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

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The authors declare that they have no conflicts of interest.

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**Abstract**

Iron supplementation for women of reproductive age is a main intervention as part of an interdisciplinary strategy recommended for the control and prevention of iron deficiency and the treatment of mild-to-moderate iron deficiency anemia. 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 seventeen countries met inclusion criteria and were included in 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, sixteen 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

## 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 (Milman, 2011, WHO, 2011, WHO, 2007). Iron deficiency is the most significant contributor to anemia, defined as insufficient mass of red blood cells circulating in the blood or hemoglobin levels below established thresholds (WHO, 2007). Anemia affects an estimated 1.55 billion people worldwide (Milman, 2011). Additional causes of anemia include acute and chronic infections causing inflammation, inherited conditions that affect red blood cells such as thalassemia, and deficiencies of other micronutrients including folate, vitamin B12, and vitamin A (WHO, 2011). Commonly used indicators for iron status include hemoglobin concentration, mean cell volume, serum transferrin receptor, serum ferritin, and zinc protoporphyrin (WHO, 2007). Anemia particularly affects women of reproductive age, as the prevalence of anemia 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 anemia because their blood volume increases substantially and they begin to transfer iron to the fetus (Allen, 2000). Between the 12<sup>th</sup> and 25<sup>th</sup> week of gestation, serum ferritin falls, likely due to 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 amenorrhea (Viteri, 1994). However, when menstruation returns, iron requirements increase if lactation continues (Viteri, 1994).

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

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

Some international organizations have advocated for the use of routine daily iron and folic acid supplementation among pregnant women in areas of high anemia prevalence (Beard, 2000) at a dosage of 60 mg if supplementation for over six months is possible and at 120 mg if the duration of supplementation is shorter (INACG, 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 programs. 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 WHO Global Expert Consultation on WIFS was convened in 2007 and concluded that where the prevalence of anemia is above 20% among women of reproductive age and mass fortification programs of staple foods are unlikely to be implemented within one to two 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 and McCabe, 1999).

A Cochrane systematic review on effects of routine oral iron supplementation among pregnant women concluded that this intervention was effective to reduce the risk of anemia at term. The review also concluded that there was insufficient evidence to determine with confidence if routine daily or intermittent iron or iron-folic acid supplementation improved functional and health outcomes for women and their babies (Peña-Rosas and 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 anemia (Cavalli-Svorza 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 (Higgins and Green, 2008, Noyes and Popay, 2007). Although the importance of qualitative research has been increasingly recognized in the health sciences and practices 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 (Atkins et al., 2008, Sandelowski et al., 1997). This article seeks to synthesize the qualitative data of 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 and 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 programs. 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 and Green, 2008) to synthesize published research and integrate existing qualitative data on iron supplementation for women of reproductive age (Noblit and Hare, 1988, Atkins et al., 2008). We employed meta-ethnography (Noblit and Hare, 1988) and meta-synthesis (Sandelowski et al., 1997) frameworks, which are used increasingly in health care research (Noyes and 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), EMBASE (1988-2009), CINAHL (1982-2009), and 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 and Popay, 2007).

### *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 complying with 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 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 (Atkins et al., 2008, Noyes and Popay, 2007). Other meta-syntheses have not found substantial



differences in quality of the studies deemed weaker by many quality appraisal criteria (Noyes and Popay, 2007, Atkins et al., 2008, Malpass et al., 2009). Quality assessment was based on an adapted version of the Critical Appraisal Skills Program (CASP) to review components that were salient for the purpose of meta-synthesis ((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 and 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 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 World Health Organization'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 seventeen 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 sixteen sub-domains emerged from the meta-synthesis (Table 2). The domains included: 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 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.

**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 <sup>1</sup>			Sample	Data collection techniques	Study aim
		Proportion of the population with Hb <120 g L <sup>-1</sup>	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 5 groups of health providers	Focus-group discussions	
	India No prevalence data given	52.0	134 495	Severe	7 rural or semi-urban villages 95 pregnant women 40 family members 46 health providers 17 groups of women 8 groups of health providers	Semi-structured interviews Focus-group discussions Key informant interviews Case studies	
	South Kalimantan, Indonesia No prevalence data given	33.1	19 240	Moderate	15 groups of females 9 groups of males 180 females 30 midwives	Focus-group discussions Semi-structured interviews Observational data	
	West Java, Indonesia No prevalence data given	33.1	19 240	Moderate	62 females 20 males 31 health providers	In-depth interviews	
Thyolo District, Malawi No prevalence data given	43.9	1 017	Severe	43 females 11 males 8 health providers 3 groups of females	In-depth interviews Focus-group discussions		

Table 1. Continued

Source paper ( <i>n</i> = 12)	Setting	Country estimates among non-pregnant women of reproductive age <sup>1</sup>			Sample	Data collection techniques	Study aim
		Proportion of the population with Hb <120 g L <sup>-1</sup>	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 <sup>-1</sup> ) 13% of study women were severely anaemic (haemoglobin <7 g dL <sup>-1</sup> ) Mean haemoglobin was 9.6 g dL <sup>-1</sup>	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 <sup>-1</sup> Female faculty workers: 127 g L <sup>-1</sup> Rural village women: 116 g L <sup>-1</sup>	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. <sup>1</sup>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
Political and socio-economic circumstances	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
	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	Health care providers	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 access	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
	Supply of supplements	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
Community and family social support	Community and family social support	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
Education and communication	Education and counselling	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
	Communication and marketing	Social marketing; different means of health communication; poor communication as a barrier	9 (75.0%)	1, 3, 5, 6, 7, 8, 9, 10, 12
Food and nutrition issues	Diet, food and nutrition	Nutrition and poverty; nutritional advice; food sources of iron	10 (83.3%)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Adherence	Adherence	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
	Physical properties of supplements	Smell, taste, colour, size, shape of iron tablets; dosage; embodied experience	8 (66.7%)	1, 2, 4, 5, 6, 7, 9, 10
	Side effects	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.

### ***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 anemia and symptoms (11 articles); societal or community-level norms and practices (10 articles); and medical pluralism (8 articles).

#### ***Individual beliefs, perceptions, and knowledge of anemia and symptoms***

In terms of local beliefs and perceptions, there may be limited knowledge of signs and symptoms of anemia (Ejidokun, 2000), or in some cases anemia symptoms are recognized but not known by their clinical name (Galloway et al., 2002). Lay explanations and understandings of anemia 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 they may lead to miscarriage (Ghanekar et al., 2002), a big baby (Ejidokun, 2000, Galloway et al., 2002, Ghanekar et al., 2002), or harm to their baby (Seck and Jackson, 2008). In addition, in Costa Rica, one commonly held belief is that anemia can progress to a life-threatening disease, such as leukemia, when not treated (Jefferds, 2002).

In some cases, iron supplements have several associations with positive health perceptions. For instance, in Nigeria people believe 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 and Jackson, 2008).

On the other hand, some studies report misunderstandings among patients of the need to continue taking tablets for long time periods (Seck and Jackson, 2008, Wulff and Ekstrom, 2003). Some study participants also report skepticism 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 anemia. 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) 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 anemia 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 and 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 and Jackson, 2008). Some studies report that the success of iron supplementation programs 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 programs 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 programs. 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 Philippines 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 weekly iron and folic acid supplementation program (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 weekly iron-folic acid supplementation 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 program. At the most basic level, study respondents reported the inability to afford food due to poverty and limited economic resources (Galloway et al.,



2002). Limited household resources also meant that following dietary advice related to anemia 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 and 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 recommends 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 programs. Studies highlighted the importance of sufficient training for health care providers to ensure the effectiveness of the service system (Paulino et al., 2005, Khan 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 anemia 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 programs have successfully used alternate channels to increase access, such as midwives, traditional birth attendants, and community organizations (Khan et al., 2005, Galloway et al., 2002).

#### *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, Tessema et al., 2009, Tita et al., 2005). 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 behaviors that were unsupportive to women taking iron tablets; therefore sensitization of community members and training of health service providers was 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 and 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 postnatal care services, causes and recommended actions for management of anemia, nutrition and dietary recommendations, and an introduction to preventive weekly iron-folic acid supplementation (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 anemia, 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 anemia 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 programs due to 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 USA 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 anemia and iron supplementation were mentioned in 10 studies. The most common discussion related anemia 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 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 anemia, Costa Ricans often attempted to eat foods that were popularly considered to be rich sources of iron, such as increased solid foods and less milk (Jefferds, 2002). A Costa Rican nutrition center gave educational presentations that often contradict local views on foods considered good sources of iron and treatments for anemia, such as cooked banana with bean broth. The presentations suggested other foods that were locally available and a normal part of the family diet, 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 anemia, which led to contradictory advice from public health clinics and the nutrition center.

### ***Adherence***

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

The physical properties of supplements were also discussed in 8 studies, which often influenced adherence. One study found that the form of the tablet, such as unappealing taste, smell, or color, 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 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 color of iron tablets (Ejidokun, 2000). In Senegal, pregnant women reported feeling better after ingesting the tablets (Seck and Jackson, 2008).

Side-effects have also been discussed in relation to adherence in 11 studies. Gastro-intestinal side-effects were found to be a major reason why women in Sweden stopped taking iron supplements (Wulff and Ekstrom, 2003), although gastro-intestinal 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 iron supplements (Hyder et al., 2002, Ghanekar 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 anemia were described in each paper. While women in some contexts were familiar with and commonly used a term such as anemia, in other areas symptoms such as tiredness or paleness were more frequently used to refer to anemia 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 anemia 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 a 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 involvement of women to create, package and market more acceptable forms of iron supplementation.

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

Across the papers, knowledge about causes and consequences of anemia were of mixed accuracy both with women and with health providers. While most individuals interviewed described anemia as being caused by poor diet or disease and that it leads 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 gastro-intestinal 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 due to side effects. Therefore, side effects should not be a major cause of non-adherence to iron supplements, particularly if women are counseled 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 counseling 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 programs, including disbursement 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 programs.

## **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 sixteen 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 (Figure 1) (WHO, 2008, Solar and Irwin, 2009).

*Figure 1 About Here*

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 programs communicate and collaborate 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 programs in innovative ways (Khan et al., 2005, Kanal 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 programs (Tessema et al., 2009, Khan et al., 2005). Physical properties, dosing, and side-effects of the iron supplements all influence adherence; therefore, programs should plan to address these various factors (Galloway and McGuire, 1994, Jefferds, 2002, Tessema et al., 2009).

Food and nutrition issues are determinants of iron supplementation and health at all levels, whether structural macro-level policies, social conditions, or circumstances of



daily life. Poor-quality diets can lead to iron deficiency anemia; 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 (Jefferds, 2002, Galloway et al., 2002, Ghanekar et al., 2002, Tessema et al., 2009, Tita et al., 2005).

Limitations of this study include the inability to infer causal relationships based on qualitative data. In addition, given current debate about quality appraisal (Noyes and 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 World Health Organization's social determinants of health framework, the domains identified in this review point to relevant strategies to improve iron supplementation programs globally.

### **Key Messages**

- Iron supplementation programs should address social determinants of health
- Having a government policy statement regarding iron supplementation facilitates its implementation
- Iron supplementation programs 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 programs 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

## References