Review Article

Social determinants of iron supplementation among women of reproductive age: a systematic review of qualitative data

Jason M. Nagata*, Lisa R. Gatti[†] and Frances K. Barg^{‡§}

*School of Medicine, University of California, San Francisco, California, USA, [†]School of Nursing, [‡]Department of Family Medicine and Community Health, and [§]Department of Anthropology, University of Pennsylvania, Philadelphia, Pennsylvania, USA

Abstract

Iron supplementation for women of reproductive age is a main part of an interdisciplinary strategy recommended for the control and prevention of iron deficiency and the treatment of mild-to-moderate iron-deficiency anaemia. This systematic review reports the findings from a meta-synthesis of qualitative data concerning the experiences and perceptions of iron supplementation among women of reproductive age and health service providers worldwide. Qualitative systematic review methods were used to conduct a search of published literature, define inclusion and exclusion criteria, appraise quality of studies and extract data on the use of iron supplementation among women of reproductive age. Coding, thematic analysis, reciprocal translation and line of argument synthesis were used to synthesize data. Twelve studies spanning 17 countries met inclusion criteria and were included in the analysis. Seven domains emerged from the review: cultural norms and societal values including explanatory models and medical pluralism; political and socio-economic circumstances; education and communication; social organization and social relationships; health care access and supplement supply; food and nutrition availability; and adherence. In addition, 16 sub-domains are highlighted. Connecting review findings to a conceptual framework of social determinants of health highlights salient issues that policy makers must consider when adapting global iron supplementation recommendations to the local context.

Keywords: systematic review, qualitative methods, iron, maternal nutrition, anaemia, social determinants of health.

Correspondence: Jason M. Nagata, School of Medicine, University of California, San Francisco, CA 94122, USA. E-mail: jason.nagata@ucsf.edu

Background

Iron deficiency, defined as a state in which there is insufficient iron to maintain the normal physiological function of tissues such as the blood, brain and muscles, is the most widespread nutritional disorder in the world, affecting more people globally than any other condition (WHO 2007; Milman 2011; WHO 2011). Iron deficiency is the most significant contributor to anaemia, defined as insufficient mass of red blood cells circulating in the blood or haemoglobin levels below established thresholds (WHO 2007).

Anaemia affects an estimated 1.55 billion people worldwide (Milman 2011). Additional causes of anaemia include acute and chronic infections causing inflammation, inherited conditions that affect red blood cells such as thalassaemia, and deficiencies of other micronutrients including folate, vitamin B12 and vitamin A (WHO 2011). Commonly used indicators for iron status include haemoglobin concentration, mean cell volume, serum transferrin receptor, serum ferritin and zinc protoporphyrin (WHO 2007). Anaemia particularly affects women of reproductive age, as the prevalence of anaemia is estimated to be

47.4% among pregnant women and 30.2% in non-pregnant women globally (de Benoist *et al.* 2008).

During pregnancy, women are at greater risk for iron-deficiency anaemia because their blood volume increases substantially and they begin to transfer iron to the fetus (Allen 2000). Between the 12th and 25th week of gestation, serum ferritin falls likely because of expansion of maternal red blood cell mass (Allen 2000). After week 30 of gestation, during the time of peak efficiency of maternal iron absorption, most of the maternal iron transfer to the fetus occurs (Allen 2000). Iron deficiency during pregnancy can persist through lactation, although it may be partially alleviated because of lactational amenorrhoea (Viteri 1994). However, when menstruation returns, iron requirements increase if lactation continues (Viteri 1994).

Severe anaemia during pregnancy has been shown to be associated with higher mortality, possibly because of a greater susceptibility to haemorrhage (Allen 2000; Stoltzfus 2001; Kavle *et al.* 2008). Consequences of iron-deficiency anaemia include diminished intellectual and productive capacity (Hunt 2002) and a potential increase in susceptibility to infections among children and adults (Oppenheimer 2001).

Iron supplementation is the most common strategy currently used to control iron deficiency and iron-deficiency anaemia in developing countries (WHO 2001). Other interventions include iron fortification, health and nutrition education, control of helminth infections and improvement of sanitation (Peña-Rosas & Viteri 2006).

Some international organizations have advocated for the use of routine daily iron and folic acid supple-

mentation among pregnant women in areas of high anaemia prevalence (Beard 2000) at a dosage of 60 mg if supplementation for over 6 months is possible and at 120 mg if the duration of supplementation is shorter (International Nutritional Anemia Consultative Group 1998). In addition, less frequent regimens such as weekly or twice weekly supplementation have been evaluated in the last decade (Viteri 1997). Among women of reproductive age, weekly iron-folic acid supplementation (WIFS) is recommended as an efficient preventive approach in public health programmes. It is thought to be more sustainable over extended time periods, operationally easier to manage at the community level and may contain less prominent side effects (Viteri *et al.* 1995; Viteri 1996). A World Health Organization (WHO) Global Expert Consultation on WIFS was convened in 2007 and concluded that where the prevalence of anaemia is above 20% among women of reproductive age and mass fortification programmes of staple foods are unlikely to be implemented within 1–2 years, WIFS should be considered as a strategy for the prevention of iron deficiency among non-pregnant women of reproductive age (WHO 2009). However, weekly doses are not recommended for pregnant women because they are not as efficacious as a daily dose (Beaton & McCabe 1999).

A Cochrane systematic review on the effects of routine oral iron supplementation among pregnant women concluded that this intervention was effective to reduce the risk of anaemia at term. The review also concluded that there was insufficient evidence to determine with confidence if routine daily or intermittent iron supplementation or WIFS improved

Key messages

- Iron supplementation programmes should address social determinants of health.
- Having a government policy statement regarding iron supplementation facilitates its implementation.
- Iron supplementation programmes should communicate and collaborate with traditional, complementary and alternative medical systems.
- The price of supplements should be suitable for the specific economic context.
- Social marketing and mobilization of social networks can be employed to promote iron supplementation programmes in innovative ways.
- Physical properties, dosing and side effects of the iron supplements all influence adherence.
- Inadequate supplies are often the most significant barriers to access of iron supplements globally.

functional and health outcomes for women and their babies (Peña-Rosas & Viteri 2006). The lack of evidence may be due to the lack of randomized controlled trials evaluating iron supplementation among pregnant women, which would pose ethical challenges. Among non-pregnant women of reproductive age, WIFS has been shown to demonstrate significant decreases in iron deficiency and iron-deficiency anaemia (Cavalli-Sforza *et al.* 2005).

Evidence from qualitative studies examining the experience of those involved in providing and receiving interventions, as well as studies evaluating factors that shape the implementation of interventions, can improve the relevance and scope of systematic reviews to policy makers and practitioners (Noyes & Popay 2007; Higgins & Green 2008). Although the importance of qualitative research has been increasingly recognized in the health science and practice disciplines in general, there has been a relative inattention to synthesizing and integrating qualitative findings, and this has specifically been the case with the topic of iron supplementation (Sandelowski *et al.* 1997; Atkins *et al.* 2008). This article seeks to synthesize qualitative data from published studies addressing this topic to facilitate the use of this information and help inform future efforts in both policy and practice.

Recent work on the social determinants of health, or the underlying social, cultural, political and economic factors that may lead to health inequalities, provides a means for situating the findings from qualitative review into a conceptual framework useful for policy making (WHO 2008; Solar & Irwin 2009). In particular, the political economy, societal and cultural values and epidemiological conditions are all determinants that policy makers must consider when adapting global recommendations to public health programmes. To aid with the clarity and utility of our findings, we discuss how these determinants are related to iron supplementation for women of reproductive age and make recommendations for how this framework can be used in future work in this area.

Methods

We followed the guidelines in the Cochrane Handbook for Systematic Reviews to conduct a systematic

and integrative review (Higgins & Green 2008) to synthesize published research and integrate existing qualitative data on iron supplementation for women of reproductive age (Noblit & Hare 1988; Atkins *et al.* 2008). We employed meta-ethnography (Noblit & Hare 1988) and meta-synthesis (Sandelowski *et al.* 1997) frameworks, which are used increasingly in health care research (Noyes & Popay 2007; Al-Janabi *et al.* 2008; Malpass *et al.* 2009). We divided this work in three stages: systematic search, critical appraisal and synthesis using techniques of meta-ethnography and meta-synthesis.

Systematic search

We conducted a systematic search of the literature using keyword and subject heading searches in four electronic databases: Medline (1966–2009), Excerpta Medica Database (EMBASE) (1988–2009), Cumulative Index to Nursing and Allied Health Literature (CINAHL) (1982–2009) and Psychological Information Database (PsycINFO) (1972–2009) with advice from researchers and experts in the field and citation tracking. The search terms listed in the supplementary online material were combined with the Boolean logic terms ‘or’ and ‘and’. The reference lists and other articles that cited all potentially relevant papers were examined and read to find additional articles relevant to the review (Noyes & Popay 2007) (Supporting Information Table S1).

Inclusion and exclusion criteria

The database search produced 1401 abstracts. Studies that captured qualitative data including stand-alone qualitative studies and those which collected qualitative data as part of a larger multi-method study were included. The first author screened all titles and abstracts and the third author screened a subset. We included papers that were relevant to the following questions which guided the review: ‘what does qualitative research tell us about the facilitators and barriers to accessing and adhering to iron supplementation among women of reproductive age?’ and ‘what does qualitative research tell us about experiences and perceptions of iron supplementation among

women of reproductive age and health service providers?' Papers were only excluded if they did not contribute to these questions. The most common reasons for exclusion were that the study did not include qualitative data or that it was not focused on women of reproductive age.

Quality appraisal

Because of the lack of consensus in the literature concerning the use of critical appraisal of qualitative research (Barbour 2001), we made an *a priori* decision to appraise studies but not exclude any due to a strict quality rating scheme (Noyes & Popay 2007; Atkins *et al.* 2008). Other meta-syntheses have not found substantial differences in quality of the studies deemed weaker by many quality appraisal criteria (Noyes & Popay 2007; Atkins *et al.* 2008; Malpass *et al.* 2009). Quality assessment was based on an adapted version of the Critical Appraisal Skills Programme to review components that were salient for the purpose of meta-synthesis [Critical Appraisal Skills Programme (CASP) 2002, Atkins *et al.* 2008].

Data extraction and synthesis

Our framework for data extraction included two themes: (1) information about the study focus and methods; and (2) thematic findings illuminating perceptions, experiences, facilitators and barriers of iron supplementation among pregnant and non-pregnant women of reproductive age and health care providers. We used thematic analysis for initial data extraction, similar to the analytical approach in much qualitative research (Noyes & Popay 2007). Papers identified through the literature search were reviewed in chronological order, with the oldest first. Two reviewers independently read and reviewed the selected articles. The first author was responsible for creating the domains and the second author verified the final domains.

Characteristics, concepts and quotations from the final set of studies were listed in a grid, which was used to compare studies and to identify the domains that were relevant across studies (Atkins *et al.* 2008). The study texts were read and coded, with all articles

revisited after new codes had been created (Al-Janabi *et al.* 2008). An initial set of domains emerged, and as subsequent papers were reviewed, new domains were identified or existing domains were refined until no further new domains emerged.

We used reciprocal translation, or the comparison of domains across papers and an attempt to match domains from one paper with domains from another, ensuring that a key domain captured similar domains from different papers (Atkins *et al.* 2008). This process identified seven domains.

Finally, a line of argument synthesis was used to develop a new model, theory or understanding by synthesizing and interpreting the themes found in the text, integrating study participants' understandings and interpretations made by authors of studies (Atkins *et al.* 2008). We decided *post hoc* that the WHO's conceptual framework of the social determinants of health (WHO 2008) was appropriate and helpful for situating the domains that emerged from our review. We developed a line of argument synthesis by tying domains from research participants, study authors' interpretations and meta-synthesis findings using social determinants of health conceptual framework and making the findings relevant to policy makers.

Results

Twelve articles were deemed appropriate for this systematic review. The data in this body of literature spanned 17 countries and a variety of environments such as rural, urban and multiple socio-economic situations. Five of the articles were based on qualitative studies and seven were multi-method studies that included relevant qualitative data. Qualitative data collection techniques included extensive one-on-one interviewing, large-scale open- and closed-ended questionnaires, key informant selection, focus groups and use of social marketing and community mobilization techniques. Study characteristics of these 12 papers are listed in Table 1.

Seven domains and 16 sub-domains emerged from the meta-synthesis (Table 2). The domains included: cultural norms and societal values including explanatory models and medical pluralism; political

Table 1. Study characteristics of papers to be synthesized

Source paper (<i>n</i> = 12)	Setting	Country estimates among non-pregnant women of reproductive age ^a			Sample	Data collection techniques	Study aim
		Proportion of the population with Hb <120 g L ⁻¹	Population with anaemia (number of individuals) (000)	Public health problem			
1. Ejidokun (2000)	Lagos, Nigeria No prevalence data given in study	62.0	15 568	Severe	Rural and semi-urban 23 pregnant females 2 health care providers	Focus-group discussions Observational data In-depth interviews	To identify community perspectives and attitudes on pregnancy, anaemia, iron and folate supplements during pregnancy.
2. Galloway <i>et al.</i> (2002)	Bolivia No prevalence data given	32.9	673	Moderate	3 rural or urban towns 90 females, 12 males 36 health professionals 12 community leaders	In-depth interviews Focus group discussions	To investigate factors that influence women's decisions to take iron supplements and suggest ways to improve existing programmes.
	Bobo-Dioulasso, Burkina Faso No prevalence data given	52.0	1 239	Severe	22 females 9 local healers 5 midwives/nurses 1 pharmacy president	Semi-structured interviews	
	Guatemala No prevalence data given	20.2	537	Moderate	4 rural or semi-urban villages 8 groups of women 4 groups of men 4 groups of midwives 100 health professionals 530 women	Focus-group discussions Observational data In-depth interviews Questionnaires Key Informant interviews	
	Honduras No prevalence data given	14.7	239	Mild	5 rural or semi-urban towns 24 groups of women 5 groups of men	Focus-group discussions	
	India No prevalence data given	52.0	134 495	Severe	5 groups of health providers 7 rural or semi-urban villages 95 pregnant women 40 family members 46 health providers 17 groups of women	Semi-structured interviews Focus-group discussions Key informant interviews Case studies	
	South Kalimantan, Indonesia No prevalence data given	33.1	19 240	Moderate	8 groups of health providers 15 groups of females 9 groups of males 180 females 30 midwives 62 females 20 males	Focus-group discussions Semi-structured interviews Observational data In-depth interviews	
	West Java, Indonesia No prevalence data given	33.1	19 240	Moderate	31 health providers 43 females 11 males 8 health providers 3 groups of females	In-depth interviews Focus-group discussions	
	Thyolo District, Malawi No prevalence data given	43.9	1 017	Severe			

Table 1. Continued

Source paper (<i>n</i> = 12)	Setting	Country estimates among non-pregnant women of reproductive age ^a			Sample	Data collection techniques	Study aim
		Proportion of the population with Hb <120 g L ⁻¹	Population with anaemia (number of individuals) (000)	Public health problem			
3. Ghanekar <i>et al.</i> (2002)	Vadodara, India National anaemia prevalence: up to 80% 75% of study women were anaemic (haemoglobin <11 g dL ⁻¹) 13% of study women were severely anaemic (haemoglobin <7 g dL ⁻¹) Mean haemoglobin was 9.6 g dL ⁻¹	52.0	134 495	Severe	Poor, urban population 36 pregnant women 20 family members of women	In-depth interviews Home visits with observation Ethnographic decision models Haemoglobin levels	To understand the household-level behaviours of slum-dwelling pregnant women and their family members related to procurement of and compliance with iron supplements in an urban setting using qualitative research tools
4. Hyder <i>et al.</i> (2002)	Mymensingh, Bangladesh No prevalence data given Study haemoglobin data included elsewhere	33.2	11 085	Moderate	Rural areas 172 pregnant women	Questionnaires with open-ended questions Recall of side effects Medication monitoring equipment	To compare side effects and their impact on compliance between two regimes of iron supplementation
5. Jefferds (2002)	Costa Rica No prevalence data included for women 25% of children aged 12–36 months had iron-deficiency anaemia in another study (haemoglobin)	18.9	211	Mild	1 rural village 70 female caretakers 4 biomedical health providers	Ethnographic interviews Participant observation	To examine how lay women and health care providers conceptualize iron-deficiency anaemia, and how their perceptions influence the success of public health initiatives to prevent and treat iron-deficiency anaemia in young children
6. Kanai <i>et al.</i> (2005)	Cambodia National anaemia prevalence: 58% women of reproductive age Leading cause of anaemia is iron deficiency Median haemoglobin at baseline: Secondary school students: 120 g L ⁻¹ Female faculty workers: 127 g L ⁻¹ Rural village women: 116 g L ⁻¹	57.3	1 920	Severe	Rural and semi-urban villages 423 secondary school students 478 garment factory workers 639 women	Questionnaires Social marketing and community mobilization	To report the effectiveness of the social marketing and participatory communications methodologies applied in the Cambodian weekly iron-folic acid supplementation project and their impact on knowledge, attitudes and practices that may prevent the development of anaemia

7. Khan <i>et al.</i> (2005)	Than Mien, Vietnam National anaemia prevalence: 30–45% Iron deficiency listed as primary cause of anaemia throughout the country Anaemia among pregnant women in the region of study: above 50% (survey)	24.3	5 505	Moderate	19 rural villages 2579 women of reproductive age	Knowledge, attitudes and practices questionnaires Social marketing and community mobilization	To promote a new preventive supplementation of iron-folic acid to women of reproductive age through social marketing and mobilization activities and to assess the effectiveness of such a combined approach in improving knowledge, attitudes and practices in the prevention and control of iron-deficiency anaemia.
8. Paulino <i>et al.</i> (2005)	Pangasinan, Philippines National anaemia prevalence: 50.7% and 45.6% among pregnant/lactating women Iron-deficiency listed as first cause	42.1	8 412	Severe	3 municipalities 590 pregnant women 1568 non pregnant women	Knowledge, attitudes and practices questionnaires Social marketing and community mobilization	To introduce iron-folic acid supplements to women of reproductive age in the Philippines and to assess the effectiveness of the approach in improving knowledge, attitudes and practices.
9. Seck and Jackson (2008)	Dakar, Senegal National anaemia prevalence: >50% Anaemic at baseline: 25–37% (haemoglobin) Iron-deficient at baseline: 28% (erythrocyte protoporphyrin, serum ferritin)	48.4	1 206	Severe	Urban population 128 pregnant women with high compliance 93 pregnant women with low compliance	Semi-structured interviews Pill count Randomization	To determine factors that influence compliance with iron supplementation among pregnant women in Senegal
10. Tessema <i>et al.</i> (2009)	USA No prevalence data given	6.9	4 833	Mild	3 cities in different regions 104 African American and Hispanic women	Focus-group discussions	To examine differences between women who used prenatal supplements regularly and those who did not. To assess multiple intersecting motivators and barriers to prenatal supplement adherence associated with the prophylactic regimen, health-care provider-patient interactions, and individual, social and environmental contexts
11. Tita <i>et al.</i> (2005)	Cameroon No prevalence data given	44.3	1 527	Severe	Population study of 1 province 26 workers in charge of health units or maternity sections	In-depth interviews Key informants	To estimate the prevalence of awareness and use of evidence-based interventions among health providers in north-west Cameroon
12. Wulff & Ekstrom (2003)	Sweden No prevalence data given	13.3	257	Mild	5 regions throughout country 901 pregnant women 134 midwives 43 obstetricians	Questionnaires	To assess adherence to the current recommendation and to describe factors associated with prescription and use of iron supplements

Hb, haemoglobin. †Country estimates according to de Benoist *et al.* (2008) based on data from 1993–2005 among non-pregnant women of reproductive age.

Table 2. Domains and sub-domains within papers included in the meta-synthesis

Domain	Sub-domain	Summary definition(s)	n (%)	Papers that include the sub-domain*
Social and cultural beliefs, norms, and values	Local beliefs, perceptions and knowledge	Local understandings of anaemia and symptoms; associations of anaemia with other pregnancy outcomes, blood and strength; understandings of efficacy of supplements	11 (91.7%)	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12
	Societal norms and practices	Societal norms related to iron supplementation including a disinclination to take pills during pregnancy and norms associated with good parenting	10 (83.3%)	1, 2, 5, 6, 7, 8, 9, 10, 11, 12
	Medical pluralism	The interaction of iron supplements and home remedies, herbal medicines, midwives and experiences with collaboration across differing health systems	8 (66.7%)	1, 2, 5, 8, 9, 10, 11, 12
	Government and politics	The importance of the government health system; examples of government support and collaboration with iron supplementation programmes from the community to national levels.	12 (100%)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Political and socio-economic circumstances	Economics and material resources	Poverty, hunger and related nutritional issues; lack of material resources, cost of iron supplements and situations in which they are affordable, class differences between patients and practitioners, and differing compliance among groups of different socio-economic status	12 (100%)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
	Health care provision, access and supply	Training of health care providers, conflicting advice from health care providers, the clinical encounter	12 (100%)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Health care provision, access and supply	Health care providers	Barriers to access to health care, strategies to increase access through alternative medicine and community groups	11 (91.7%)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
	Health care access	Inadequate supply of supplements or unevenly distributed supply; shortage of skilled health staff	10 (83.3%)	1, 2, 3, 5, 6, 7, 8, 9, 10, 11
	Supply of supplements	Support from community members; support from health care providers; support from family members, particularly husbands	10 (83.3%)	1, 2, 3, 5, 6, 7, 8, 9, 10, 11
	Community and family social support	Education of health care providers; counselling services by health care providers; education materials	12 (100%)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Education and communication	Education and counselling	Social marketing; different means of health communication; poor communication as a barrier	9 (75.0%)	1, 3, 5, 6, 7, 8, 9, 10, 12
	Communication and marketing	Nutrition and poverty; nutritional advice; food sources of iron	10 (83.3%)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
	Diet, food and nutrition	Daily vs. weekly iron supplementation and adherence; forgetfulness and lost supplements	12 (100%)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
	Adherence	Smell, taste, colour, size, shape of iron tablets; dosage; embodied experience	8 (66.7%)	1, 2, 4, 5, 6, 7, 9, 10
Food and nutrition issues	Adherence	Gastro-intestinal problems; constipation; nausea and vomiting; teeth and cavities	11 (91.7%)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12

*References (corresponding number in Table 1) in bold contain in-depth explanations of the sub-domain.

and socio-economic circumstances; education and communication; social organization and social relationships; health care access and supplement supply; food and nutrition availability; and adherence.

In the following section, we describe the domains and sub-domains pertaining to determinants of supplementation in more detail. The sources of evidence for these domains and sub-domains are summarized in Table 2.

Societal and cultural norms and values

One prominent domain that emerged from the meta-synthesis was societal and cultural norms and values. This included individual beliefs, perceptions and knowledge of anaemia and symptoms (11 articles), societal or community-level norms and practices (10 articles) and medical pluralism (eight articles).

Individual beliefs, perceptions and knowledge of anaemia and its symptoms

In terms of local beliefs and perceptions, there may be limited knowledge of signs and symptoms of anaemia (Ejidokun 2000), or in some cases, anaemia symptoms are recognized but not known by their clinical name (Galloway *et al.* 2002). Lay explanations and understandings of anaemia and iron supplementation often draw on biomedical concepts to promote or discourage supplement use (Jefferds 2002). For instance, study respondents reported fearing iron supplements because they believed that these may lead to miscarriage (Ghanekar *et al.* 2002) or a big baby (Ejidokun 2000; Galloway *et al.* 2002; Ghanekar *et al.* 2002) or may cause harm to their baby (Seck & Jackson 2008). In addition, in Costa Rica, one commonly held belief is that anaemia can progress to a life-threatening disease, such as leukaemia, when not treated (Jefferds 2002).

In some cases, iron supplements have several associations with health benefits. For instance, in Nigeria, people believe that iron supplements are good simply because they are distributed by health care providers (Ejidokun 2000). Iron supplements are also thought to give strength (Ghanekar *et al.* 2002) or increase the blood (Seck & Jackson 2008).

On the other hand, some studies report misunderstandings among patients of the need to continue taking tablets for long time periods (Wulff & Ekstrom 2003; Seck & Jackson 2008). Some study participants also report scepticism at the efficacy of iron supplements. However, intervention evaluation studies show that knowledge, attitudes and practices related to iron supplementation can significantly change (Khan *et al.* 2005).

Societal norms and practices

Apart from the individual belief and perception level, the meta-synthesis identified societal or community-level norms and values related to iron supplementation and anaemia. For instance, studies from Bolivia and Indonesia report that there is a disinclination to take pills during pregnancy, and that herbal preparations and tonics are preferred during pregnancy (Galloway *et al.* 2002). In addition, formal public health measures may result in effects (such as dental effects) that Costa Ricans consider unacceptable and incongruent with being a good parent (Jefferds 2002). In contrast, the biomedical community often dismisses parents' preoccupations as inappropriate or as signs of ignorance (Jefferds 2002).

Medical pluralism

The sub-domain of medical pluralism emerged in several studies. Aside from iron supplementation, home remedies are often viewed as more effective than iron supplements in several countries (Galloway *et al.* 2002; Jefferds 2002). Herbal preparations and tonics are particularly popular around the world (Galloway *et al.* 2002), and the existence of several systems of healing allows for people to reject biomedical and public health measures related to anaemia and easily access alternative remedies (Jefferds 2002). Several studies point to the critical position of midwives in communities, who often provide locals with advice related to pregnancy and may have greater access than biomedical clinics (Galloway *et al.* 2002; Wulff & Ekstrom 2003). Midwives have been able to distribute iron supplements in communities to increase access (Galloway *et al.* 2002) and their advice

can help to increase adherence (Seck & Jackson 2008). Some studies report that the success of iron supplementation programmes depends on a collaborative or at least cordial relationship among biomedical and 'alternative' or 'traditional' systems of healing (Ejidokun 2000).

Political and socio-economic circumstances

Another important domain that emerged related the political economy to iron supplementation programmes at both the macro and micro levels, through government and politics or economic and material resources.

Government and politics

All 12 studies mentioned the role of the government, through the government health system, policy or politics, in iron supplementation programmes. In some contexts, the government health system was viewed as trustworthy, while in others, it was not. For instance, in parts of Latin America, women are reluctant to accept iron tablets from outside the government health system, fearing poor quality control and lack of medical supervision (Galloway *et al.* 2002). In contrast, in south India, the private sector was well developed at the community level, and women were suspicious of the quality of government-supplied pharmaceuticals (Galloway *et al.* 2002).

Several studies emphasize the importance of government support, whether at the community or national levels (Jefferds 2002). At the community level, one Philippine study demonstrated how social mobilization of local officials such as the mayor, councilmen, priests and health personnel was integral to the social marketing strategy of a WIFS programme (Paulino *et al.* 2005). At the national level, the same study concluded that there was a need for a national government-issued policy statement on the adoption of WIFS for all non-pregnant women of reproductive age to facilitate its implementation in any country (Paulino *et al.* 2005). A lack of government promotion can be a barrier to the use of evidence-based interventions (Tita *et al.* 2005).

Economics and material resources

All 12 studies also mentioned the influence of economics and material resources in iron supplementation programme. At the most basic level, study respondents reported the inability to afford food because of poverty and limited economic resources (Galloway *et al.* 2002). Limited household resources also meant that following dietary advice related to anaemia was nearly impossible for many women (Galloway *et al.* 2002).

The relatively high cost of iron supplements was a salient issue for respondents in several studies (Ejidokun 2000; Seck & Jackson 2008; Tessema *et al.* 2009). In addition, some women believed that because iron supplements improve one's appetite, they were concerned that they could not afford to buy more food to satisfy their increased appetite (Galloway *et al.* 2002). One Vietnamese study recommended that for a preventive iron supplementation to be sustainable, recipients should perceive the supplement to be of sufficient value to purchase it themselves, which would make them more likely to use it (Khan *et al.* 2005). However, the price must be suitable to the economic condition of the communities and acceptable for women to purchase over long periods of time (Khan *et al.* 2005). One study in the Philippines demonstrated that women in a non-controlled setting were willing to buy iron-folic acid supplements in certain environments.

Health care provision, access, and supply

Salient issues related to health care systems included sub-domains related to health care provision, health care access and supply of supplements.

Health care providers

All 12 studies discussed the role of health care providers in the effectiveness of iron supplementation programmes. Studies highlighted the importance of sufficient training for health care providers to ensure the effectiveness of the service system (Khan *et al.* 2005; Paulino *et al.* 2005). One study in Cameroon found that a vast majority of health workers cited

deficiencies in education and training, and this was the most frequently cited barrier to awareness of interventions (Tita *et al.* 2005). In addition, other barriers cited were the presence of unqualified supervisors who were unable to sufficiently educate their subordinates (Tita *et al.* 2005).

A related issue to insufficient training that emerged was the experience of the clinical encounter. First, the routinization and standardization of language can make it difficult for patients with anaemia to express themselves outside of the directed questioning format (Jefferds 2002). Patients also reported receiving conflicting advice about dosage or nutrition from health care providers (Ejidokun 2000). The perception of gender and class difference between the health care provider and patient can also be a barrier and exacerbate patients' inabilities to voice concerns (Jefferds 2002).

Access to iron supplements

Issues related to health care access were mentioned by 11 of 12 studies. Although iron supplements are often available through multiple sources, such as government hospitals, private clinics and pharmacies, there are nonetheless regions such as slums that do not have access to any of these health care facilities (Ghanekar *et al.* 2002). Therefore, iron supplementation programmes have successfully used alternate channels to increase access, such as midwives, traditional birth attendants and community organizations (Galloway *et al.* 2002; Khan *et al.* 2005).

Supply of iron supplements

Another frequently cited sub-domain was inadequate supply of iron supplements in local settings. National-level supply problems exist in Malawi, Bolivia, Burkina Faso, Guatemala, Honduras, India and Indonesia, to name a few countries (Galloway *et al.* 2002), and this serves as one of the greatest barriers to access of supplements (Ghanekar *et al.* 2002; Jefferds 2002; Tita *et al.* 2005; Tessema *et al.* 2009). One tea estate medical officer in Malawi explained that the organization's policy was to emphasize good nutrition because they did not want to encourage women to be

dependent on iron tablets in short supply (Galloway *et al.* 2002). The supply problem is not limited to inadequate supply but also includes uneven distribution of tablets (Ghanekar *et al.* 2002). Skilled health staff are also frequently in shortage (Tita *et al.* 2005).

Community and family social support

The importance of social network support, whether in the community or family, was emphasized in 10 studies. At the community level, studies discussed the importance of community mobilization (Kanal *et al.* 2005; Paulino *et al.* 2005), community organizations such as women's groups (Khan *et al.* 2005) and social networks (Tessema *et al.* 2009). One study reported that many community members and health providers had beliefs and behaviours that were unsupportive to women taking iron tablets; therefore, sensitization of community members and training of health service providers were needed (Galloway *et al.* 2002).

At the family level, one Nigerian study demonstrated that support from husbands can sustain motivation for women to continue taking tablets (Ejidokun 2000). Other studies confirm that family members play a major role in permitting or supporting women in consuming iron supplements (Ghanekar *et al.* 2002; Seck & Jackson 2008).

Education and communication

All 12 papers discussed education, whether related to service providers or patients. The lack of training and education of health service providers can be a barrier to awareness of interventions (Tita *et al.* 2005). One Vietnamese study described a model training process for health workers, which included lessons on pre- and post-natal care services, causes and recommended actions for management of anaemia, nutrition and dietary recommendations, and an introduction to preventive WIFS (Khan *et al.* 2005). The training sessions emphasized participation and included formal presentations, discussions, role playing and distribution of a practical manual, posters, leaflets and educational videos (Khan *et al.* 2005).

In terms of community education, the same Vietnamese study utilized a women's union network to conduct trainings and education. These workshops emphasized the importance of women's health, iron-deficiency anaemia and nutrition. The workshops were conducted through role playing, composing folk songs, poems and dramas. The participants in the Women's Union workshop then conducted education and communication sessions for women of reproductive age in their communes and villages (Khan *et al.* 2005).

In addition to education, specific communication and marketing strategies were discussed in nine studies. Several studies evaluated social marketing strategies, which included developing an attractive name and image to promote supplementation (Kanal *et al.* 2005; Khan *et al.* 2005; Paulino *et al.* 2005). Many different channels of communication have been used to distribute iron and anaemia information. For instance, in Nigeria, radio and bus were the main sources that women learned about iron-folate tablets. Many pregnant women had access to battery-operated radios, but few were able to watch television programmes because of infrequent electric supply (Ejidokun 2000). Furthermore, most women in the study were unable to read newspapers or magazines. One study among minority women in the United States found that poor communication from a health care provider was one of the most common barriers to prenatal supplement use (Tessema *et al.* 2009).

Food and nutrition issues

Food and nutrition issues related to anaemia and iron supplementation were mentioned in 10 studies. The most common discussion related anaemia and its symptoms to poverty and a poor-quality diet (Galloway *et al.* 2002; Jefferds 2002). In Malawi, health workers, who were not informed that pregnant women should take iron-folic acid supplements, relied on nutritional advice because they thought that giving advice about improving women's diets created less dependency than taking iron supplements which were in short supply (Galloway *et al.* 2002). When diagnosed with anaemia, Costa Ricans often attempted to eat foods that were popularly consid-

ered to be rich sources of iron, such as increased solid foods and less milk (Jefferds 2002). A Costa Rican nutrition centre gave educational presentations that often contradicted local views on foods considered good sources of iron and treatments for anaemia, such as cooked banana with bean broth. The presentations suggested other foods that were locally available and a normal part of the family diet, which included beans to be served along with bean broth (Jefferds 2002). Costa Rican mothers reported that medical doctors made poor recommendations of foods to treat anaemia, which led to contradictory advice from public health clinics and the nutrition centre.

Adherence

All 12 studies discussed adherence to iron supplementation. One discussion compared adherence of women on daily vs. weekly iron supplementation, finding that adherence to weekly supplementation was often higher (Hyder *et al.* 2002). Forgetfulness and losing pills were often cited as reasons for non-adherence (Wulff & Ekstrom 2003; Seck & Jackson 2008; Tessema *et al.* 2009).

The physical properties of supplements were also discussed in eight studies, which often influenced adherence. One study found that the form of the tablet, such as unappealing taste, smell or colour, was one of the major reasons that women did not continue taking iron supplements (Galloway *et al.* 2002). Size (Tessema *et al.* 2009), dosage (Jefferds 2002), difficulty in swallowing (Tessema *et al.* 2009) and form as injection (Ejidokun 2000) or liquid (Jefferds 2002) also mattered to some respondents. In contrast, one study found that respondents had no objections to the smell, taste, or colour of iron tablets (Ejidokun 2000). In Senegal, pregnant women reported feeling better after ingesting the tablets (Seck & Jackson 2008).

Side effects have also been discussed in relation to adherence in 11 studies. Gastrointestinal side effects were found to be a major reason why women in Sweden stopped taking iron supplements (Wulff & Ekstrom 2003), although gastrointestinal side effects were not significantly associated with adherence in Bangladesh (Hyder *et al.* 2002). Nausea and vomiting are other side effects that may affect adherence to

Table 3. Important messages, common barriers and common facilitators across studies

	Women of reproductive age	Additions for pregnant women
Important messages	<ul style="list-style-type: none"> Anaemia is a serious and dangerous health threat to women. All women of childbearing age should actively prevent/treat anaemia. Iron supplements can be taken to prevent (not just cure) anaemia. Taking iron supplements should make women healthy and strong. Iron supplements need to be taken regularly. 	<ul style="list-style-type: none"> It is critically important for women to prevent/treat anaemia with iron during pregnancy and post-partum. Anaemia can increase risk of maternal death because of bleeding or infection. Anaemia can increase risk of infant death or illness at birth. Intermittent doses are not recommended for pregnant women because they are not as efficacious as a daily dose.
Common barriers	<ul style="list-style-type: none"> Anaemia is viewed as common and not recognized by women as a serious problem. Iron supplementation is negatively associated as medicine. Women in many cultures prefer using traditional or natural remedies. It is hard to take a daily pill for long periods of time. Common misconceptions and/or concern about how iron will affect blood. In some countries, receiving something for free decrease the sense of value. Receiving prescriptions rather than doses causes extra work or cost to women. 	<ul style="list-style-type: none"> Symptoms of anaemia such as tiredness are seen as common feelings during pregnancy, so women don't seek treatment unless it is severe. Pregnancy is viewed as a natural and healthy state which is not necessarily congruent with needing biomedicine. Common misconception that iron supplements will increase blood in your body and cause more bleeding during or after birth.
Common facilitators	<ul style="list-style-type: none"> Involve women and local leaders throughout development of initiatives. Ensure health providers including traditional/lay providers have knowledge and ability to educate about anaemia and iron. Have health providers provide education and advice along with supplements. Change marketing and packaging to be more natural, appropriate and less biomedical. Use a form of iron supplementation that is acceptable/desirable in that context. Make the supplements readily available for a small, feasible fee. Identify private sector channels to distribute supplements. 	<ul style="list-style-type: none"> Use targeted education about the risks and importance associated with anaemia during pregnancy. Have iron supplements available for free for all women the moment they determine they are pregnant. Have front-line and trusted providers such as traditional birth attendants provide the iron supplements.

iron supplements (Ghanekar *et al.* 2002; Hyder *et al.* 2002). In Honduras, taking iron during pregnancy is associated with cavities or spots on babies teeth (Galloway *et al.* 2002).

Synthesis

While individual studies included differing purposes and contexts, many facets were common throughout the papers. Table 3 identifies the most common findings and recommendations across studies including important messages for women, as well as barriers and facilitators of iron supplementation. Common features of these papers are described below.

Definitions or conceptualizations of anaemia were described in each paper. While women in some contexts were familiar with and commonly used a term such as anaemia, in other areas, symptoms such as tiredness or paleness were more frequently used to refer to anaemia in place of a separate term. In all contexts, there was a high level of awareness of the existence of the condition and the commonality of the experience. Several papers highlighted that the commonness of anaemia and its symptoms could act as a barrier, as women did not perceive it to be a serious condition. Additionally, in several contexts, there seemed to be a perceived incongruence between pregnancy, a natural and healthy state and taking

medication, an unnatural and unhealthy entity. Women in many contexts often preferred to use local, natural, traditional practices for their health. Several papers addressed these barriers by working with social marketing and involving women to create, package and market more acceptable forms of iron supplementation.

Across the papers, knowledge about causes and consequences of anaemia were of mixed accuracy both with women and with health providers. While most individuals interviewed described anaemia as being caused by poor diet or disease and leading to weak blood and tiredness, there were also additional inaccurate, perceived causes and consequences described that may have been unique to that context.

All papers address the issue of real and perceived side effects. Real side effects of iron supplements included gastrointestinal upset and black stools. However, Galloway *et al.* (2002) reported that while one-third of women experienced real side effects of iron supplements, only one-tenth stopped taking the supplements because of side effects. Therefore, side effects should not be a major cause of non-adherence to iron supplements, particularly if women are counselled that the side effects are not serious and will subside in a few days. Women can also be advised to take a smaller dose twice a day or to avoid taking the supplements with meals. Common perceived side effects of iron supplementation include the causation of high blood pressure, big babies, dental problems and heavy bleeding during or after birth. Some papers suggest providing education and counselling along with the supplements to counteract beliefs about perceived side effects and to highlight the health benefits of taking the supplements for mothers and children. Individual studies report that targeted marketing, dosing and education can improve use and adherence.

Findings and recommendations about the cost and dispensing of iron supplementation varied across the studies. Some articles included staunch recommendations that free supplements should be distributed to all women, and that this can increase use. Others found that when pills were given for free, there was little use of the pills and little value associated with them. These studies recommended selling the iron supplements to women for a small, feasible fee;

however, these findings may be highly context dependent. Alternative channels to distribute iron supplements, including private sector shops, may be a convenient way for women to restock their supplements. Commonly, authors suggested that programmes, including dispersal of physical iron supplement supplies, be conducted through existing, trusted sources such as community health facilities or individual birth attendants. This is frequently seen as improving the acceptability as well as sustainability of programmes.

Discussion

To our knowledge, this is the first systematic review of qualitative data using Cochrane methodology on the topic of iron supplementation among women of reproductive age. Given the increased demand for evidence-based health care (Dixon-Woods *et al.* 2001), systematic reviews on diverse research questions are necessary, particularly for areas such as health care delivery and social determinants of health that may commonly use qualitative methods (Atkins *et al.* 2008).

This systematic review identified seven domains and 16 sub-domains (Table 2) that allow for novel understandings of relevant issues and further conceptual development, referred to as 'third-order' concepts (Britten *et al.* 2002). The domains reported here were identified *de novo* based purely on analyses of the included studies. However, after the domains were solidified, we integrated them into a social determinants of health conceptual framework, to make results more relevant for research and policy (Fig. 1) (WHO 2008; Solar & Irwin 2009).

Structural drivers of health include political circumstances and social and cultural norms and values. At the national level, having a government policy statement regarding iron supplementation facilitates its implementation at the local level (Jefferds 2002). Furthermore, local government supporters can be effective proponents of iron supplementation through social marketing (Paulino *et al.* 2005). Given the high usage of traditional, complementary and alternative medicines globally, it is important that iron supplementation programmes communicate and collaborate

Fig. 1. Conceptual framework for social determinants of iron supplementation among women of reproductive age.

with traditional medical systems (WHO 2002). These structural drivers are macro-level determinants that may be the most distant from individuals and health experience, often making it challenging to attribute causality or demonstrate effectiveness of action on health equity for these determinants (WHO 2008).

Socio-economic circumstances, as well as education and communication, reflect social position and are more proximal determinants than structural drivers (WHO 2008). Because of limited resources in many settings, the price of supplements should be suitable for the specific economic context, particularly if women are expected to use them in the long-term (Khan *et al.* 2005). In addition, novel education and communication strategies, such as social marketing, can be employed to promote iron supplementation programmes in innovative ways (Kanal *et al.* 2005; Khan *et al.* 2005; Paulino *et al.* 2005).

Circumstances of daily life include community and family social support as well as adherence, both proximal determinants of health. Mobilization of any social network, particularly women's groups or families, may be beneficial for iron supplementation programmes (Khan *et al.* 2005; Tessema *et al.* 2009). Physical properties, dosing and side effects of the iron supplements all influence adherence; therefore, programmes should plan to address these various factors (Galloway & McGuire 1994; Jefferds 2002; Tessema *et al.* 2009).

Food and nutrition issues are determinants of iron supplementation and health at all levels, through struc-

tural macro-level policies, social conditions or circumstances of daily life. Poor-quality diets can lead to iron-deficiency anaemia; therefore, improving the quality of diets may increase intake of iron as well as other micronutrients (Galloway *et al.* 2002; Jefferds 2002).

Health care provision, access and supply in the case of iron supplementation are the most proximal determinants of health and well-being. Inadequate supplies of iron supplements at national and local levels are often the most significant barriers to access across regions globally (Galloway *et al.* 2002; Ghanekar *et al.* 2002; Jefferds 2002; Tita *et al.* 2005; Tessema *et al.* 2009).

Limitations of this study include the inability to infer causal relationships based on qualitative data. In addition, given the current debate about quality appraisal (Noyes & Popay 2007), we did not exclude any studies based on quality rating schemes.

The study's strengths include the usage of Cochrane systematic review methodology to synthesize qualitative data on a novel topic. Integrated with the WHO's social determinants of health framework, the domains identified in this review point to relevant strategies to improve iron supplementation programmes globally.

Acknowledgements

We would like to thank Juan Pablo Pena-Rosas, Lisa Rogers, Craig Cohen, Sera Young, Paule Pillard,

Grace Rob, Daniel Albrecht Alba, Nicole Valentine and Anand Sivasankara Kurup for assistance, advice and thoughtful comments.

Source of funding

This research was made possible by a grant from the Dean's Research Fellowship at the University of California, San Francisco and conducted through an internship in the Department of Nutrition for Health and Development at the World Health Organization.

Conflicts of interest

The authors declare that they have no conflicts of interest.

Author contributions

JN and FB designed the review protocol; JN, LG and FB conducted the systematic review; JN and LG drafted the article; and FB oversaw the project and critically revised the article.

References

- Al-Janabi H., Coast J. & Flynn T.N. (2008) What do people value when they provide unpaid care for an older person? A meta-ethnography with interview follow-up. *Social Science & Medicine* **67**, 111–121.
- Allen L.H. (2000) Anemia and iron deficiency: effects on pregnancy outcome. *American Journal of Clinical Nutrition* **71**, 1280S–1284S.
- Atkins S., Lewin S., Smith H., Engel M., Fretheim A. & Volmink J. (2008) Conducting a meta-ethnography of qualitative literature: Lessons learnt. *BMC Medical Research Methodology* **8**, 21.
- Barbour R.S. (2001) Checklists for improving rigour in qualitative research: A case of the tail wagging the dog? *British Medical Journal* **322**, 1115–1117.
- Beard J.L. (2000) Effectiveness and strategies of iron supplementation during pregnancy. *American Journal of Clinical Nutrition* **71**, 1288S–1294S.
- Beaton G.H. & McCabe G.P. (1999) *Efficacy of intermittent iron supplementation in the control of iron deficiency anaemia in developing countries*. The Micronutrient Initiative: Ottawa.
- de Benoist B., Mclean E., Egli I. & Cogswell M. (2008) *Worldwide Prevalence of Anaemia 1993–2005: WHO Global Database on Anaemia*. World Health Organization: Geneva.
- Britten N., Campbell R., Pope C., Donovan J., Morgan M. & Pill R. (2002) Using meta-ethnography to synthesise qualitative research: a worked example. *Journal of Health Services Research & Policy* **7**, 209–215.
- Cavalli-Sforza T., Berger J., Smitasiri S. & Viteri F. (2005) Weekly iron-folic acid supplementation of women of reproductive age: impact overview, lessons learned, expansion plans, and contributions toward achievement of the Millennium Development Goals. *Nutrition Reviews* **63**, S152–S158.
- Critical Appraisal Skills Programme (CASP) (2002) *Ten questions to help you make sense of qualitative research* [Online]. Available: <http://www.sph.nhs.uk/sph-files/casp-appraisal-tools/S.Reviews%20Appraisal%20Tool.pdf> [Accessed 4 June 2011].
- Dixon-Woods M., Fitzpatrick R. & Roberts K. (2001) Including qualitative research in systematic reviews: opportunities and problems. *Journal of Evaluation in Clinical Practice* **7**, 125–133.
- Ejidokun O.O. (2000) Community attitudes to pregnancy, anaemia, iron and folate supplementation in urban and rural Lagos, south-western Nigeria. *Midwifery* **16**, 89–95.
- Galloway R., Dusch E., Elder L., Achadi E., Grajeda R., Hurtado E. *et al.* (2002) Women's perceptions of iron deficiency and anemia prevention and control in eight developing countries. *Social Science & Medicine* **55**, 529–544.
- Galloway R. & McGuire J. (1994) Determinants of compliance with iron supplementation: Supplies, side effects, or psychology? *Social Science & Medicine* **39**, 381–390.
- Ghanekar J., Kanani S. & Patel S. (2002) Toward better compliance with iron-folic acid supplements: Understanding the behavior of poor urban pregnant women through ethnographic decision models in Vadodara, India. *Food and Nutrition Bulletin* **23**, 65–72.
- Higgins J. & Green S. eds. (2008) *Cochrane Handbook for Systematic Reviews of Interventions Version 5.0.1*. The Cochrane Collaboration [Online]. <http://www.cochrane-handbook.org/>.
- Hunt J.M. (2002) Reversing productivity losses from iron deficiency: The economic case. *Journal of Nutrition* **132**, 794S–801S.
- Hyder S.M.Z., Persson L.A., Chowdhury A.M.R. & Ekstrom E. (2002) Do side-effects reduce compliance to iron supplementation? A study of daily- and weekly-dose regimens in pregnancy. *Journal of Health, Population and Nutrition* **20**, 175–179.
- International Nutritional Anemia Consultative Group (1998) *Guidelines for the use of iron supplements to prevent and treat iron deficiency anaemia*. ILSI Press: Washington DC.

- Jefferds M.D. (2002) Concepts of iron deficiency anemia and public health measures in rural Costa Rica. *Social Science & Medicine* **55**, 1143–1156.
- Kanal K., Busch-Hallen J., Cavalli-Sforza T., Crape B. & Smitasiri S. (2005) Weekly Iron-Folic Acid Supplements to Prevent Anemia among Cambodian Women in Three Settings: Process and Outcomes of Social Marketing and Community Mobilization. *Nutrition Reviews* **63**, S126–S133.
- Kavle J.A., Stoltzfus R.J., Witter F., Tielsch J.M., Khalfan S.S. & Caulfield L.E. (2008) Association between anaemia during pregnancy and blood loss at and after delivery among women with vaginal births in Pemba Island, Zanzibar, Tanzania. *Journal of Health, Population, and Nutrition* **26**, 232–240.
- Khan N.C., Thanh H.T., Berger J., Hoa P.T., Quang N.D., Smitasiri S. *et al.* (2005) Community mobilization and social marketing to promote weekly iron-folic acid supplementation: a new approach toward controlling anemia among women of reproductive age in Vietnam. *Nutrition reviews*. **63**, S87–S94.
- Malpass A., Shaw A., Sharp D., Walter F., Feder G., Ridd M. *et al.* (2009) 'Medication career' or 'Moral career'? The two sides of managing antidepressants: A meta-ethnography of patients' experience of antidepressants. *Social Science & Medicine* **68**, 154–168.
- Milman N. (2011) Anemia-still a major health problem in many parts of the world! *Annals of Hematology* **90**, 369–377.
- Noblit G. & Hare R. (1988) *Meta-ethnography: Synthesizing Qualitative Studies*. Sage: Newbury Park, CA.
- Noyes J. & Popay J. (2007) Directly observed therapy and tuberculosis: How can a systematic review of qualitative research contribute to improving services? A qualitative meta-synthesis. *Journal of Advanced Nursing* **57**, 227–243.
- Oppenheimer S.J. (2001) Iron and its relation to immunity and infectious disease. *Journal of Nutrition* **131**, 616S–635S.
- Paulino L.S., Angeles-Agdeppa I., Etorma U.M., Ramos A.C. & Cavalli-Sforza T. (2005) Weekly iron-folic acid supplementation to improve iron status and prevent pregnancy anemia in Filipino women of reproductive age: the Philippine experience through government and private partnership. *Nutrition Reviews* **63**, S109–S115.
- Peña-Rosas J.P. & Viteri F.E. (2006) Effects of routine oral iron supplementation with or without folic acid for women during pregnancy. *Cochrane Database of Systematic Reviews* (3), CD004736.
- Sandelowski M., Docherty S. & Emden C. (1997) Qualitative metasynthesis: issues and techniques. *Research in Nursing & Health* **20**, 365–371.
- Seck B.C. & Jackson R.T. (2008) Determinants of compliance with iron supplementation among pregnant women in Senegal. *Public Health Nutrition* **11**, 596–605.
- Solar O. & Irwin A. (2009) *A Conceptual Framework for Action on the Social Determinants of Health*. World Health Organization: Geneva.
- Stoltzfus R.J. (2001) Iron deficiency anemia: reexamining the nature and magnitude of the public health problem. Summary: implications for research and programs. *Journal of Nutrition* **131**, 2S-2,697S–700S.
- Tessema J., Jefferds M.E., Cogswell M. & Carlton E. (2009) Motivators and barriers to prenatal supplement use among minority women in the United States. *Journal of the American Dietetic Association* **109**, 102–108.
- Tita A.T.N., Selwyn B.J., Waller D.K., Kapadia A.S. & Dongmo S. (2005) Evidence-based reproductive health care in Cameroon: Population-based study of awareness, use and barriers. *Bulletin of the World Health Organization* **83**, 895–903.
- Viteri F.E. (1994) The consequences of iron deficiency and anemia in pregnancy of maternal health, the foetus and the infant. *SCN News* **11**, 14–17.
- Viteri F.E. (1996) Weekly compared with daily iron supplementation. *American Journal of Clinical Nutrition* **63**, 610–612.
- Viteri F.E. (1997) Iron supplementation for the control of iron deficiency in populations at risk. *Nutrition Reviews* **55**, 195–209.
- Viteri F.E., Xunian L., Tolomei K. & Martin A. (1995) True absorption and retention of supplemental iron is more efficient when iron is administered every three days rather than daily to iron-normal and iron-deficient rats. *Journal of Nutrition* **125**, 82–91.
- WHO (2001) *Iron deficiency anaemia: assessment, prevention, and control*. World Health Organization: Geneva.
- WHO (2002) *WHO traditional medicine strategy 2002–2005*. World Health Organization: Geneva.
- WHO (2007) *Assessing the Iron Status of Populations*, Second edn, World Health Organization: Geneva.
- WHO (2008) *Closing the gap in a generation: health equity through action on the social determinants of health. Final report of the Commission on Social Determinants of Health*. World Health Organization: Geneva.
- WHO (2009) *Weekly iron-folic acid supplementation (WIFS) in women of reproductive age: its role in promoting optimal maternal and child health position statement*. World Health Organization: Geneva.
- WHO (2011) *Iron deficiency anemia* [Online]. Available: <http://www.who.int/nutrition/topics/ida/en/> [Accessed 4 June 2011].
- Wulff M. & Ekstrom E.C. (2003) Iron supplementation during pregnancy in Sweden: To what extent is the national recommendation followed? *Acta Obstetrica et Gynecologica Scandinavica* **82**, 628–635.

Supporting information

Additional Supporting Information may be found in the online version of this article:

Table S1. Final search criteria and search terms.

Please note: Wiley-Blackwell is not responsible for the content or functionality of any supporting materials supplied by the authors. Any queries (other than missing material) should be directed to the corresponding author for the article.