; midwives &gt; GPs in assessing PCC risk factors</li> <li>• Perceptions (-): PCC only for women with high risks, PCC medicalised preconception period, PCC without women asking for it was objectionable (descriptive results)</li> </ul> <p><b>Organizational: /</b> <b>Societal: /</b></p>
Fieldwick et al. (2017)	(1) To explore the knowledge and practice of GPs regarding PC and gestational weight management (2) PC weight management (in women having overweight, obesity or women who excess gestational weight gain)	Cross-sectional, mixed methods	(1) New Zealand (2) /	Self-administered questionnaire (not validated), consisting of closed-ended questions (quantitative) and an open question (qualitative)	<i>n</i> = 200 GPs; / Age: <30y: 2%, 30-39y: 26%, 40-49y: 23%, 50-59y: 35%, 60+y: 15% Years in practice: <4y: 11%, 4-9y: 20%, 10-15y: 17%, >15y: 52%	<p><b>Client:</b></p> <ul style="list-style-type: none"> <li>• Health status: GPs more often discuss weight management with overweight or obese women (+) (descriptive result); if women present preconception, it is often related to infertility (+)</li> <li>• Rarely presenting for PCC (-)</li> </ul> <p><b>Provider:</b></p> <ul style="list-style-type: none"> <li>• Lack of opportunity to provide PCC (-)</li> <li>• Lack of awareness: not knowing what PCC involves and the benefits of PC interventions in overweight and obese women (-)</li> </ul> <p><b>Organizational: /</b> <b>Societal: /</b></p>
M'hamdi et al. (2017)	(1) To examine healthcare professionals' views of their role and responsibilities in providing PCC and identify barriers that affect the delivery and uptake of PCC (2) General PCC	Cross-sectional, qualitative	(1) The Netherlands (2) One university hospital (specialists), GP and midwifery practices	Semi-structured interviews	<i>n</i> =20 midwives, GPs, specialists; / Age: / Years in practice: /	<p><b>Client:</b></p> <ul style="list-style-type: none"> <li>• Unfamiliarity with PCC (-)</li> <li>• Limited awareness about importance of PCC (-)</li> <li>• Low socioeconomic women are hardest to reach (-)</li> <li>• Not willing to invest time and effort (-)</li> </ul> <p><b>Provider:</b></p> <ul style="list-style-type: none"> <li>• Unfamiliarity with PCC (-)</li> <li>• Lack of knowledge of PCC (-)</li> <li>• Ethical barriers (-): tension between personal beliefs about pregnancy and the wellbeing of the future child on the one hand ⇔ the professional responsibility to provide the best</li> </ul>

						<p>care possible for clients while respecting the reproductive autonomy of the future parents on the other hand</p> <p><b>Organizational:</b></p> <ul style="list-style-type: none"> <li>• Time consuming (-): PCC is a new form of care, a substantial amount of risk factors should be addressed, competing preventive care which also needs to be delivered</li> <li>• Poor or lack of communication between different healthcare disciplines that offer PCC (-)</li> </ul> <p><b>Societal:</b></p> <ul style="list-style-type: none"> <li>• No financial compensation (-): lack of a fee in combination with labour intensiveness</li> </ul>
Poels et al. (2017)	(1) To identify bottlenecks and solutions for the delivery of PCC from a HC providers' perspective (2) General PCC	Cross-sectional, qualitative	(1) The Netherlands (2) /	Parallel group sessions	n=30 health providers (gynaecologists, midwives, preventive child healthcare, fertility specialists, maternity care, GPs, dietician, physiotherapists, patient advocacy, municipal policy officer; / <i>Age: /</i> <i>Years in practice: /</i>	<p><b>Client:</b></p> <ul style="list-style-type: none"> <li>• Lack of attendance for healthcare before pregnancy due to unawareness (-) and poor understanding of personal risks (-)</li> <li>• High-risk groups (low socioeconomic status, non-western ethnicity or living in deprived areas) due to ignorance, lack of self-knowledge and inadmissibility for PC information (-)</li> </ul> <p><b>Provider:</b></p> <ul style="list-style-type: none"> <li>• Role/responsibility: unclear who should be the entitled provider for PCC (-)</li> <li>• Profession/speciality: midwives less access to women with childbearing plans, but most willing to provide PCC; GPs have more access to women with childbearing plans, but less interested in providing PCC</li> <li>• Lack of awareness and knowledge (-)</li> <li>• Not being convinced of the importance, need, benefits and efficacy of PCC (-)</li> <li>• Lack of experience (-)</li> </ul> <p><b>Organizational:</b></p> <ul style="list-style-type: none"> <li>• Role/responsibility: unclear who should be the entitled provider for PCC (-)</li> <li>• PCC consults are time consuming (time constraints) (-)</li> <li>• Limited collaboration and referrals between healthcare providers with regard to PCC due to lack of awareness of PCC and existing tension between different healthcare disciplines (-)</li> </ul> <p><b>Societal:</b></p> <ul style="list-style-type: none"> <li>• Lack of tools/guidelines for PCC (-)</li> <li>• Lack of overview of collaboration partners (-)</li> <li>• Education: formal professional education on PCC falls short (midwives) (-)</li> <li>• Absence of a costing structure (financial constraints) (-)</li> </ul>

Bortolus et al. (2017)	(1) To investigate attitudes and behaviours of Italian women of childbearing age and healthcare professionals regarding preconception health (2) General PCC	Cross-sectional, qualitative	(1) Italy (2) Hospital setting	Focus group interviews	<i>n</i> =12 health providers with expertise in a mother and child health field (neonatal nurses, hospital midwives, ObGyns, paediatrician); 100% female <i>Age</i> : 38.4y (29-52) <i>Years in practice</i> : 13.9y (4-32)	<p><b>Client:</b></p> <ul style="list-style-type: none"> <li>• Not initiating discussions about preconception health (-)</li> </ul> <p><b>Provider:</b></p> <ul style="list-style-type: none"> <li>• Role/responsibility: unclear who should be the entitled provider for PCC (-)</li> </ul> <p><b>Organizational:</b></p> <ul style="list-style-type: none"> <li>• PCC consults are time consuming (time constraints) (-)</li> </ul> <p><b>Societal:</b> /</p>
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Abbreviations: PC: preconception; PCC: preconception care; CF: cystic fibrosis; FA: folic acid; fam/gen: family/general; FamPhys: family physician; FAS: foetal alcohol syndrome; FASD:

foetal alcohol spectrum disorders; GP: general practitioner; NTD: neural tube defects; ObGyns: obstetrician-gynaecologists; STD: sexually transmitted diseases.

All included research articles ( $n = 31$ ) were published in English between 2003 and 2017. This review discussed 17 quantitative studies (including 16 cross-sectional study designs (Abu-Hammad et al., 2008; Baars et al., 2004; Bonham et al., 2010; Burris et al., 2011; Heyes et al., 2004; Morgan et al., 2004; Morgan et al., 2006; Parker et al., 2010; Poppelaars et al., 2004; Power et al., 2013; Tough et al., 2007; Tough et al., 2004; Tough et al., 2008; Tough et al., 2006; van Voorst et al., 2016; Williams et al., 2006), one transverse correlational study design (Miranda et al., 2003), 13 qualitative studies (Archibald et al., 2016; Bortolus et al., 2017; Chuang et al., 2012; Coll et al., 2016; M'Hamdi et al., 2017; Mazza et al., 2013; McClaren et al., 2008; McPhie et al., 2016; Mortagy et al., 2010; Ojukwu et al., 2016; Poels et al., 2017; Schwarz et al., 2009; Stephenson et al., 2014), and one mixed method design (Fieldwick et al., 2017). The studies were conducted in a variety of settings, including general / university / public / private hospitals, private practices, and primary care settings in the field of obstetrics and gynaecology, paediatrics, midwifery, and family practice in particular. The majority of the studies were conducted in the USA ( $n = 10$ ) (Bonham et al., 2010; Burris et al., 2011; Chuang et al., 2012; Coll et al., 2016; Morgan et al., 2004; Morgan et al., 2006; Parker et al., 2010; Power et al., 2013; Schwarz et al., 2009; Williams et al., 2006), the Netherlands ( $n = 5$ ) (Baars et al., 2004; M'Hamdi et al., 2017; Poels et al., 2017; Poppelaars et al., 2004; van Voorst et al., 2016), Canada ( $n = 4$ ) (Tough et al., 2007; Tough et al., 2004; Tough et al., 2008; Tough et al., 2006), the UK ( $n = 4$ ) (Heyes et al., 2004; Mortagy et al., 2010; Ojukwu et al., 2016; Stephenson et al., 2014), and Australia ( $n = 4$ ) (Archibald et al., 2016; Mazza et al., 2013; McClaren et al., 2008; McPhie et al., 2016). Sample size, referring to the total number of healthcare providers included, ranged from small-scale studies ( $n = 7$ ) to large-scale studies ( $n = 2101$ ).

Thirteen publications focused on general PCC (Bortolus et al., 2017; Chuang et al., 2012; Heyes et al., 2004; M'Hamdi et al., 2017; Mazza et al., 2013; Morgan et al., 2006; Ojukwu et al., 2016; Parker et al., 2010; Poels et al., 2017; Power et al., 2013; Stephenson et al., 2014; Tough et al., 2006; van Voorst et al., 2016), six studies on preconception genetic screening (e.g. cystic fibrosis carrier screening, fragile X syndrome) (Archibald et al., 2016; Baars et al., 2004; Bonham et al., 2010; McClaren et al., 2008; Morgan et al., 2004; Poppelaars et al., 2004), four studies on preconception folic acid supplementation (and multivitamins) (Abu-Hammad et al., 2008; Burris et al., 2011;

Miranda et al., 2003; Williams et al., 2006), three studies on preconception alcohol use (e.g. abstinence, foetal alcohol spectrum disorder prevention) (Tough et al., 2007; Tough et al., 2004; Tough et al., 2008; Williams et al., 2006), one study on weight management (McPhie et al., 2016), and one study on teratogenic medications (Schwarz et al., 2009). Few publications focused on PCC in specific subpopulations e.g. women with diabetes (n = 1) (Mortagy et al., 2010), HIV-infected women (n = 1) (Coll et al., 2016), and women suffering from overweight or obesity (n = 1) (Fieldwick et al., 2017).

### ***Methodological quality of the studies included***

A summary of the quality assessment of the included quantitative studies is displayed in Supplementary file 1, in Supplementary file 2 for studies with a qualitative approach, and in Supplementary file 3 for mixed methods studies. In general, the overall methodological quality of the quantitative studies was weak to moderate. A considerable risk of selection bias was present in half of these studies. Five studies mentioned the potential influence of confounding factors (Baars et al., 2004; Bonham et al., 2010; Burris et al., 2011; Morgan et al., 2006; Tough et al., 2004). Data collection methods were evaluated as moderately valid and/or reliable in only two studies (Baars et al., 2004; Miranda et al., 2003). Few studies reported on power calculation (n = 4), and nine articles did not report on how they handled missing data (Baars et al., 2004; Heyes et al., 2004; Miranda et al., 2003; Morgan et al., 2004; Morgan et al., 2006; Poppelaars et al., 2004; Power et al., 2013; Tough et al., 2007; van Voorst et al., 2016). However, in all studies, the main results of statistical analysis were unambiguously reported, the statistical methods were appropriate, and the results-section reported on all outcomes measures mentioned in the method-section.

With regard to the qualitative studies, the articles generally showed good methodological quality. All qualitative studies had a clear statement of aims, an appropriate methodology and data collection, an appropriate recruitment strategy, a clear statement of findings, and were considered to be valuable research. Nevertheless, in one study (McPhie et al., 2016), the presence of an appropriate design could not be evaluated. Three articles did not sufficiently report on rigorousness of the data analysis (Bortolus et al., 2017; McClaren et al., 2008; Stephenson et al., 2014). Only two research articles

clearly considered the relationship between the researcher and the participants (McPhie et al., 2016; Poels et al., 2017). Ethical issues were inadequately discussed in four qualitative studies (Chuang et al., 2012; McClaren et al., 2008; Mortagy et al., 2010; Stephenson et al., 2014).

One article with a relevant mixed method design, integrating both qualitative and quantitative data, was included (Fieldwick et al., 2017). Nevertheless, the study inappropriately considered the limitations of this integration. The qualitative part was based on relevant data sources, and an adequate data analysis process. The relation between the findings and the context as well as the researchers' influence were, however, inadequately considered. The quantitative part was characterized by inappropriate measurements, and the absence of an acceptable response rate. The sampling strategy was found to be relevant, and the presence of a representative sample could not be evaluated.

#### ***Provider factors as facilitators or barriers to the provision of PCC***

Most provider facilitators and barriers were related to the *professional responsibility*. Being confused about who should (be the entitled provider to) deliver PCC was a frequently reported barrier (Bortolus et al., 2017; Chuang et al., 2012; Heyes et al., 2004; Mortagy et al., 2010; Poels et al., 2017; Stephenson et al., 2014; Tough et al., 2004). Conversely, the belief that having a responsibility in PCC facilitated the provision of PCC (Parker et al., 2010; Tough et al., 2004).

The intention to provide PCC appeared to depend on the HCPs' *profession or specialty*, although research findings were often inconsistent. HCPs in obstetrics and gynaecology (ob/gyn) practice settings, including obstetrician–gynaecologists (Burriss et al., 2011; Morgan et al., 2004; Williams et al., 2006), maternal-foetal medicine specialists (Power et al., 2013), and midwives (Poels et al., 2017) tended to be more involved in PCC compared with HCPs in non-ob/gyn practice settings such as gynaecologists only (Burriss et al., 2011; Morgan et al., 2004) and general practitioners (Poels et al., 2017; Williams et al., 2006). Some studies, however, observed a greater PCC–engagement among family physicians in comparison with midwives and obstetricians (Tough et al., 2004; van Voorst et al., 2016). In addition, the intention to provide PCC seemed to depend on which PCC aspect was dealt with. Obstetrician-gynaecologists seemed to discuss Pap testing and pregnancy related issues (including folic acid, smoking, drug use, sexual abuse) more frequently than family physicians, while



family physicians tended to handle mental health, depression, and workplace stress related topics more often (Tough et al., 2006). Midwives seemed to assess PCC risk factors more regularly compared with general practitioners (Poels et al., 2017). Moreover, nurse practitioners in ob/gyn settings were most likely to talk about folic acid while family physicians were least likely to discuss the topic (Williams et al., 2006).

Having good *knowledge on PCC* was also identified as one of the main facilitators to provide PCC (Archibald et al., 2016; Coll et al., 2016; M'Hamdi et al., 2017; Miranda et al., 2003; Parker et al., 2010; Poels et al., 2017; Stephenson et al., 2014; Tough et al., 2004). By contrast, lack of *awareness* of PCC and *unfamiliarity* with PCC (e.g. not knowing what PCC involves and what the benefits of PC interventions are) were identified as barriers to the provision of PCC (Archibald et al., 2016; Fieldwick et al., 2017; M'Hamdi et al., 2017; Poels et al., 2017).

Another influencing factor seemed to be a HCP's *personal attitude*; those considering PCC as a high priority more frequently provided PCC (Heyes et al., 2004; Morgan et al., 2006) than those having negative perceptions and not being convinced of the importance, need, benefits and efficacy of PCC (Chuang et al., 2012; Mazza et al., 2013; Poels et al., 2017; van Voorst et al., 2016). Perceiving PCC as specialized rather than routine care was also a barrier for the provision of PCC (Morgan et al., 2006). One study identified lack of motivation as a barrier (Ojukwu et al., 2016). Being interested or not might have a stimulating (Mortagy et al., 2010) or restraining influence (Stephenson et al., 2014) on the provision of PCC.

The HCP's *perception of having no opportunity to deliver PCC* was also found to be a considerable barrier for the provision of PCC (Fieldwick et al., 2017; Mazza et al., 2013). Some professionals experienced a limited access to women of childbearing age who plan to conceive (McPhie et al., 2016). *Competing priorities* (e.g. medical, preventive) might also discourage professionals to engage in PCC (Coll et al., 2016; Mazza et al., 2013).

Some studies cited *communication* problems as a barrier. HCPs might experience some difficulties in addressing the topic of pregnancy intentions or fertility desires (Coll et al., 2016; Schwarz et al., 2009), or did not routinely ask clients for it (Schwarz et al., 2009). The sensitive nature of the topic

also seemed to prevent professionals in beginning a PC-conversation with their clients (McPhie et al., 2016), which may be attended by a lack of *confidence* (McPhie et al., 2016). Having good or a lack of confidence (Chuang et al., 2012; Stephenson et al., 2014), as well as having more or less (years of *work*) *experience* in providing PCC (Bonham et al., 2010; McClaren et al., 2008; Morgan et al., 2004; Poels et al., 2017) were also found to be either a facilitator or barrier. Moreover, lack of training seemed to hamper HCPs (Heyes et al., 2004).

Several articles mentioned that a HCP's *workplace* influences the provision of PCC; those working in a university, teaching, or residency training environment (Bonham et al., 2010), and coming from areas with high levels of morbidity (Parker et al., 2010) were more likely to engage in PCC. Urban providers tended to discuss folic acid more often than providers in rural areas (Tough et al., 2008). Another facilitating factor was having *clients of high risk groups*; healthcare providers seeing lower income clients, and whose practice consisted of at least 10% minorities tended to be more inclined to provide PCC (Williams et al., 2006). Two studies found a positive association between *female* professionals and the provision of PCC (Heyes et al., 2004; Tough et al., 2006).

The following facilitating HCP factors were mentioned in only one study: provider who personally took multivitamin (Williams et al., 2006); being nonreligious compared to reformed (Poppelaars et al., 2004); obtaining information from medical journals (Tough et al., 2004); support from other healthcare providers (Archibald et al., 2016); and being uncertified (Abu-Hammad et al., 2008). Experiencing ethical barriers (M'Hamdi et al., 2017) was considered to be an additional barrier related to the provision of PCC.

#### ***Client factors as facilitators or barriers to the provision of PCC***

A total of 14 studies identified *contact with clients only after conception* as the main barrier for HCPs to deliver PCC. This implies clients who do not present (whether consciously or not e.g. due to being unaware of availability and importance of PCC) at preconception stage (Fieldwick et al., 2017; Mazza et al., 2013; Ojukwu et al., 2016; Poels et al., 2017), and those having unplanned pregnancies (Coll et al., 2016; Heyes et al., 2004; McPhie et al., 2016; Ojukwu et al., 2016; Stephenson et al., 2014). The aforementioned barrier also implies communication difficulties; the perception that clients are not

thinking about having children (McClaren et al., 2008) or do not (want to) initiate discussions about pregnancy planning or preconception health, dissuaded HCPs from providing PCC (Bortolus et al., 2017; Chuang et al., 2012; Heyes et al., 2004; Schwarz et al., 2009). By contrast, client request (Morgan, 2004, Morgan et al., 2006), and mentioning the desire to become pregnant (Morgan et al., 2004; Power et al., 2013; van Voorst et al., 2016) incited HCPs to offer PCC.

Several barriers related to the *client's personal attitude*, seemed to negatively influence the degree to which HCPs are willing to provide PCC, including clients who are not willing to invest time, money, and effort in preconception consultations (M'Hamdi et al., 2017; Mazza et al., 2013), not interested in discussing PCC-related topics (Tough et al., 2004), perceiving PCC as less needed (Ojukwu et al., 2016) or important (Heyes et al., 2004), and less attending for healthcare before pregnancy due to poor understanding of personal risks (Poels et al., 2017).

The client's *lack of knowledge on PCC* was considered as another impeding factor (Archibald et al., 2016; Coll et al., 2016; Ojukwu et al., 2016). Healthcare providers also seemed to be susceptible to the extent to which clients are *aware of PCC* or otherwise. While awareness can be seen as a facilitating factor (Stephenson et al., 2014), the client's lack of or limited awareness about the availability and importance of PCC were identified as discouraging factors in the provision of PCC (Archibald et al., 2016; M'Hamdi et al., 2017; Mazza et al., 2013; McPhie et al., 2016; Poels et al., 2017).

Furthermore, HCPs mentioned the negative influence of the *client's status*, especially those belonging to high risk groups (e.g. low socioeconomic status, living in deprived areas) (M'Hamdi et al., 2017). Those clients might be hardest to reach due to lack of self-knowledge, ignorance, and inadmissibility for preconception information (M'Hamdi et al., 2017; Poels et al., 2017). The client's ethnicity or race might either hamper or stimulate HCPs to provide PCC. Healthcare providers were more likely to discuss preconception-related topics if their clients were Jewish (Abu-Hammad et al., 2008), if the client's race was black (Bonham et al., 2010), or other than white, black or Hispanic (Burriss et al., 2011). Physicians caring for Indigenous clients were more likely to inform their clients about drinking prior to pregnancy (Tough et al., 2007). One study identified a non-western ethnicity as a possible barrier for HCPs (Poels et al., 2017).

Several studies named the *potential psychosocial impact for clients* as a discouraging factor for HCPs to provide PCC, including the potential to increase anxiety (related to specific information, e.g. teratogenic risk of certain medications) (Archibald et al., 2016; Schwarz et al., 2009), as well as the potential to cause stress on relationships (McClaren et al., 2008). Existing stigmas among clients might also hamper HCPs to initiate PCC (Coll et al., 2016; McClaren et al., 2008). However, other articles found that the client's *health status* may trigger HCPs to discuss PCC-related topics. A family history of cystic fibrosis, having a partner who has cystic fibrosis or is a known carrier (Morgan et al., 2004), suffering from diabetes (Power et al., 2013) or a chronic disease (van Voorst et al., 2016), having experienced a miscarriage (van Voorst et al., 2016), having infertility problems (Fieldwick et al., 2017), taking medicines (e.g. contraception) (van Voorst et al., 2016), or having overweight or obesity (Fieldwick et al., 2017) were mentioned as facilitating factors.

The following facilitating client factors were mentioned in only one or two studies: the client's insurance status (Burris et al., 2011), gender (i.e. female clients) (Bonham et al., 2010), and age (Bonham et al., 2010; Burris et al., 2011).

#### ***Organizational factors as facilitators or barriers to the provision of PCC***

The main organizational factors were related to *resources*. Especially lack of time was found to be a major barrier for HCPs to provide PCC (Archibald et al., 2016; Bortolus et al., 2017; Chuang et al., 2012; Coll et al., 2016; Heyes et al., 2004; M'Hamdi et al., 2017; Mazza et al., 2013; McClaren et al., 2008; McPhie et al., 2016; Ojukwu et al., 2016; Poels et al., 2017; Schwarz et al., 2009; Tough et al., 2007; Tough et al., 2008). Those time constraints refer to e.g. the decision-making process (Archibald et al., 2016), the provision of pretest counselling (Archibald et al., 2016), and other competing preventive care which also needs to be delivered (M'Hamdi et al., 2017). HCPs in the study of McPhie et al. (2016) considered limited available time as the reason why there is no scope for PCC in both their role and the current healthcare system. Other resource-related barriers were lack of money (Heyes et al., 2004; Ojukwu et al., 2016), lack of space (Heyes, 2004), lack of client / provider resources for PCC (Coll et al., 2016; Mazza et al., 2013), and lack of manpower (Heyes et al., 2004). The latter includes a limited number of general practitioners (willing) to deliver PCC (Mazza et al.,

2013), and a lack of (access to) local specialists or general practitioners (e.g. long waiting list) (Chuang et al., 2012; Mazza et al., 2013). Conversely, the availability of PCC resources (e.g. checklists, client brochures, handouts, waiting room posters), as well as trained and qualified care providers were identified as organizational facilitators (Archibald et al., 2016; Mazza et al., 2013; Schwarz et al., 2009).

HCPs tended to be less inclined to provide PCC if there was poorly formatted *information* (Tough et al., 2007; Tough et al., 2008), or if they experienced difficulties in finding clinically relevant information (e.g. on medications' teratogenicity) (Schwarz et al., 2009). Disposing of the necessary aids regarding PCC (e.g. online references, computerized decision support, practice protocols), however, stimulated HCPs to engage in PCC (Mortagy et al., 2010; Schwarz et al., 2009).

Besides the potential negative influence of resource- and information-related factors, a lack of clear division of *responsibility* concerning PCC was regarded as another barrier; some HCPs still found it unclear who should be the entitled provider for PCC (Mortagy et al., 2010; Poels et al., 2017). HCPs also mentioned that PCC (consultations) might cause *burden* on organizational level owing to e.g. an added workload (Heyes et al., 2004; Mazza et al., 2013).

Only Baars et al. (2004) identified the provision of genetic counselling in an HCP's own practice as an facilitating factor on organizational level. Limited reproductive options, a selective approach to offering screening (Archibald et al., 2016), limited collaboration and referrals between HCPs regarding PCC, and existing tension between different healthcare disciplines (Poels et al., 2017) were identified once as organizational factors that discourage HCPs to provide PCC.

### ***Societal factors as facilitators or barriers to the provision of PCC***

Societal barriers and facilitators were particularly related to the *availability of resources, guidelines, and reimbursement*. The degree to which HCPs are triggered to deliver PCC seemed to depend on having access to educational materials for clients (e.g. information leaflets) and professional resources (e.g. evidence based websites) or not (Mazza et al., 2013; Mortagy et al., 2010; Schwarz et al., 2009; Stephenson et al., 2014). HCPs need a society in which client information and evidence-based guidelines for PCC are available (Heyes et al., 2004; Mortagy et al., 2010) and being developed

(Archibald et al., 2016). A lack of PCC-related tools and guidelines were seen as discouraging factors to provide PCC (Mortagy et al., 2010; Poels et al., 2017). Being reluctant to provide PCC can also be attributed to financial constraints, including the absence of a costing structure (Poels et al., 2017), and the lack of a financial compensation for PCC (M'Hamdi et al., 2017; Schwarz et al., 2009). A society that equips financial incentives, by contrast, might entice HCPs into providing PCC to their clients (Stephenson et al., 2014). In the study of Archibald et al. (2016) HCPs also identified the performance of economic evaluations of PCC as a facilitating factor.

The following additional societal barriers were mentioned in only one study: rural community norms (e.g. accepting early childbearing, unintended pregnancies) (Chuang et al., 2012), poor or lack of communication between different healthcare disciplines that offer PCC (M'Hamdi et al., 2017), lack of formal professional education on PCC (Poels et al., 2017), lack of overview of collaboration partners (Poels et al., 2017), and the organization of the current healthcare system (e.g. time constraints) (McPhie et al., 2016).

## **DISCUSSION**

The aim of this review was to provide an overview of barriers and facilitators that could influence the provision of PCC by HCPs. Thirty-one studies were included in this review. Findings of this review suggest that the provision of PCC is influenced by several client, provider, organizational, and societal factors. Most of the factors influencing the provision of PCC were identified as barriers, which might explain why the provision of PCC is low. The majority of the reported barriers were situated at client level (e.g. not contacting a HCP in the preconception stage, negative attitude and lack of knowledge of PCC), and HCP level (e.g. unfavourable attitude and lack of knowledge of PCC, not working in the field of obstetrics and gynaecology, and lack of clarity on the responsibility for the provision of PCC). The aforementioned barrier was one of the most reported barriers in the provision of PCC (Bortolus et al., 2017; Chuang et al., 2012; Heyes et al., 2004; M'Hamdi et al., 2017; McPhie et al., 2016; Mortagy et al., 2010; Poels et al., 2017; Schwarz et al., 2009; Stephenson et al., 2014, Tough et al., 2004). Several studies found that HCPs perceive PCC as the responsibility of other HCPs rather than their

own responsibility. This lack of clarity of responsibility can be explained by the fact that PCC is still an emerging topic. In 2006, the Centers for Disease Control and Prevention (CDC) were one of the first to develop recommendations to improve preconception health and care (Johnson et al., 2006). Since then, more attention has been given to PCC with an increased research activity and development of national and global guidelines (Jack et al., 2008; Shawe et al., 2014; World Health Organization, 2012). However, there is still a lack of clarity regarding who should provide PCC. Most studies and guidelines recommend a shared responsibility between all healthcare providers who have contact with women, from obstetricians/gynaecologists to general practitioners, paediatricians, family practice physicians, midwives, nurses, (advanced) midwife/nurse practitioners, and so on, which may reduce the sense of individual responsibility and efforts (Johnson et al., 2006, Shawe et al., 2014).

Another frequently reported barrier was the lack of client initiative in the preconception stage to discuss pregnancy planning or preconception health due to unplanned pregnancies and lack of awareness (Bortolus et al., 2017; Chuang et al., 2012; Coll et al., 2016; Fieldwick et al., 2017; Heyes et al., 2004; Mazza et al., 2013; McPhie et al., 2016; Morgan et al., 2004; Ojukwu et al., 2016; Poels et al., 2017; Schwarz et al., 2009; Stephenson et al., 2014; van Voorst et al., 2016). The perception of women as main initiators of a dialogue about pregnancy planning and preconception health may result from the belief that PCC is the responsibility of others, including women's responsibility (Goossens et al., 2014). Another explanation is that HCPs hesitate to pose personal questions about women's reproductive plans because they believe these questions are sensitive or embarrassing. Yet, literature suggests that the majority of clients appreciate a discussion about their reproductive plans and health (Stern et al., 2013). In addition, the research of Wendt and colleagues suggests that women may experience difficulties in raising a conversation about sexual health issues themselves, and therefore, would find it easier if a HCP would initiate a dialogue about these matters (Wendt et al., 2007).

Limited resources were frequently reported barriers at the organizational and societal level. At the organizational level, lack of time was found to be a major barrier for the provision of PCC. Previous research also identified lack of time and heavy workload as one of the most important factors that prevented HCPs from providing health promotion and prevention (Luquis and Paz, 2015). A study in six European countries found that mean consultation length in general practices was 10.7 minutes

(Deveugele et al., 2002). Given the restricted amount of time, the opportunities to discuss preconception health promotion may be limited, as physicians need to spend their time discussing more urgent care issues. A possible solution to lack of physician time is to use a team-based PCC approach in which midwives and nurses, and health educators are responsible for general preconception health promotion, and advanced nurse/midwife practitioners and physicians address the more complicated cases.

Lack of reimbursement for PCC, tools and guidelines were the main societal barriers for the provision of PCC. These barriers were also frequently reported in other studies on factors influencing the provision of preventive health services and health promotion (Luquis and Paz, 2015). Clear evidence-based guidelines, and education materials and tools might support the provision of PCC .

This systematic review has some limitations. First, a number of methodological issues and potential biases were identified in the included studies. More than half of the quantitative studies had a considerable risk of selection bias due to low response rates (Bonham et al., 2010; Fieldwick et al., 2017; Tough et al., 2007; Tough et al., 2004; Tough et al., 2008; Tough et al., 2006; van Voorst et al., 2016) and convenience sampling (Miranda et al., 2003). Furthermore, only two quantitative studies used a validated and reliable data collection method (Baars et al., 2004; Miranda et al., 2003) , and only Morgan et al. (2004, 2006) and Tough et al. (2006, 2008) performed a sample size or power calculation. Some of the qualitative studies had a relatively small and heterogeneous sample of HCPs (Bortolus et al., 2017; Coll et al., 2016; Mortagy et al., 2010; Ojukwu et al., 2016), and a rather short interview duration (Coll et al., 2016; McPhie et al., 2016). In addition, the authors critically considered their role as researcher and the potential bias and influence during the data collection in only two qualitative studies (McPhie et al., 2016; Poels et al., 2017). The aforementioned methodological concerns may affect the validity of the study findings. Second, physicians (e.g. GPs and obstetricians-gynaecologist) were overrepresented in this review with 14 studies focusing on physicians only (Abu-Hammad et al., 2008; Baars et al., 2004; Bonham et al., 2010; Burris et al., 2011; Chuang et al., 2012; Fieldwick et al., 2017; Mazza et al., 2013; Miranda et al., 2003; Morgan et al., 2004; Morgan et al., 2006; Ojukwu et al., 2016; Power et al., 2013; Tough et al., 2007, Tough et al., 2006), and 16 studies



included both physicians and non-physicians healthcare providers (e.g. midwives and nurses) (Archibald et al., 2016; Bortolus et al., 2017; Coll et al., 2016; Heyes et al., 2004; M'Hamdi et al., 2017; McClaren et al., 2008; McPhie et al., 2016; Mortagy et al., 2010; Poels et al., 2017; Poppelaars et al., 2004; Schwarz et al., 2009; Stephenson et al., 2014; Tough et al., 2004; Tough et al., 2008; van Voorst et al., 2016; Williams et al., 2006). Because most findings relate to physicians, findings might be less generalizable to non-physician healthcare providers including midwives and nurses. It is possible that nurses and midwives experience other barriers and facilitators influencing the provision of preconception care. In addition, due to heterogeneity in study characteristics, including content of PCC (PCC in general or a specific care domain), target population (general population or subgroups of the population), study country, and healthcare setting, findings may be less generalizable to a broader context. Third, this heterogeneity in methodology and content of PCC made it impossible to perform a meta-analysis, which would have allowed us to learn more about associated factors of the provision of PCC. Finally, we did not search for grey literature. Therefore, it is possible that some studies might have been missed due to publication bias.

To overcome the different client, provider, organizational, and societal barriers, it is necessary to develop and implement multilevel interventions (Eldredge et al., 2016). At the client level, developing and implementing preconception mass media campaigns with e.g. posters, leaflets, TV spots, mobile applications, and evidence-based websites could improve people's attitude, awareness, and knowledge about preconception health (Poels et al., 2017; Toivonen et al., 2017). However, this does not guarantee a preconception lifestyle change (Delissaint and McKyer, 2011; Toivonen et al., 2017). Therefore, it is important to gain insight in which determinants are associated with the intention to prepare for pregnancy (Toivonen et al., 2017). The study of intentions to prepare for pregnancy may also be more enlightening than measuring knowledge or attitude alone to assess the effectiveness of a preconception campaign (Toivonen et al., 2017). In addition, most preconception interventions focus on women only (Toivonen et al., 2017). Yet, preconception health is considered as a shared responsibility between women and men, therefore, future research should target both future parents (Toivonen et al., 2017). At provider level, there is a need to define the role and responsibility of the

different HCPs in providing PCC. A team-based PCC approach with general PCC provided by nurses and midwives, and specialized individual PCC provided by advanced nurse/midwife practitioners and physicians should be further explored. In addition, further research should be undertaken to investigate barriers and enablers to provide PCC among non-physician HCPs (e.g. midwives, nurses, health educators) as none of the included studies focused solely on factors influencing the provision of PCC by these HCPs. At organizational level, our findings suggest that the development of education materials and tools could facilitate the provision of PCC. The Reproductive Life Plan (RLP), a tool for reproductive health promotion across the life span, might be a feasible tool for promoting reproductive and preconception health in primary care settings, such as student health centres, STD clinics, and community health centres (Stern et al., 2013). Preconception interventions should also be delivered through non-medical channels, for example, through school-based education programs. By integrating preconception health and care in existing sexual health education, the vast majority of the population could be reached. At societal level, the provision of preconception care can be encouraged by developing clear evidence-based guidelines and reimbursing PCC.

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### **Contribution of the Paper**

#### **What is already known about the topic?**

- Healthcare providers play an important role in the uptake of preconception care.
- The provision of preconception care is low and offered on an ad hoc basis.

#### **What this paper adds?**

- There are several barriers and facilitators at client, provider, organizational, and societal level that influence the provision of preconception care by healthcare providers.
- Most barriers were situated at client and provider level.

- Lack of clarity on the responsibility for the provision of PCC was one of the most reported barriers in the provision of PCC.

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