

Iron supplementation compliance among pregnant women in Bicol, Philippines

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Abstract

Objective: To quantify factors influencing iron supplementation compliance and haemoglobin (Hb) concentrations among pregnant women participating in an iron supplementation programme under routine field conditions.

Design: Cross-sectional interviews and Hb measurements.

Settings: Albay and Sorsogon provinces, Bicol, Philippines.

Subjects: Three hundred and forty-six pregnant women receiving iron supplements via the Philippine iron supplementation programme.

Results: Women had a mean Hb concentration of 10.75 ± 1.43 g dl⁻¹, and 56.4% were anaemic (Hb < 11.0 g dl⁻¹). On average, the first prenatal visit occurred at nearly 4 months (3.80 ± 1.56). The ratio of visits to number of months pregnant was 0.51 ± 0.24 . Self-reported consumption of pills received was 85% (0.85 ± 0.23), although pill counts suggested that consumption was 70% (0.70 ± 0.35). Using multiple regression, an earlier first prenatal visit and greater self-reported compliance were positively associated with Hb concentrations. Additionally, perceived health benefits from taking the supplements and higher health programme knowledge were positively associated with pill consumption, while experiencing side-effects and disliking the taste of the supplements were associated with lower pill consumption. A greater number of living children was negatively associated with the frequency of prenatal visits. The number of children was also directly negatively associated with Hb concentrations.

Conclusions: Compliance was positively related to Hb concentrations. Several factors associated with greater compliance were identified, including marital status, number of children, health programme knowledge, side-effects, perceived health benefits, and dislike of taste. Some of these factors may serve as avenues for interventions to increase compliance, and ultimately Hb concentrations.

Keywords
Compliance
Supplementation
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Anaemia
Side-effects
Philippines

Iron deficiency anaemia affects more than 3.5 billion people in the developing world¹, making it the most prevalent single-nutrient deficiency². Deficiency results in large productivity losses, lowered immunity, impaired cognitive development in children, and maternal morbidity and mortality¹. Pregnant women are at particular risk. Using the international cut-off for anaemia in pregnant women³ of 11.0 g dl⁻¹, 50.7% of pregnant women in the Philippines are anaemic⁴, as are 64.4% in the Bicol region. Anaemia is a consequence of severe iron defi-

ciency, and for every case of iron deficiency anaemia found in a population, it is estimated that there are at least two additional cases of iron deficiency⁵. Although not all anaemia is a consequence of iron deficiency^{1,6}, iron deficiency is the predominant cause in the developing world⁷.

Iron supplementation is the most widely employed strategy to alleviate iron deficiency, both globally⁶ and in the Philippines⁸. Clinical trials have established the efficacy of iron supplements in alleviating maternal iron deficiency. However, clinical trials represent optimal situations for programme effectiveness⁹. Often they achieve results superior to what may be observed under

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actual programme implementation, as trials generally (1) have sufficient funds to ensure supplement acquisition and distribution, (2) have intense participant monitoring, which may lead to greater compliance, (3) are of relatively short duration, and (4) select their target population in a manner such that they are likely to see success.

The results from trials are essential, but it is also imperative that the effectiveness of programmes under real-world situations is understood. This, however, is rarely assessed. (The FAO–WHO report) stressed that short-term interventions often show dramatic results in limited target populations of carefully controlled trials or in hospitals and clinical settings, but then fail to work when applied to the real world ... Assessments of the performance and impact of countrywide iron supplementation programmes are also disappointingly few ... Gauging the impact and quality of operational procedures in large scale, ongoing programmes is extremely important in order to determine their sustainability under field conditions¹⁰.

Additionally, a meta-analysis of the efficacy of intermittent iron supplementation stated as one of its major findings that, 'Unless ways are found to greatly improve "compliance" in comparison to that seen in existing programmes, neither daily nor weekly supplementation is likely to be an effective approach to preventing and controlling anaemia in developing countries⁶. Although patient compliance is widely viewed as a major barrier to the success of iron supplementation programmes, relatively few efforts have been made to quantify compliance, or to identify factors at the individual level that influence compliance.

The Philippines provides an optimal setting to assess the impact of patient compliance on the effectiveness of iron supplementation programmes. The Philippines has an established nation-wide primary care system managed by the Philippine Department of Health (DOH), and at the time of the study the Philippines had a sufficient supply of iron supplements for pregnant women provided by the Maternal and Child Health Programme of the Philippine DOH with some assistance from UNICEF in 20 provinces. Patient-level care is provided at widely utilised barangay (village) health stations (BHS) that are operated by trained midwives.

The primary aims of this study were to (1) evaluate the effectiveness of an ongoing community-based iron supplementation programme and (2) identify patient characteristics associated with supplement-taking behaviour.

Methods

Population and subjects

Within the Philippines, the region of Bicol was selected as the study site due to the high percentage of women who received at least one iron supplement during their last pregnancy (66.5%)¹¹ and the high prevalence of anaemia among pregnant women (64.4%)⁴.

Within Bicol, the adjacent provinces of Albay and Sorsogon were chosen based on somewhat easier accessibility and the willingness and cooperation of the provincial health officers and staff. Rates of iron supplementation and anaemia in these two provinces were similar to those of the Bicol region as a whole. Within each province, three municipalities were randomly selected and, within the municipalities, two BHS were randomly selected. Thus, a total of 12 BHS were surveyed. Finally, within the catchment area of each BHS (1–7 villages), there was essentially complete enumeration.

The midwife in each BHS identified all pregnant women who had received iron supplements from the BHS during their pregnancy. Philippine DOH guidelines state that upon diagnosis of pregnancy, all pregnant women are to consume one tablet of 60 mg elemental iron and 400 µg folic acid daily⁸. At each monthly prenatal visit to the BHS, women are provided with 30 tablets, free of charge. Pregnant women whose first issuance of iron supplements was less than 2 weeks before the interview date were excluded from the study.

Data collection

Trained enumerators interviewed all subjects at their homes in their native dialect, and then encouraged the women to visit the BHS, that same day, for haemoglobin (Hb) and anthropometric measurements. Written informed consent was received from all participants.

The interviewer-administered questionnaire was piloted in two locations before data collection, and consisted of questions regarding demographics, pregnancy history, stage of pregnancy, iron supplement receipt history, side-effects, perceived health benefits, opinion of supplement taste, comprehension of instructions, health programme knowledge, and a self-report of the number of pills consumed. The health programme knowledge score is the summation of correct responses to seven questions related to knowledge of major Philippine DOH initiatives. Difficulty getting to the BHS was assessed using a 5-point Likert scale, with responses ranging from very easy to very difficult. During the home visit, enumerators also conducted a pill count and, as a surrogate measure of income, identified the highest quality building material of the women's homes.

Following home interviews, registered nurses employed by the Albay and Sorsogon DOH measured Hb concentrations using HemoCue machines¹², and the height and weight of all women who visited the BHS. Upon completion of all measurements, subjects received nutrition counselling from DOH employees and midwives, and were given iron-fortified food products as incentives. Subjects were unaware of incentives until all measurements had been completed. Midwives were also interviewed to confirm procedural consistency within the iron supplementation programme.

Measures of compliance

For the purposes of this study, compliance was defined as 'the willingness and ability of pregnant women to follow a prescribed course of treatment'. Thus, compliance is a function of both maternal initiative to attend prenatal visits where iron supplement distribution occurs and supplement-taking behaviour, as both are essential to following the course of treatment.

Four compliance measures were considered in this analysis. Pill receipt was assessed by timeliness of first prenatal visit and the number of prenatal visits per month, while pill consumption was assessed by self-reported pill consumption and a pill count. To standardise signs for calculations, 'month of first prenatal visit' was converted to 'timeliness of first prenatal visit' (9 – month of first visit). The frequency of prenatal visits was calculated as (number of prenatal visits)/(number of months pregnant). Self-reported pill consumption was the average number of pills women reported taking each month. The pill count variable was created by comparing the actual number of pills remaining to the number of pills expected to remain, as calculated from the date of the last prenatal visit, the number of pills received at that visit, and the interview date. Home pill counts for iron supplementation have been highly correlated with biochemical measures¹³.

Statistical analysis

Statistical analyses were conducted using STATA (version 7.0). Pearson's correlations, multiple linear regression, and two-stage least squares regression analyses were performed. All regressions controlled for clustering at the municipality level. Two-stage least squares was used in the visits per month regression to control for the potential endogeneity of health programme knowledge, with education used as an instrument for health programme knowledge.

Although much of the literature emphasises anaemia status as opposed to Hb concentrations, this paper will focus on Hb concentrations since the negative effects of iron deficiency occur on a continuum, and iron deficiency results in negative health effects even at concentrations higher than the conventional 11.0 g dl⁻¹ anaemia cut-off for pregnant women.

Results

All 346 women were pregnant, and had received iron supplements from the BHS at least 2 weeks before the survey date. Unadjusted distributions of Hb, demographics, compliance, and supplementation experience are provided in Table 1. Respondents were 6.9 ± 1.6 (range: 1–9) months

Table 1 Distributions of demographic characteristics, compliance, supplementation experience, and serum Hb in 346 pregnant women in Bicol, Philippines

Variable	
<i>Demographics</i>	
Age, mean years (SD)	28.0 ± 6.02
Married, <i>n</i> (%)	312 (90.2)
Education, ≥high school, <i>n</i> (%)	184 (53.2)
Living children, mean (SD)	2.1 ± 2.1
Housing material*	
Grassy or indigenous, <i>n</i> (%)	87 (25.1)
Wood, <i>n</i> (%)	88 (25.4)
Concrete, <i>n</i> (%)	171 (49.4)
Difficulty getting to BHS, 5-item scale: 1 = very easy; 5 = very difficult, mean (SD)	1.97 ± 0.83
Health programme knowledge, 8-item scale: 0 = no knowledge; 7 = highest knowledge, mean (SD)	1.80 ± 1.77
Underweight†, <i>n</i> (%)	92 (30.8)
<i>Compliance</i> (mean, SD)	
Month of first prenatal visit‡	3.80 ± 1.56
Prenatal visits per month	0.51 ± 0.24
Self-reported % of pills taken per month	0.85 ± 0.23
Pill count	0.70 ± 0.35
<i>Supplementation experience</i>	
Side-effects, <i>n</i> (%)	84 (24.3)
Perceived health benefits, <i>n</i> (%)	91 (26.3)
Disliked the taste, 5-item scale: 1 = likes very much; 5 = greatly dislikes, mean (SD)	2.75 ± 0.97
Hb, mean g dl ⁻¹ (SD)	10.75 ± 1.43

Hb – haemoglobin; SD – standard deviation.

*Based on highest quality material.

†Based on the Philippine Food and Nutrition Research Institute Weight-for-Height by Month of Pregnancy Table.

‡Regression analysis modelled 'timeliness of first prenatal visit,' computed as (9 – month of first prenatal visit).

pregnant, and for 26.9% of the women this was their first pregnancy. Virtually all women (97.7%) received verbal instructions to take one pill per day, even when healthy, and 12.4% also received written instructions.

Side-effects from the supplements were reported by 24.3% of women. Of women with side-effects, 56.4% experienced nausea and 12.8% stomach pain. Many women also disliked the taste of supplements (25.7%). Of these women, 59.7% thought they tasted rusty, while 40.9% thought they tasted fishy.

Conversely, 26.3% perceived positive health benefits associated with iron supplement use. The most common benefits reported were feeling stronger (72.7%) and more active (18.4%).

Haemoglobin

Nearly all (92.8%, *n* = 321) of the women interviewed visited the BHS for Hb and anthropometric measurements. Demographic characteristics of those who visited the BHS were similar to those who did not (data not shown). All BHS measurements occurred on the same day as the interview, with most women travelling to the BHS immediately upon completion of their at-home

interview. Women had a mean Hb concentration of $10.75 \pm 1.43 \text{ g dl}^{-1}$, and 56.4% were anaemic.

In multiple regression analysis controlling for demographic and compliance measures, higher concentrations of Hb were positively associated with higher self-reported pill consumption, receiving prenatal care earlier in the pregnancy and fewer living children ($R^2 = 0.121$, $P < 0.01$) (Table 2). We considered gestational age as a potential confounder of Hb concentrations. It was not a confounder, however, and was consequently omitted from our models (data not shown).

Compliance

The first prenatal visit occurred at 3.80 ± 1.56 months of pregnancy, and the frequency of prenatal visits (visits per month) was 0.51 ± 0.24 (Table 1). The self-reported proportion of pills taken per month was 0.85 ± 0.23 , meaning that on average 85% of pills were taken each month. Of women, 40.3% reported having taken 100% of the pills they received. A lower proportion was obtained from the direct pill count, 0.70 ± 0.35 . The two pill-receipt measures of compliance were highly correlated ($r = 0.683$) (Table 3), as were the two pill consumption measures ($r = 0.548$).

Table 2 Results of multiple regression analyses of Hb and measures of compliance among pregnant women in Bicol, Philippines; regression coefficient (t-statistic)

Dependent variable	Hb (g dl ⁻¹)	Timeliness of first prenatal visit	Visits per month	Self-reported pill consumption
<i>N</i>	313	346	346	335
<i>R</i> ²	0.121***	0.108***	0.122***	0.225***
Age	0.000 (0.03)	-0.007 (-0.35)	0.002 (0.79)	-0.005 (-1.27)
Married	-0.099 (-0.35)	0.520* (1.83)	0.037 (0.88)	0.003 (0.08)
HS graduate	0.050 (0.27)	0.099 (0.54)		-0.019 (-0.77)
Home of wood	-0.220 (-0.98)	-0.319 (-1.38)	-0.050 (-1.47)	0.020 (0.57)
Home of concrete	-0.004 (-0.02)	0.089 (0.43)	-0.013 (-0.40)	0.025 (1.18)
Difficulty getting to BHS	0.115 (1.13)	-0.007 (-0.07)	-0.007 (-0.44)	0.013 (1.10)
Health programme knowledge	0.011 (0.22)	0.061 (1.21)	0.019‡ (0.69)	0.018* (2.14)
Side-effects			-0.002 (-0.06)	-0.140*** (-5.14)
Perceived health benefits			0.007 (0.23)	0.068** (3.57)
Disliked the taste			-0.020 (-1.51)	-0.043** (-2.86)
No. of living children	-0.134** (-2.23)	-0.045 (-0.76)	-0.023** (-2.64)	-0.007 (0.61)
Timeliness of first prenatal visit	0.184** (2.51)			
Prenatal visits per month	-0.266 (-0.55)			0.123* (2.01)
Self-reported pill consumption	0.850** (2.30)			
Constant	9.62*** (17.89)	5.00*** (6.79)	0.56** (5.45)	0.985*** (8.35)

Hb – haemoglobin; BHS – barangay (village) health station.

*Significant at $P < 0.10$; **significant at $P < 0.05$; ***significant at $P < 0.01$.

†Regressions were controlled for clustering by municipality.

‡Health programme knowledge was instrumented using the high school (HS) grade variable.

Table 3 Correlations among measures related to compliance in 346 pregnant women in Bicol, Philippines; *r* (*P*-value)

	Timeliness of first prenatal visit	Visits per month	Self-reported pill consumption	Pill count
<i>N</i>	346	346	335	191
Timeliness of first prenatal visit	1	0.683 (0.001)	0.066 (0.230)	0.032 (0.660)
Visits per month		1	0.165 (0.002)	0.098 (0.180)
Self-reported pill consumption			1	0.548 (0.001)
Pill count				1

Multiple regression analyses were carried out with timeliness of first prenatal visit, number of visits per month, and self-reported pill consumption as dependent variables (Table 2). Regression analyses are not reported for the pill count variable due to problems collecting the 'date of most recent prenatal visit' for 40% of the sample. Nevertheless, its strong correlation with the self-reported pill consumption ($r=0.548$, $P<0.01$) for 60% of the sample supports the validity of the self-report, and suggests that social desirability or recall bias did not substantially influence our results. Demographic characteristics did not differ between those who had complete pill-count data and those who did not (data not shown). Additionally, gestational age was considered as a potential confounder of compliance. It was not identified as such, however, and was consequently omitted from our models.

In the timeliness of first prenatal visit regression ($R^2=0.108$, $P<0.01$), married mothers tended to have an earlier month of first visit, while in the visits per month regression ($R^2=0.122$, $P<0.01$), having more children was associated with a lower frequency of visits.

Of the compliance regressions, self-reported pill consumption had the greatest explanatory power ($R^2=0.233$, $P<0.01$). Greater self-reported pill consumption was associated with having more frequent prenatal visits, perceiving health benefits from taking the supplements, and better knowledge of health programmes, while lower consumption was reported among women who experienced side-effects and disliked the taste.

To assess reasons for not taking supplements, women were asked: 'At times when you did not take your iron supplement, why did you not do so?' The most commonly cited answers were that they forgot (78.8%), experienced side-effects (20.2%), found them inconvenient (10.3%), or had no more supplements remaining (9.9%).

Discussion

All of the women in this study received prenatal iron supplements from their local BHS, yet 56.4% were anaemic. As there was an ample and accessible supply of the supplement, the fact that over half of the women were anaemic was unexpected. In considering possible explanations, lack of patient compliance appears to be a major factor contributing to the low Hb concentrations observed in this population. Furthermore, our cross-sectional data are supportive of this hypothesis, as greater compliance was associated with higher Hb concentrations. In our regression analysis, each 1-month delay in the timeliness of the first prenatal visit was associated with a decline of 0.184 g dl^{-1} in Hb concentration. Additionally, each 10 percentage point increase in the

proportion of pills consumed was associated with 0.085 g dl^{-1} higher Hb concentrations. A review of iron supplementation programmes by Galloway and McGuire¹⁴ came to a similar conclusion, citing poor compliance as an explanation for why iron supplementation programmes are frequently less effective than theoretically expected.

The pills – side-effects, perceived health benefits, and dislike of taste

The percentage of women in this study who reported experiencing side-effects is similar to, or slightly higher than, that of other studies¹⁴. Consistent with other studies^{15,16}, we found lower pill consumption among women who experienced side-effects. Controlling for other factors, our regression analysis found that the experience of side-effects was associated with pill consumption that was lower by 14 percentage points. In turn, this decline in consumption was associated with 0.12 g dl^{-1} lower Hb concentrations (equal to 0.140×0.85 ; coefficients obtained from multiple regressions reported in Table 2). Dislike of taste was also negatively associated with the percentage of pills that were consumed, though to a lesser degree than experience of side-effects. Conversely, the perception of positive health benefits was associated with a 6.8 percentage point increase in pill consumption. In turn, this was associated with higher Hb concentrations of 0.06 g dl^{-1} . Positive behavioural changes, similar to our perceived health benefits variable, were also cited by Galloway *et al.*¹⁷ as facilitators of effective iron supplementation.

Before receiving supplements, 11.8% of women reported being warned that they may experience side-effects. Interestingly, of women warned about possible side-effects, 56.1% experienced them, as compared to 20.0% of those who had not been warned. One possible explanation is that women who were warned about potential side-effects misattributed nausea and stomach pain to be side-effects of the supplement rather than normal symptoms of pregnancy. Alternately, women who experienced side-effects may have been more likely to recall having been warned.

In apparent contrast to the present study, discussion of side-effects with HIV-positive individuals at treatment initiation has been associated with better treatment adherence¹⁸. Given that women who were warned of side-effects appeared to experience them more frequently, and that those who experienced side-effects were less likely to consume the supplements, it may be possible to improve health outcomes by encouraging doctors and midwives to emphasise that unwanted side-effects are possibly due to the pregnancy itself, as opposed to the supplements, and that side-effects experienced from taking supplements are generally mild and subside with time¹⁹. Further study is needed

regarding the utility of warning women about possible side-effects, and the best means of doing so.

Utilisation of prenatal services: marital status and number of children

Utilisation of prenatal services was less than ideal in our sample, and has previously been cited as a major barrier to effective supplementation¹⁷. The timeliness of the first visit was not associated with the percentage of pills consumed, but a delay of 1 month in the first visit will reduce the total number of pills received and was associated with 0.18 g dl⁻¹ lower Hb concentrations (column 1, Table 2).

Being single was associated with a later first prenatal visit. We speculate that single mothers may be embarrassed that they are pregnant, and thus delay their first visit. Another factor cited by midwives is that, especially in remote areas, breastfeeding mothers may believe that they cannot become pregnant, causing a delay in their first visit (Lopez O, personal communication, 2003). Informational campaigns targeted to such women might help alleviate these effects.

Fewer prenatal visits per month was associated with a lower percentage of pills consumed, possibly due to reduced encouragement from midwives. Health programme knowledge was not associated with the number of visits per month, but the number of living children was. A possible explanation for this, based on conversations with midwives, is that women who have already had a child may have a 'been there, done that' attitude, and consequently feel that receiving prenatal care is not critical to a healthy pregnancy. Travel to the BHS may also be more difficult and expensive for women with multiple children. Either of these explanations would result in women with multiple children being less likely to attend prenatal visits. The number of children was not directly associated with self-reported pill consumption, but there was an indirect association through its effect on the number of visits per month.

The number of living children was strongly negatively correlated with education levels; women with a high school education had substantially fewer children. Thus, education was indirectly associated with a greater frequency of prenatal visits.

Health programme knowledge

In our study, health programme knowledge had a small positive association with pill consumption, which in turn had a positive association with Hb concentrations. Based on the regression coefficients, a one standard deviation increase in programme knowledge was associated with an increase in pill consumption of 3.2 percentage points, which in turn was associated with an increase in Hb concentrations of 0.027 g dl⁻¹. Given the small increase,

improving health programme knowledge may not be a very effective means of improving Hb concentrations.

Conclusions

This is one of the first studies to quantify compliance levels and the effects of individual characteristics that influence compliance in a large iron supplementation programme under routine field conditions. The iron supplementation programme in our study, unlike many in developing nations, had an adequate, accessible, and free supply of supplements for all pregnant women. Thus, many of the barriers that have traditionally reduced the impact of iron supplementation programmes in developing countries were absent, and we could focus our study on the characteristics of pregnant women that affect compliance. Limitations of this study are that dietary data were not collected, and that much of the data was self-reported.

In our study, greater compliance (in terms of the timeliness of the first prenatal visit and the proportion of pills received that were consumed) was associated with higher Hb concentrations, suggesting that iron supplements improve Hb concentrations in real-world settings. Controlling for other forms of compliance, more frequent prenatal visits were not directly associated with higher Hb concentrations. Having fewer children was also directly associated with higher Hb concentrations.

Furthermore, the study identified several underlying factors associated with greater compliance. Being married was positively associated with an earlier first prenatal visit. Having more children was negatively associated with the frequency of prenatal visits, and more visits were associated with a higher ratio of pills consumed to pills received. These relationships could be used to help target information to specific sub-groups of women. Greater health programme knowledge and the perception of health benefits upon consumption of iron supplements were also positively associated with the ratio of pills consumed to pills received. Experience of side-effects and dislike of taste were negatively associated with the proportion of pills consumed. Some of these factors may serve as avenues for interventions to increase compliance, although without assessing the costs of different interventions (e.g. providing knowledge, coating pills, and implementing different approaches to counselling about side-effects), it is not possible to recommend one approach as more cost-effective than another at improving compliance and increasing Hb concentrations.

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