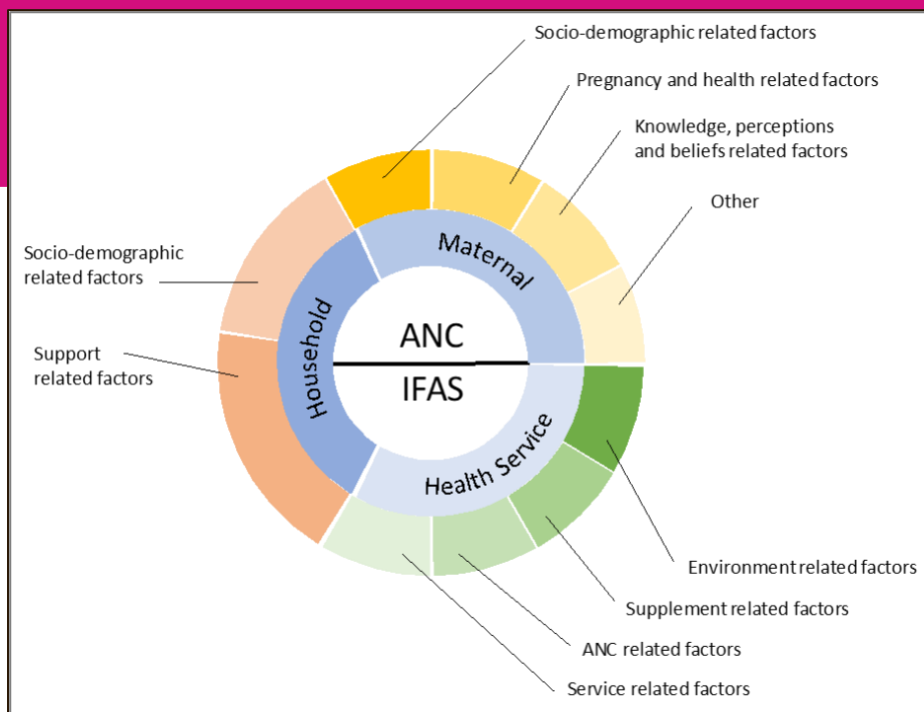


Appendix 1: Factors Related to ANC Attendance and IFAS Adherence

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SUMMARY

The barriers and enablers for ANC attendance and IFAS adherence were examined together as they are closely related. The coding was organized in relation to three broad categories or levels: *Women, Household and Health Services*. Within each level, information was coded for barriers and enablers that influence ANC attendance and IFAS adherence. A total of 38 papers were included in the review. A brief description of the factors identified follows.

ANC/IFAS: Women

1. **Socio-demographic factors:** For ANC, socio-demographic characteristics, especially education level, is the most common positive predictor of ANC attendance. Employment is reported to be associated with either positive or negative effects. For IFAS, education is strongly positively associated with women's adherence to IFA supplements. Results from the studies vary concerning the effects of age: 3 studies found positive associations with IFAS adherence and 3 reported negative associations.
2. **Health status:** For ANC a common association with attendance is a woman's health status, specifically the presence or absence of sickness. This is also the case for IFAS. Women are less likely to consume IFAS when they have health problems. While a history of complications during previous pregnancies and number of children are negatively associated with IFAS adherence, a history of abortion and not knowing one's own HIV status are positively associated with adherence to IFAS. The results related to the number of pregnancies vary: three found them to be a positive predictor and in two this was a negative predictor.
3. **Knowledge, perceptions and beliefs:** For ANC, knowledge of pregnancy danger signs, the timing of the first ANC visit and total number of visits are positively associated with use of clinics, while negative perceptions of the value and need of ANC visits is negatively associated with use of services. For IFAS, knowledge about supplements and anemia are strong positive predictors of IFAS attendance. Fear of side effects, fear of increased baby size, fear of injury to mother or infant, fear of illness if a pill is missed and fear of a complicated delivery are all negatively associated with IFAS adherence. Another common explanation for not taking the supplement is forgetting. In one study more than half of women reported occasionally missing doses because they forgot, were away from home, or were busy with household chores or caring for children.
4. **Effects of the Supplement:** The occurrence of side effects is the most common barrier to regular consumption of IFAS. These side effects include heartburn, stomach cramps, and nausea or vomiting.
5. **Use of ANC services:** Lack of knowledge about the benefits of ANC is associated with not attending, as well as delayed timing of first visit and total number of visits. A recommendation for a higher number of visits can be a barrier, even delaying the first ANC visit by women in order to limit the total number. Positive motivations for attendance include access to support during labor, access to birth certificates, access to other health service interventions (e.g. Vaccines) and attendance by peers were among the reasons for ANC attendance.

ANC/IFAS: Households

1. **Socio-demographic factors:** For ANC, socio-demographic factors household factors positively associated with women's attendance at clinics includes education and occupation of the husband, as well as a husband who is not a farmer or a fisher by occupation. Higher income and lower family size are also positive predictors. The same factors influence IFAS adherence. Only one study found a negative association between household income and IFAS adherence, while seven report it is a positive predictor of IFAS adherence.
2. **Support:** For ANC, several factors related to the household support have been found to influence women's ANC attendance. Women who have relative autonomy on health care spending are more likely to use ANC. Sometimes, the decision on ANC attendance is not taken by the women themselves, but by a family member. Their support or discouragement affects ANC attendance. For IFAS, getting daily reminders from family members to take supplements helps to reduce forgetfulness. For that reason, some providers recommend women asking their family to help them remember their supplements. As observed by some authors, women themselves considered social support as a critical adherence facilitator and reported receiving general advice from family members during pregnancy, as well as encouragement and reminders to take IFA supplements.

ANC/IFAS: Health services

1. **Characteristics of the health service:** For ANC, waiting is a barrier to ANC attendance. Unavailability of the provider demotivates attendance while the availability of female doctors and midwives is positive. Women who received advice to complete ≥ 4 ANC visits before delivery are more likely to attend ANC. For IFAS, counseling, including nutritional counseling, is by far the greatest service-related predictor of women's adherence to IFAS. A strong relationship with the provider and the trust are reported as enablers for IFAS adherence. Inadequate tools and other problems in the facility are reported as barriers to adherence.
2. **Shortages of IFA supplements in health facilities:** This is a strong negative predictor of women's adherence to IFAS. Cost is also a barrier to IFAS adherence. The appeal of supplements in terms of formulation is a predictor adherence, whereas the lack of women's preferred form of IFAS, or unpleasant taste of the tablets, is reported to be barrier to adherence.
3. **Accessibility:** For ANC, accessibility of ANC services is the most common predictor of women's ANC attendance. Accessibility includes both geographical and economic characteristics. For example, one study reports that women who live less than an hour's walk from the clinic were 4 times more likely to utilize antenatal care than those residing greater than a 2 hour walk away. Women in urban areas are more prone to use ANC services, as are women with media exposure, such as radio or television. For IFAS: The same factors influence adherence. Proximity of ANC services, living in an urban area and media exposure are all positively associated with women's adherence to IFAS.

ANC ATTENDANCE AND IFAS ADHERENCE

The topics of ANC attendance and IFAS adherence were examined together as they are closely related. A total of 38 papers were included in the review. One member of the research team (MG) coded all 38 papers and a subset of about 10 papers was double-coded by another member of the research team (IML). Any discrepancies in coding and the evolving codebook were discussed on an ongoing basis among the two researchers and shared with the broader team.

Figure 1 presents the main categories of factors identified as influencing ANC and IFAS. An initial representation was developed (**Figure 1**). **Table 1** (next page) provides more details on each of the coded individual factors (enablers and barriers) for ANC and IFAS respectively. The application of the lens of the COM-B model allowed distinctions among the various levels of influence for behavior change to emerge. Thus, a fourth column was added to include the main categories of the COM-B model in which the factors primarily fall.

Figure 1: Factors influencing ANC and IFAS

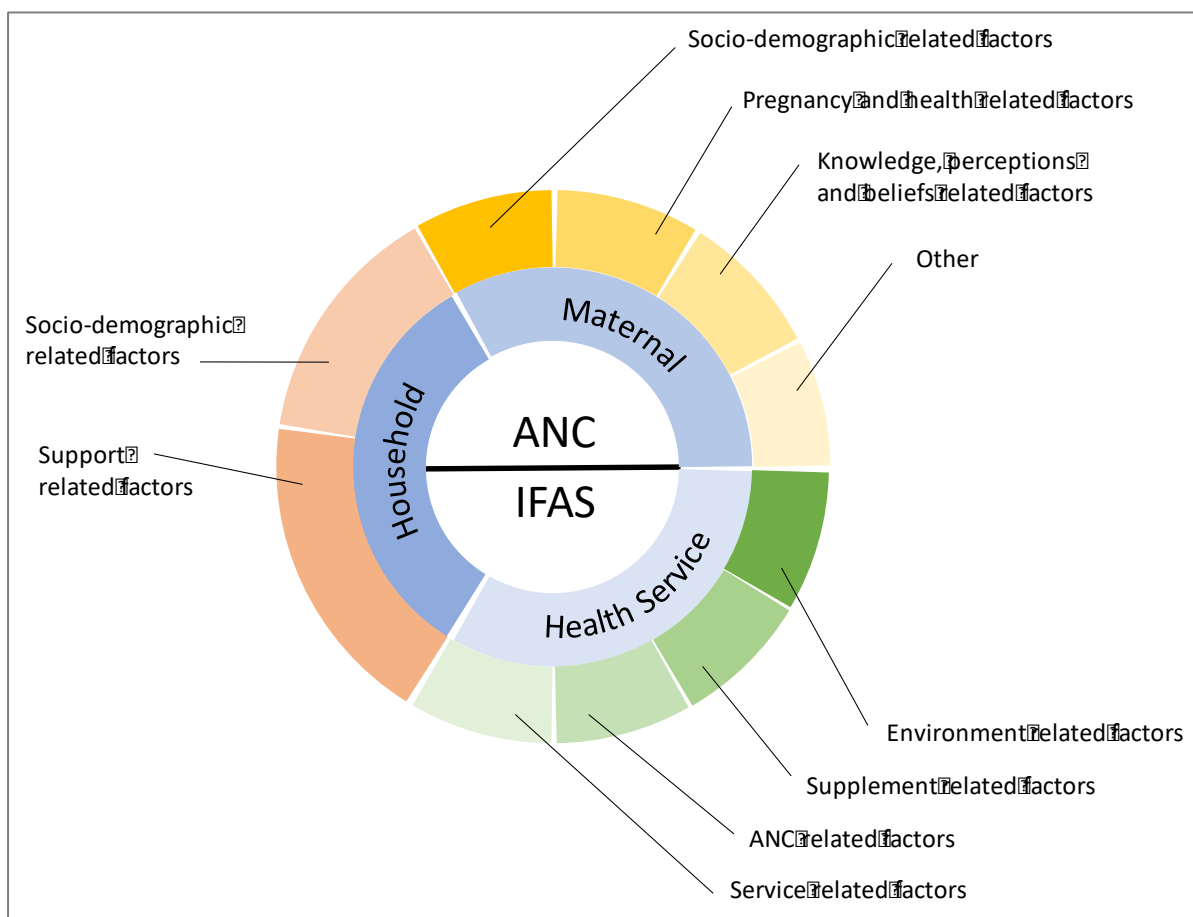


Table 1: Factors influencing ANC and IFAS

Category of factors	Individual factors (ANC)	Individual factors (IFAS)	Categories of the COM-B model
LEVEL 1: WOMEN			
Socio-demographic	<ul style="list-style-type: none"> - age - marital status - ethnicity - education - job/workload 	<ul style="list-style-type: none"> - age - marital status - tribe-religion - education - job/housewife 	<ul style="list-style-type: none"> - physical opportunity - social opportunity - physical capability
Pregnancy and health	<ul style="list-style-type: none"> - presence/absence of sickness - number of live births - number of parities - number of pregnancies - planned pregnancy - pregnancy disclosure - female genital mutilation 	<ul style="list-style-type: none"> - presence/absence of sickness - current anemia - complication during previous pregnancy - number of pregnancies - number of children - not knowing HIV status - history of abortion - health improvement/relief from symptoms 	<ul style="list-style-type: none"> - physical opportunity - social opportunity - reflective motivation - automatic motivation
Knowledge, perceptions and beliefs	<ul style="list-style-type: none"> - knowledge on danger signs of pregnancy - knowledge on number of ANC visits - perceived value and need - perceived quality - attitude towards pregnancy - attitude towards maternal health - fear of hospitals - fear of HIV testing - shame 	<ul style="list-style-type: none"> - knowledge on anemia - knowledge on IFAS - perceived value and need - fear of side effects - fear of illness if missed - fear of increased baby size - fear of injury for mother or infant - fear of complicated delivery 	<ul style="list-style-type: none"> - psychological capability - reflective motivation - automatic motivation - social opportunity
Other		<ul style="list-style-type: none"> - forgetfulness 	<ul style="list-style-type: none"> - psychological capability - reflective motivation
LEVEL 2: HOUSEHOLD			
Socio-demographic	<ul style="list-style-type: none"> - husband's education/occupation - wealth/income - family size 	<ul style="list-style-type: none"> - husband's education - wealth/income - family size 	<ul style="list-style-type: none"> - physical opportunity - social opportunity
Support	<ul style="list-style-type: none"> - decision by peers - discouragement by peers - support from peers - relying on peers - necessity to be accompanied - autonomy on health care spending 	<ul style="list-style-type: none"> - support from peers 	<ul style="list-style-type: none"> - social opportunity - reflective motivation - automatic motivation
LEVEL 3: HEALTH SERVICE			
Environment	<ul style="list-style-type: none"> - accessibility (cost, geographic)/proximity - urban area - radio-television programs 	<ul style="list-style-type: none"> - accessibility - television-radio - urban 	<ul style="list-style-type: none"> physical opportunity
Supplement		<ul style="list-style-type: none"> - cost - availability of IFA tablets - number of tablets collected - side effects - appeal of supplement 	<ul style="list-style-type: none"> physical opportunity automatic motivation
ANC	<ul style="list-style-type: none"> - timing of initiation - number of visits recommended - attendance by peers - access to support during labour - access to health status - access to birth certificate - awareness on ANC - prevention-focused motivation 	<ul style="list-style-type: none"> - number of antenatal visits - timing of initiation of ANC 	<ul style="list-style-type: none"> physical opportunity social opportunity psychological capability
Service	<ul style="list-style-type: none"> - waiting times - counseling/health education - availability of provider - availability of female doctors and midwives 	<ul style="list-style-type: none"> - waiting times - counseling/health education (including nutrition counseling) - relationship with provider - trust in provider - availability of tools - perceived value and need by provider - provider's inconsistency - provider's reluctance - training of providers - problem within facility 	<ul style="list-style-type: none"> physical opportunity automatic motivation psychological capability

Factors influencing ANC and IFAS

This section describes the main factors related to ANC and IFAS with the frequency of their appearance in the 38 papers coded on the topic, which can give an illustration of their appearance within the studies.

LEVEL 1: Women

Socio-demographic

ANC: Among the socio-demographic factors, education (6/38) is the most common positive predictor of ANC attendance. Having a job (2/38) is also positively associated with women's ANC attendance, although the workload (2/38) can sometimes be a barrier. It is uncertain whether age is a predictor of ANC attendance, because two studies positively associate it with ANC attendance and two other associate it negatively. While the marital status of the women has also been associated with ANC attendance, the results tend to vary between the different studies: Never married (1/38), separated (1/38) and divorced (2/38) status are positively associated with ANC attendance; but singleness is positively (1/38) and negatively (1/38) associated with ANC attendance; as is marriage, which is positively (1/38) and negatively (3/38) associated with ANC attendance. Finally, the ethnicity (1/38) could be a significant factor as the ANC attendance varied among those compared in one study^[1].

IFAS: It is no surprise that education (11/38) is positively associated with women's adherence to IFA supplements. Nonetheless, one study found that women with secondary education and above were less adherent to IFAS than those with primary education. The authors had various possible explanations for this result: "those who were secondary and above were prone to forgetfulness since most spent their time outside home with work; they did not want to suffer from side effects; think that they can get it (iron) just from diet and were reluctant to accept the counseling given by the health care providers, compared to those who had primary education" [2]. Results from the studies vary concerning the age: three studies associated it positively with IFAS adherence whereas 3 others associated it negatively. Being married (1/38) is a positive predictor of IFAS adherence. It is not clear if having a job is a facilitator or a barrier as one study found that being a private employee is an enabler, and another found that being a housewife is an enabler. Finally, the tribe (1/38) and the religion (1/38) could also influence IFAS consumption.

Pregnancy and health

ANC: One common reason for going or not to ANC is the presence or absence of sickness (4/38). This can probably be related to the women's perceived value of and need for ANC. The number of pregnancies (1/38), the number of live births (1/38) and the number of parities (3/38) are associated with ANC attendance. While the first two are negatively associated with ANC attendance, only 2 of the 3 reviewed papers describing an association with the number of parities found it negative. On the contrary, a planned pregnancy (2/38) was positively associated with ANC attendance. Female genital mutilation (1/38) showed a negative association with ANC attendance. Finally, because of its social implications, pregnancy disclosure (1/38) can be a barrier to ANC attendance.

IFAS: As for ANC attendance, the presence or absence of sickness (2/38) is a predictor of IFAS adherence. Women are less prone to consume IFAS when they have health problems. Some authors hypothesized that "this might be due to fear of exacerbation of their condition if they took IFA" [3]. However, when women have current anemia, they tend to be more adherent to IFAS (9/38). Only one article found a negative association between anemia status and adherence to IFAS, but the association was positive if

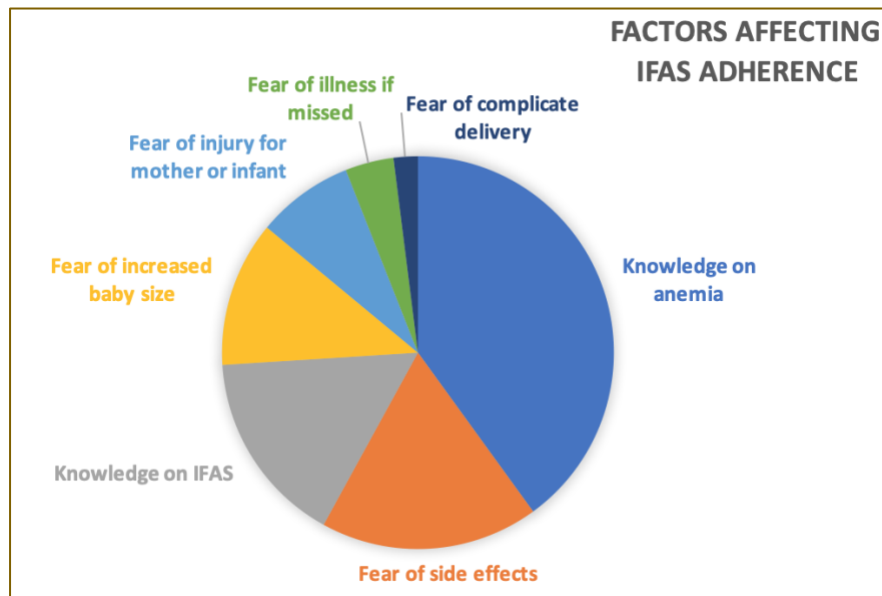
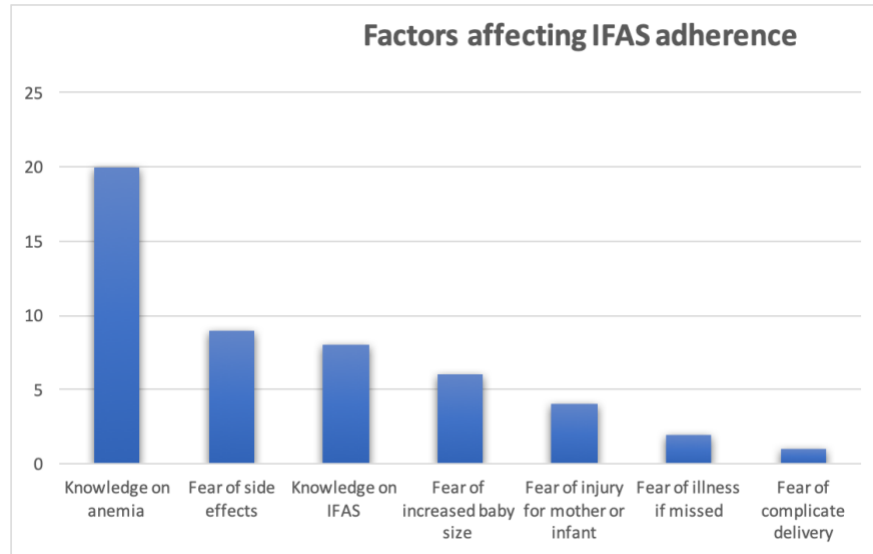
the anemia was during the first ANC visit [4]. In the same vein, it is not surprising that health improvement or relief from symptoms (3/38) are positive predictors of IFAS adherence. While a history of complications during previous pregnancies (1/38) and the number of children (1/38) are negatively associated with IFAS adherence, a history of abortion (1/38) and not knowing one's own HIV status (1/38) are positively associated with adherence to IFAS. Finally, the results related to the number of pregnancies (5/38) vary according to the studies. Three of them classified it as a positive predictor and two as a negative predictor.

Knowledge, perceptions and beliefs

ANC: Several points of knowledge, perceptions, or attitudes of the pregnant women impact their ANC attendance. Women's perceptions of the value and need of ANC visits (2/38) and of the quality of ANC (3/38) may negatively influence their ANC attendance. On the contrary, knowledge of the danger signs of pregnancy (1/38) and knowledge of the recommended number of ANC visits (1/38) were positively associated with ANC attendance. The attitude of women towards pregnancy (1/38) or maternal health (1/38) also influences their attendance: the ones who perceive pregnancy as a risky event are more likely to seek ANC, as is for those with a good attitude towards maternal health. Finally, the feeling of shame (1/38) and some fears (2/38) including fear of hospitals or fear of HIV testing can also prevent women from attending ANC.

IFAS: Knowledge on IFAS (8/38) and knowledge on anemia (20/38) are the most common factors associated with IFAS adherence of pregnant women. Some authors hypothesized that the pregnant women who had appropriate knowledge about the benefits and side effects may have better opportunities to adhere to the medications and to identify and seek counseling for complications [2]. Knowledge about anemia and IFAS can be increased by giving adequate counseling during ANC visits (see level of health). A common reason for not taking IFAS was fear: fear of side effects (9/38), fear of increased baby size (6/38), fear of injury of mother or infant (4/38) and fear of complicated delivery (1/38), while the fear of illness if IFAS was missed was associated with better adherence (2/38). Finally, women's perceptions of the value and need of IFAS also influenced their adherence (1/38). The authors mentioned that "In Senegal, women perceived iron supplements as useful for restoring blood, avoiding complications during delivery, and giving strength for the delivery. Under this paradigm, it made sense for pregnant women to take the supplements later in the pregnancy in preparation for the delivery. The utility of IFAS for anemia prevention or treatment of asymptomatic anemia was less well understood or important to these women" [5].

Figure 2: Illustrative examples of how we could present some results



Other

ANC: -

IFAS: The forgetfulness factor is significantly associated with the lack of adherence of women to IFAS during pregnancy (12/38). In the reviewed articles, it is often classified as the main reason for missing the tablets. As some authors stated, a possible explanation for that is the time at which the tablet is taken. "Findings from the qualitative study revealed that since the tablet is taken at night, pregnant women were more likely to forget the tablet since the daytime is loaded with various tasks and at night time they become tired. Lack of concern for adherence might also lead pregnant women to forget the tablets"[2]. Others reported that " When probed, more than half of women reported occasionally missing doses because they forgot, were away from home, or were busy with household chores or caring for children" [6].

LEVEL 2: Household

Socio-demographic

ANC: Among the socio-demographic factors related to the household, the education (2/38) and the occupation (2/38) of the husband are positive predictors of women's ANC attendance. Indeed, women having a husband with a non-farming or fishing occupation are more likely to attend ANC. Along the same lines, higher income (4/38) of the family is a positive predictor of women's ANC attendance. Finally, the family size (1/38) is also associated with their attendance: having less than three children is a positive predictor.

IFAS: The same factors influence IFAS adherence. Concerning the husband's education, two studies mention that a secondary education and above of the husband is a barrier to maternal adherence to IFAS, while one study has the husband's education positively associated to women's adherence to IFAS. Only one study negatively associates the household income (1/38) with IFAS adherence, when seven others (7/38) find it is a positive predictor of IFAS adherence. Finally, in opposition with what is found for ANC attendance, a bigger family size (2/38) is positively associated with women's adherence to IFAS.

Support

ANC: Several factors related to the household support have been found to influence women's ANC attendance. Sometimes, the decision on ANC attendance is not taken by the women themselves, but by a family member (1/38). In other cases, their discouragement (1/38) or their support (3/38) (or lack of) can strongly influence the decision made by the pregnant women. However, requiring the support of a family member (1/38) or the necessity to be accompanied by one (1/38) can be a burden on the women and discourage her from attending ANC. On the contrary, women who have a relative autonomy on health care spending (1/38) are more likely to use ANC.

IFAS: Having support from peers (7/38) has a positive influence on women's adherence to IFAS. For example, getting daily reminders from family members to take supplements helps to reduce forgetfulness. For that reason, some providers recommend women asking their family to help them remember their supplements. As observed by some authors, women themselves considered "social support as a critical adherence facilitator and reported receiving general advice from family members during pregnancy, as well as encouragement and reminders to take IFA" [6].

LEVEL 3: Health services

Environment

ANC: The accessibility of ANC services (6/38) is the most common environment predictor for women's ANC attendance, both geographically and economically. For example, it was found that women "who are residing within a nearer walking distance (less than an hour) from a health facility were about 4 times more likely to utilize antenatal care than those residing farther (greater than 2 hours)" [7]. Women's places of residence are also significantly associated with their ANC attendance: those living in urban areas (2/38) are more prone to use ANC services. Similarly, those with media exposure such as radio or television (2/38) are more likely to seek ANC services than the others.

IFAS: The same factors influenced IFAS adherence. The proximity of ANC services (2/38) is positively associated with women's adherence to IFAS. Living in an urban area (5/38) is an important predictor for maternal adherence to IFAS during pregnancy. Some authors stated that "the reason could be the urban

pregnant women might have better exposure to information than rural" [8]. In line with this, media exposure (1/38) along with possession of a television and a radio, is positively associated with adherence to iron supplementation.

Supplement

ANC: -

IFAS: The occurrence of side effects (10/38) is the most common barrier to regular consumption of IFAS among the supplement-related factors. Heartburn, stomach cramps, and nausea or vomiting are the most cited ones. Self-efficacy in managing the side effects could be gained by adequate counseling. Just behind, shortages of IFA supplements (8/38) in health facilities is also a strong predictor of women's adherence to IFAS. Of note, the barriers and enablers associated with the supply chain system have not been reviewed here, as the focus was specifically on the service delivery system. The lack of supplies at health facilities can lead to additional cost for women, should they, for example, acquire the tablets at pharmacies. However, cost (1/38) is another barrier to IFAS adherence. In one study, the authors find a negative association between the number of tablets collected per ANC visit (1/38) and women's adherence as a result of the increased pill burden [9]. Finally, the appeal of supplements in terms of formulation (2/38) is also a predictor for maternal adherence to IFAS. The lack of women's preferred form of IFAS, or the taste of the tablets has been mentioned as barriers to continued consumption.

ANC

ANC: The lack of awareness of the benefits of ANC (3/38) is the most common reason cited by women for not attending ANC, but other factors related to ANC also influence their attendance. The timing of initiation (1/38) and the number of visits recommended (1/38) figure among those. Indeed, beginning the ANC visits in the first trimester is positively associated with achieving ≥ 4 ANC visits, compared to beginning later during pregnancy. On the contrary, a high frequency of recommended visits is identified as a barrier, some women even delaying the first ANC visit in order to limit the total number [10]. Having access to support during labor (2/38), to birth certificates (1/38) and to the maternal or fetus health status (2/38) motivate women to attend ANC. The attendance by their peers (1/38) is also positively seen by pregnant women. Finally, several women mention prevention-focused motivation (1/38), such as receiving vaccinations, as an influencing factor.

IFAS: The timing of the first ANC visit (1/38) and the total number of ANC visits (12/38) are two strong predictors for maternal adherence to IFAS. Some authors stated that "The reason may be those who had early registration would have had better attention for their prenatal period and had more ANC follow ups which will have effect for getting counseling and ultimately improved knowledge about anemia and IFAS" [2].

Service

ANC: Among the service-related factors associated with ANC attendance, the waiting time (3/38) is the most cited one. This factor is a barrier to ANC attendance. Similarly, "women who received advice to complete ≥ 4 ANC visits before delivery" have greater odds of doing so compared to their counterparts (1/38). While the unavailability of the provider (1/38) demotivates women to attend ANC, in contrast, the availability of female doctors and midwives (1/38) is positively mentioned.

IFAS: Counseling (19/38), including nutritional counseling (4/38), is by far the greatest service-related predictor for women's adherence to IFAS during pregnancy. Getting health education or counseling about

IFAS can mean getting advice for example on the management of IFAS side effects, the benefits of IFAS, or the recommended schedule. Some authors also suggested that "increased knowledge of both anemia (including pregnancy complications) and iron and folic acid supplementation" resulting from proper counseling could explain a greater adherence [2]. This again emphasizes the need for an adequate training of the providers to support counseling for IFAS, which happens to be another predictive factor of IFAS adherence (2/38). As a possible effect, the provider's inconsistency (1/38) in prescription practices (dosage and duration), their perceived lack of value of IFAS (1/38) or even their reluctance (1/38) to prescribe IFA supplements in early pregnancy have all been observed. In addition, other authors mentioned inadequate tools (1/38) as a barrier to support and monitor adherence. In contrast, a strong relationship with the provider (1/38), and the trust (1/38) put in them are reported as enablers for IFAS adherence. Finally, mothers who face long waiting times (1/38) or different problems within the health facility (2/38) when collecting their supplements are less likely to adhere to IFAS.

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