






## METHOD ARTICLE

**REVISION** **Visualizing participant experiences in maternal and child nutrition studies using timeline mapping [version 2; peer review: 2 approved]**

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**Abstract**





Iron and folic acid (IFA) supplementation is one of the most cost-effective interventions to prevent and treat anemia during pregnancy. Despite having the highest global burden of anemia among pregnant women, rates of IFA uptake in pregnancy in India are still very low, particularly in the state of Uttar Pradesh. While there have been several studies that explored challenges around IFA consumption and adherence, there is a paucity of studies that have synthesized this information into a single visual tool that can help program implementers understand the challenges and identify potential areas of intervention. Timeline maps were developed as a visual qualitative tool to explore the nuances of health behaviors among pregnant women with respect to antenatal care (ANC) services, including IFA consumption. Timeline maps were used to visually document critical events pertaining to ANC services chronologically, including details on contact points with the health system and events specific to IFA distribution, consumption and counselling. Six research assistants (RAs) were trained on how to use timeline maps and record participant narratives. The RAs later participated in a focus group discussion to gain insight about their experiences using the tool. RAs reported that the timeline maps were easy-to-use and facilitated in-depth conversations with participants. RAs shared that they were able to actively engage the participants in co-creating the maps. The visual nature of the tool prompted participants' recall of key pregnancy events and reflexivity. Challenges reported with the tool/process included recollection of past events and potential misrepresentation of information. These highlight a need to restructure training processes. Our findings indicate that timeline maps have the potential to be used in a variety of other program contexts, and merit further exploration.


**Keywords**

Timeline map, maternal and child nutrition, pregnancy, Iron and Folic Acid, implementation research, India

**Open Peer Review**

**Reviewer Status**  

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Any reports and responses or comments on the article can be found at the end of the article.

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**REVISED Amendments from Version 1**

We greatly appreciate the reviewers' comments. We have made the suggested changes to further clarify the objectives of our study, provide more information on the interviewers (RAs), strengthen the discussion of the study's results to better frame the study's conclusions.

**Any further responses from the reviewers can be found at the end of the article**

**Introduction**

India has the highest global burden of iron deficiency anemia in women and children, with the northern state of Uttar Pradesh (UP), India's largest state, having persistently high rates of anemia in women of reproductive age (52%) and among pregnant women (51%)<sup>1</sup>. The consequences of anemia during pregnancy are significant, and can lead to poor birth outcomes and postpartum complications<sup>2,3</sup>. The National Iron+ Initiative of the Government of India recommends that all pregnant women with hemoglobin levels  $\geq 11$  g/dl take 180 iron and folic acid (IFA) tablets antenatally, starting at 12–14 weeks of pregnancy, and 180 IFA tablets postpartum<sup>4</sup>. For pregnant women with hemoglobin levels between 9–11 g/dl, the guidelines recommend taking 2 tablets/day. Distribution of IFA tablets to pregnant women is done through routine antenatal care (ANC) services provided by the Auxiliary Nurse Midwife, a community health practitioner, at designated village health and nutrition days (VHNDs)<sup>5</sup>. VHNDs are an inter-sectoral convergence platform at the village level, where the community can access a package of services, including registration of pregnant women, ANC services, immunization for all eligible children, growth monitoring, supplementary food provision, and health education. Other frontline workers (FLWs) such as the Accredited Social Health Activist (ASHA) and the Anganwadi worker (AWW) are responsible for follow-up and to ensure distribution of IFA to those women unable to attend VHNDs. Thus, distribution and receipt of IFA tablets are very closely linked to access, availability and quality of ANC services and timely follow-up.

In UP, intake of IFA among pregnant women remains low, with only 12% of pregnant women consuming 100 or more IFA tablets during pregnancy<sup>1</sup>. Additionally, less than half (46%) of pregnant women have ANC check-ups in the first trimester and only 26% have at least four ANC visits during pregnancy. There are, however, inherent drawbacks to assessing IFA consumption using only quantitative data because of the potential for recall bias, as ANC and IFA data rely on mother's recall of events up to 5 years before the survey. Several studies that have explored barriers and challenges to IFA compliance highlight different challenges such as poor knowledge of consequences of anemia, accessibility of ANC services, IFA stock-outs, low decision-making power and irregular follow-up by FLWs<sup>6–9</sup>. Yet, there is a paucity of studies that have consolidated all of this critical information into a straight-forward, visual tool that can help program managers understand these factors comprehensively and identify potential areas of intervention.

The current study was conducted to explore the feasibility and field-friendliness of timeline mapping to visually document rich narrative data specific to IFA tablet distribution, consumption, counselling and follow-up. The map is intended to enable the implementation team to better understand critical events that occur during pregnancy, and to explore the nuances of health-seeking behaviour among pregnant women with respect to ANC services, including IFA consumption. The study sought to explore field experiences in using timeline maps to facilitate communication with pregnant women, including an understanding of the process of timeline mapping itself.










This feasibility study was part of an implementation study conducted in Behta block of Sitapur district, UP to explore factors associated with IFA consumption during pregnancy and gaps in knowledge of critical pregnancy events from a pregnant woman's perspective. The implementation study, in turn, is part of larger on-going project based in UP that seeks to reduce morbidity and mortality due to malnutrition in children under five in 25 high priority districts in UP, by strengthening maternal, infant and young child nutrition service delivery through the Government of UP's Integrated Child Development Services and National Health Mission programs<sup>10</sup>.

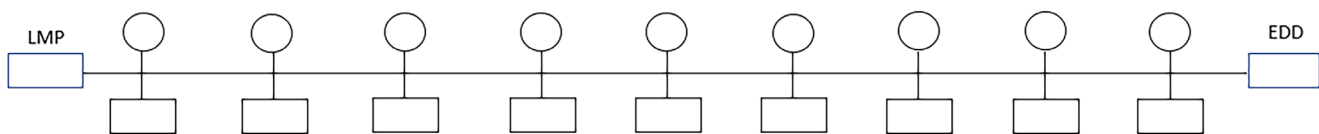
**Developing a timeline map**

Narrative interviews are a means of eliciting stories about people's lived experiences via a conversation between the interviewer and interviewee that allow the interviewer to better understand participants' experiences<sup>11</sup>. Participatory visual methods help in shifting power imbalances between the researcher and the participants and provide more meaningful engagement with participants<sup>12</sup>. Constructing timelines is one way of visually depicting rich narrative data. Timelines are usually constructed from a participant's life events, in some sort of chronological order, with visual notations of highlighted events<sup>13–16</sup>. Timelines have been previously used to study several topics including substance use and treatment<sup>13</sup>, health equity and homelessness<sup>14</sup> and resilience among marginalized groups<sup>15</sup>, but they are still underutilized in maternal and child health and nutrition research. Timelines are a useful tool to explore pregnant women's antenatal experiences, since pregnancy naturally lends itself to thinking of antenatal experiences in a chronological manner. We used timeline mapping as a methodology, to explore not just the "what" around IFA consumption among pregnant women but also the "why", within the context of their antenatal experiences.

The timeline map consists of a straight, horizontal line divided into several compartments (Figure 1). The circles on top and the squares on the bottom represent the month and date respectively. In our study, timeline maps were used to document (chronologically and in a single visual representation) critical events pertaining to ANC services, different contact points with the health system, and events specific to IFA distribution, consumption and counselling. In this instance, the compartments represented the nine months of pregnancy, and the woman's last menstrual period and expected date of delivery were used as a frame of reference for the duration of pregnancy (Figure 1).

## IFA TIMELINE MAP

Indicators	
	Date of Visit
	Registration
	Date of VHND
	Hb value
	No. of IFA tablets received
	Regular IFA consumption
	Irregular IFA consumption
	No IFA consumption
	Counselling on IFA



**Figure 1. A template of the IFA timeline map.** Abbreviations used are: IFA- Iron and folic acid, VHND- Village health and nutrition day, Hb- Hemoglobin, LMP- Last menstrual period, EDD- Expected date of delivery.

The key indicators are highlighted on the top right of the map and serve as a legend for the notations for each indicator. The timeline map is placed on an 11x17 (A3) sheet with sufficient room for the interviewer to annotate key details of participants' pregnancy events. Having all these details in a single visual representation provides a quick contextual and comprehensive snapshot of all the relevant events from the participants' perspective. Emphasis is placed on highlighting all the ANC services accessed by the pregnant woman during her pregnancy, including interactions with FLWs. Interviewers are encouraged to probe for details pertaining to each ANC visit such as location, tests performed, receipt of IFA and other supplements. However, the details (including the legend) can be customized to the specific thematic area of the researcher. The timeline map tool and methodology were developed with the assistance of project staff in Kannauj district of UP.

### Methods

As part of the broader study, in August 2018, in-depth interviews were conducted with fifteen pregnant women in their ninth month of pregnancy in Behta block of Sitapur district in UP to understand the nuances around IFA consumption during pregnancy. Six interviewers (hereafter referred to as Research Assistants, RAs) were selected from among the existing project staff in Sitapur district, as they best understood the project context. The RAs were frontline staff of the nutrition project based at a sub-block level, trained in maternal, infant and young child nutrition as part of the larger project. Their primary responsibility was to mentor and provide on-the-job support to Government of India frontline workers (namely AWWs and ASHAs) to deliver high quality maternal, infant and young child nutrition services. All six RAs had graduate degrees, with more than 2 years of experience working at the community level. The RAs

participated in a one-day training led by the project technical experts on the study objectives, how to use the timeline maps and the interview guides. RAs practiced using the tool on each other during the training sessions. Prior to actual data collection, the RAs practiced interviewing at least two pregnant women in their catchment areas using the timeline maps. A debrief was held after their practice sessions to respond to any queries or concerns. Signed informed consent was obtained from the pregnant women prior to the start of the interviews. A data collection team of two RAs conducted the interviews using a semi-structured interview guide and the timeline map. The interview guide comprised open-ended questions on different aspects of ANC, with a focus on IFA consumption. Questions included time of registration of pregnancy, ANC services received, IFA/anemia counselling received, number of IFA tablets received during each ANC visit, and patterns in IFA consumption. Of the two RAs, one acted as the moderator and constructed the timeline map, while the other team member was a note-taker and managed the logistics of the interview. While the data from the interviews with the pregnant women are not presented in this paper, a sample timeline map has been included (Figure 2).

### Assessing the timeline map

An hour-long focus group discussion was conducted with the six RAs in order to explore their experiences using timeline maps. The focus group discussion was conducted at a Community Health Centre in Behta block by technical experts in the project (co-authors PS and TS). Signed informed consent was obtained from the RAs, after which the focus group discussion was conducted in Hindi and was audio-recorded. The focus group discussion guide comprised open-ended questions on benefits and challenges of using the tool, focusing on the RAs' experiences.





*So we get to write about the counselling, and all information related to the ANC, the VHND as well as what the woman reveals about herself, in a pre-determined manner. (RA5)*

**Chronology of timeline map.** RAs noted that the timeline map's chronology helped guide the sequence of questions asked during the interview, so that there was consistency across all interviews.

*The tool provided a chronological process, about which sequence is to be followed from its starting to its end. This was the best part about the tool that it was in a sequence, guiding us to ask specific questions in a specific order. ... Whatever had to be done was available on the paper and I knew what I had to ask the woman at what time. The responses obviously initiated several other questions but the tool kept us bound to the format we have to follow. Otherwise, if I did not have this tool and had been asked to verbally assess the pregnant woman's situation, I would have forgotten or omitted several things. ... But through this tool, I did not forget anything anywhere, irrespective of whether I was talking to the first woman or the third, my questions were the same that revealed respective answers. (RA1)*

Another RA expressed that the timelines prompted them to remember details of the interview even when they reviewed the map much later on.

*What happens because of the mapping is that we get to meet the pregnant women only for a little while. But when you go back to sit and read the paper, it feels as though someone's entire story from the beginning of her pregnancy, to who she told the first time, where all did she go, is revealed. The indicators show whether or not she took her tablets regularly and when she stopped eating them...(RA5)*

**Snapshot of a woman's pregnancy.** The RAs noted that the timeline map provided an overall snapshot of all key events during a woman's pregnancy "in one place" and contained all the information that "could possibly be" elicited from a pregnant woman. They felt that using the map facilitated dialogue with the participants, who revealed information that otherwise "may never have surfaced".

*When the pregnant woman started talking, we got to know all the details. Otherwise, it is possible that this information would not have ever surfaced. Because of the timeline map, she has told everything properly, from the beginning of her pregnancy... everything. (RA3)*

*The tool contained all the information that could possibly be extracted from a pregnant woman. When did she become pregnant? When did she get herself registered? When was her ANC done and when she got the iron tablets and what all she ate during her pregnancy, how she took care of herself and who helped her out in her family,*

*giving and taking information from her, all of this was possible to know and understand because of the timeline tool. (RA1)*

**Co-creation of the timeline map with participants.** RAs were able to co-create the timeline map with the participants, instead of it being a purely researcher-created timeline. They felt that the map increased participant engagement since the participants were the navigators of the entire process.

*The last pregnant woman I met, when I was doing the exercise with the timeline mapping for her, she was actually pointing out to correct what happened in which month. She was a little educated, so she was participating efficiently in telling me about the point at which her ANC happened and when she went to her maternal house or started with her tablets. She was looking at the map and telling me things. (RA4)*

*This happened with me in [name of village]. ...when we reached ahead in the sequence, she realized that she wanted to tell us something and took us back to the previous section. (RA1)*

RAs believed that the tool helped the participants reflect on their pregnancy experiences. One RA felt that the visual nature of the tool and filling it out "in front of" the pregnant woman, rather than writing down notes in a notebook or diary, made the information more transparent and helped in greater reflexivity.

*Looking at the map, they would also be amazed at the extent of information that was being taken from them from the beginning until the end of their pregnancy, wondering what would happen with it and realizing that these are important things and whatever they have forgotten or omitted, are actually important and should be followed. ...The woman was also able to understand what she followed or omitted. Otherwise, I would just note things in my diary and she would not understand anything. But when I was filling the timeline map in front of her, she could see what was being discussed about her own pregnancy and what were the things she had done wrong or right. (RA3)*

The RAs found that having a pre-determined structure and a sequence to follow helped with consistency across all interviews. Visually summarizing all the information in "one place" provided a snapshot of all relevant pregnancy events. Notably, the visual nature of the timeline map aided in co-creation with the participants, and having the detailed map laid out in front of them also resulted in greater reflexivity among participants.

**Understanding a woman's pregnancy experiences**

**Greater empathy towards participants.** RAs reported that the timeline mapping exercise provided deeper insight into and sensitivity towards different experiences during a woman's pregnancy. They felt it helped them empathize with the participants, as opposed to just viewing them as beneficiaries who needed to be counselled. They felt that this also improved their own field

work since they had a deeper understanding of pregnant women's experiences. They reported incorporating insights from the timeline mapping process in their routine home-based counselling of pregnant women.

*Generally, when we conduct home visits, we talk about the state of the month we are visiting in and give the woman counselling based on that. In the case of the timeline mapping, we had to take the information of their entire history. We held the discussion on their entire history and not only that, if there was something wrong or problematic in her history, we did not point it out and start giving advice, we were only trying to understand. ...[the timeline mapping exercise] has allowed us to associate with the beneficiary with sensitivity (RA1)*

*The assessment of the pregnant women also helped us in the field. The questions I would otherwise not ask the woman, I have been asking now and talk to them accordingly... (RA3)*

**Eliciting previously 'unknown' information.** RAs shared that the tool helped elicit information from the pregnant women. They felt that it helped reveal the women's 'thought processes', including personal fears and misgivings with respect to revealing their pregnancy, accessing services during pregnancy, unwanted pregnancies and taking IFA.

*Through this [tool], we even got to know that in case she has had one or two miscarriages, she tries to hide her pregnancy because if people find out, she will be made fun of for being pregnant again, after a miscarriage. Women do not reveal their pregnancy to ASHA worker or AWW up to four or five months sometimes, out of fear of being jested at. They do not feel that it is important to reveal this information... (RA4)*

*...When we ask her about why or why not did she did a certain thing, she tells us about her thought process, for instance, that eating the tablet might make her child dark complexioned. Whatever her deepest thoughts are, they are revealed with this tool. (RA2)*

*...after becoming pregnant, women have quietly left for their maternal home and not told anyone... including the husband. And later, when the 'dawa' [abortion pills] have not worked, then they come back to their husbands to tell them about it. When we would go for home visits [earlier], such things are not revealed. (RA5)*

**Understanding support systems and key influencers.** RAs reported getting a better understanding of which family members influenced a pregnant woman's health behaviors and related decisions.

*Through this map, we even get to know about the family member the woman is closest to and who supports her in all her good and bad times and takes care of her diet, her day-to-day activities and who really pays attention to her in the house or say, which family member, like*

*the mother-in-law, stops her from doing certain things. (RA2)*

*... there are certain families in which the mother-in-law, the father-in-law, husband, all help out. In that family, everyone was helping her out, all medicines, everything. ...She was getting a lot of support. (RA4)*

The RAs shared that the narratives that evolved as part of the timeline mapping exercise promoted compassion towards the participants, and greater insight into different aspects that could influence health behaviors. In fact, the Hindi word that the RAs used was *samvedana* which loosely translates to sensitivity/compassion. Additionally, they observed that the tool helped to provide space for the women to share their fears and misgivings, decisions surrounding family upheavals, and feelings on unwanted pregnancies. They also gained an understanding of a pregnant women's support systems and influencers within their families. RAs had already started incorporating insights from the timeline mapping process in their routine home-based counselling.

#### Challenges faced while using timeline maps

When asked about some of the challenges of using the tool and suggestions to improve the tool and the interview process, several of the RAs noted that some of the participants may have misrepresented, misremembered or felt uncomfortable answering questions (one-on-one) about their pregnancy. They suggested that having another family member present during the interview, particularly someone who was close to the pregnant woman, would alleviate this.

*...along with involving the beneficiary, we should also involve the one person who is the closest to her and spends maximum time with her. If we take their view as well, then we will be able to understand the situation even better. (RA1)*

*...When I just spoke to the pregnant woman, she told me that she has been eating everything. I would have written everything down since I was only talking to her. But her mother in law joined us in between and told us that she had not eaten anything, she even showed me the entire bottle of syrup [iron supplement] still full, the powder had also dried up. So, if I just speak to the pregnant woman, some of them may lie and that cannot be detected. (RA5)*

Another challenge that one RA faced was participants being hesitant to provide information. This RA also felt that since the respondents were in the ninth month of their pregnancy, recollection of past events was somewhat of a challenge at the beginning of the interview. However, once the interview progressed, this posed less of a challenge.

*In the beginning, when we went and sat with them and talked a little, they would initially get a little scared looking at the timeline map, wondering what it had to do with their pregnancy. They were hesitant to answer a few initial questions. Say, it is someone's ninth month into*



*pregnancy, they would have to recall things from nine months ago, about when they had their last menstrual cycle, who they told about the pregnancy... But after we were able to extract information about a month or two, and reach up to the timeline of one ANC, they would open up, discuss amongst each other and speak on their own, telling us about everything that happened. Yes, recollection was a little challenge. (RA4)*

Some RAs suggested, as a means to improve the tool, having pre-drawn boxes for when pregnant women should have their four ANC check-ups. They conjectured that doing so would increase participant involvement and would help the pregnant woman 'realize' that she should have had her ANC check-up during the recommended time period.

*There should be boxes made for the ANC. What this will do is that if there are four ANCs and four boxes at the right places, we can show that to the woman and in case her ANC did not happen in time, we can show her where she has missed out on things. ... (RA2)*

*... [if there were preset boxes] she will know that the ANC visit was supposed to happen but did not; this will get her more involved in the mapping. With the help of the box, she will get to know what the actual position should have been and why [I am] marking it with an arrow. She will understand it better. (RA3)*

While discussing challenges with the tool/process, the RAs suggested that having another family member present during the interview would alleviate the participants' discomfort and potential misrepresentation of information. They also observed that while, initially, recollection was a challenge for a few participants since they were being asked about events that occurred a while ago, it was less of an issue as the interview progressed. RAs also recommended making certain structural changes to the tool to enhance researcher and participant experiences.

## Discussion

This study sought to describe and understand the use of the timeline map as a qualitative visual tool within an implementation research context. The findings suggest that the timeline map has great potential as a participatory, narrative interview tool to provide an in-depth understanding of women's pregnancy experiences.

There are several reasons why the interviewers felt that the narrative interview process was made easier by using the timeline map. The structure of the tool helped organize their thinking around the interview process and helped them be consistent across interviews. The visual nature of the maps likely serves as a more effective guide, compared to a traditional discussion guide, to interviewers who may be less experienced as well. Nonetheless, RAs also reported using the semi-structured interview guide as a checklist during the interviews to ensure they did not inadvertently omit any key topics. Stewart-Tufescu and colleagues<sup>17</sup> described how the "visibility" of a graphic interview tool helped

participants or researchers return to a topic, as compared to a standard narrative interviewing technique. The RAs also observed that participants would, at times, point to a section that had already been discussed and add to the details. They also posited that the tool encouraged greater participation and reflexivity among the participants. Several studies have outlined how visual methods are more participatory and provide a more holistic view of the topics being researched<sup>16-19</sup>. Additionally, participatory visual methods help in shifting power imbalances between the researcher and the participants and provide more meaningful engagement with participants<sup>12</sup>.

In our study, the timeline map was intended as a means to organize complex narrative data. However, the RAs found that it also served as a means to reveal information that was previously not known and encouraged pregnant women to explore their pregnancy experiences and reflect on them. Visual methods, such as timelines, when combined with interviews, focus "attention beyond what is possible through talk alone, thus becoming not only a piece of data in its own right but a vehicle through which further data were produced"<sup>16-20</sup>.

We chose to train existing project staff as RAs, instead of using external researchers, since they best understood the project context. The tool's easy-to-use interface is well-suited for program managers and staff to administer. The advantages to this approach were that the project staff were familiar with the implementation topic being studied; they were experts in rapport-building, since their responsibilities in the wider project entailed extensive nutrition counselling; and it provided them with a better understanding of all the events around a woman's pregnancy. Moreover, an unintended consequence was that the RAs reported developing greater sensitivity and empathy towards women's experiences during their pregnancies. For instance, they reported understanding why some women had misgivings about revealing their pregnancy to FLWs and family members, or why they did not attend ANC clinics. RAs revealed that the timeline exercise gave them greater insight into aspects of women's pregnancies that could affect pregnancy-related health behaviors, particularly deeply personal ones such as family upheavals and unwanted pregnancies. Internal empathetic validity is the potential of research to transform the emotional dispositions of researchers and participants towards each other, in a manner that promotes interpersonal understanding and compassion<sup>21</sup>. The implications of this are enormous, particularly in relation to knowledge translation. Greater interpersonal understanding between researchers and knowledge users promotes enhanced engagement in producing and applying knowledge by both parties<sup>22</sup>. Indeed, the RAs noted that participating in the timeline mapping exercise changed how they approached interpersonal counselling when visiting the homes of pregnant women, and that they were now incorporating questions that they "previously did not ask".

The RAs noted some challenges with the tool/process. They felt that some participants misrepresented or misremembered information pertaining to their pregnancies and suggested that



having another family member present during the interview could alleviate this problem. However, this could lead to other biases in reporting, and could inhibit honest responses from participants. The RAs' suggestion of having another family member to "fact-check" participants' responses suggests a need for more interviewer training, focusing on the nuances of probing and follow-up questions. Recollection of events was identified as a challenge for a few participants, at least initially, since they were being asked about events that occurred some time ago. However, the RAs observed that it was less of an issue as the interview progressed. Prolonged participant engagement, using multiple methods of data collection and participant validation are some ways to enhance trustworthiness of findings using temporal visual methods such as life histories and timelines<sup>23</sup>. RAs also recommended adding more "ANC boxes" to the tool to enable better notations, and to serve as a visual reminder to participants that accessing ANC services in the recommended time period was crucial.

This study has several limitations. The small number of interviewers provided a limited perspective on usability and acceptability of the tool. Another limitation is that this paper only presents interviewers' experiences and does not capture participants' experiences with the tool. Power imbalances between the FGD moderators (co-authors PS and TS) and the RAs could be a potential limitation, since the moderators were the senior technical experts in the project. The RAs may have felt that they had to speak positively about the tool. However, the advantages of having the co-authors as the FGD moderators was the technical expertise that they possessed and the pre-existing rapport that they had with the RAs. Both FGD moderators (PS and TS) were aware of the power inequalities and tried to mitigate them in a number of ways. For instance, the Community Health Centre where the FGD was conducted was collectively decided upon by the RAs and the moderators, being mindful of the distances the RAs had to travel. The moderators opened the discussion by stating that the purpose of the FGD was to understand RAs' experiences using the tool and by encouraging the RAs to provide inputs on how to improve it. By restating this often and by offering encouraging comments throughout the FGD, the moderators may have contributed to a safe atmosphere. Furthermore, the fact that the RAs shared challenges using the tool points to them feeling comfortable reflecting on their experiences using the map.

Despite the visual nature of the tool, participant literacy could pose a limitation. We did not systematically address the effect of literacy on the level of participation in the interviews. However, RAs interviewed an almost equal number of illiterate and literate women. According to the RAs, the level of participation was similar across participants because of the visual nature and structure of the timeline map. Due to the tool's visual nature, the participants could understand the sequence of events being noted down which kept the conversation going.

Visual methods, when combined with interviews, enhance participant engagement and facilitate a more in-depth exploration of experiences, possibly because they serve as a common visible frame of reference for the discussion between the interviewer and the interviewee<sup>16,24</sup>. This is of particular significance in overcoming linguistic and literacy barriers.

In this study, we have outlined the feasibility and field-friendliness of using timeline maps, in an implementation research context, to understand in greater detail the key events during pregnancy and how these events influenced IFA consumption. Timeline mapping is an alternate method to understanding the complexities around IFA consumption in pregnancy, thus circumventing biases inherent in more traditional, self-reported methods of IFA assessment. It can be a valuable tool for understanding other events that change over time as well. Within the domain of maternal, neonatal and child nutrition, for instance, it can be used to explore complementary feeding practices among children 6–23 months of age, understanding events that influence early initiation of breastfeeding in a labor room, and exploring food behaviors of new immigrants. Timeline maps can also be used as a training tool and for nutrition counselling where front-line workers could use an 'ideal' timeline map depicting all the health services available to pregnant women during the course of their pregnancy to create greater awareness in the community. These alternate uses might be tested in future studies.

## Conclusion

The timeline mapping tool is an easy-to-use and effective participatory tool that can be included in implementation research and program evaluation. It has immense potential to be used widely in studying other areas of program implementation. The visual representation of key pregnancy-related events, including service delivery at different time points, provides an opportunity address program gaps and to improve program delivery.

## Data availability

For confidentiality reasons, the transcript of the focus group is not available; the focus group discussion was with six individuals who are still employed with the project. It should be noted that all relevant aspects of the focus group discussion have already been included in the article as quotes.

## Acknowledgments

The authors would like to thank all the participants and the research assistants for their time and participation. We would like to acknowledge the contribution of Dr. Ankit Sharma, District Nutrition Specialist, Kannauj and Poshan Sakhis of Kannauj district in the development of the timeline mapping tool and methodology. We would also like to acknowledge Dr. Javier Mignone for providing research expertise in visual narrative methodology.

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## Open Peer Review

Current Peer Review Status:  

### Version 2

Reviewer Report 08 July 2020

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**Eva C. Monterrosa**

Global Alliance for Improved Nutrition, Basel, Switzerland

The revisions are appropriate and the article is greatly improved. I approve this manuscript for indexing.

**Competing Interests:** No competing interests were disclosed.

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

Reviewer Report 02 July 2020

<https://doi.org/10.21956/gatesopenres.14343.r28981>

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**Rebecca Heidkamp** 

Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA

The authors have addressed most of the concerns raised by reviewers. This methods-focused paper will be useful to researchers and practitioners alike.

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** large-scale evaluation, household survey measurement, maternal child nutrition

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.**

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**Version 1**

Reviewer Report 20 January 2020

<https://doi.org/10.21956/gatesopenres.14183.r28344>

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**Rebecca Heidkamp**

Department of International Health, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA

This article presents an overview of a small pilot study that examines the experience of 6 research assistants in India around using a "timeline mapping" tool during interviews with a total of 15 women in their 9th month of pregnancy. The tool is designed to elucidate a clearer picture of the woman's experience of care during the pregnancy (Including ANC and IFA). The authors used Focus Group Discussions to better understand the Research Assistant's experience of the tool.

I really appreciate that the authors are profiling an innovative tool to facilitate qualitative data collection and in this instance, to help improve our understanding of women's ANC experiences. Low IFA intake is a global problem, as are the limitations in the approaches we have used to try to assess and improve compliance.

The manuscript can be improved by addressing the following issues:

**Introduction**

- The specific objective of this study is not clear as it is currently framed as "exploring the use" of the map as a way to inform program implementation. However, the latter aspect does not appear to be addressed. Given that the "results" section is focused on findings from FGDs with the 6 RA, the aims should be more clearly explained in terms of assessing the RA experience with the tool.
- The majority of background in both the abstract and paper is about low uptake of IFA however as presented, the results and discussion are not focused on IFA. Consider reframing background or more explicitly addressing IFA in other sections.
- If IFA is going to remain the focus then it's important to acknowledge the issues with measurement validity when coverage of intake is measured using HH surveys & extended recalls about specific number of pills - the 12% intake of 100+ is likely based on recall that is highly subject to bias.

**Methods**

- My expertise is not in qualitative methods but encourage authors to consider comments by Dr Monterrosa.



- The FGD appears to be the core of the study in terms of the results reported. Considering changing the subtitle before the FGD paragraph to be more descriptive e.g. "FGD with RA to assess their experience with the map"

#### Conclusions

- Authors state "In this study, we used timeline mapping to understand in greater detail the key events during pregnancy and how these events influenced IFA consumption, from a pregnant woman's perspective." However these are not the results presented. Rather the results are related to the RA experience using map. This ties back to comments about the introduction and needing to be clearer about the actual aims.

#### **Is the rationale for developing the new method (or application) clearly explained?**

Partly

#### **Is the description of the method technically sound?**

Partly

#### **Are sufficient details provided to allow replication of the method development and its use by others?**

Partly

#### **If any results are presented, are all the source data underlying the results available to ensure full reproducibility?**

No source data required

#### **Are the conclusions about the method and its performance adequately supported by the findings presented in the article?**

Partly

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** large-scale evaluation, household survey measurement, maternal child nutrition

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

Author Response 15 Jun 2020

**Deepa Sankaran**, University of Manitoba, Winnipeg, Canada

#### **Introduction**

- The specific objective of this study is not clear as it is currently framed as "exploring the use" of the map as a way to inform program implementation. However, the latter aspect does not appear to be addressed. Given that the "results" section is focused on findings from FGDs with the 6 RA, the aims should be more clearly explained in terms of assessing the RA experience with the tool.

Response: We appreciate the reviewer's comments. This paper sought to describe the feasibility and acceptability of a novel qualitative data visualization tool, as part of a larger implementation

study seeking to improve iron and folic acid tablet adherence among pregnant women. For further clarity, we have modified the objectives of the study as stated on Pg. 5 (2<sup>nd</sup> paragraph)

- The majority of background in both the abstract and paper is about low uptake of IFA however as presented, the results and discussion are not focused on IFA. Consider reframing background or more explicitly addressing IFA in other sections.

Response: We appreciate the reviewer's suggestion of reframing the background, or addressing IFA in other sections. The intent of this paper was to focus on a novel methodology of obtaining general IFA consumption patterns, which is particularly salient given measurement validity issues with quantitative IFA intake measurements. We have split the introduction into two parts. The first part, "Introduction" (Pg 4-5), provides background on why understanding IFA consumption from a woman's perspective is key. The second part, "Developing a Timeline Map" (Pg 6-7), provides background on the use of visual methods in qualitative data collection. We intend to present the results from the timeline maps in an upcoming publication, where we specifically outline the IFA consumption patterns obtained using timeline maps.

- If IFA is going to remain the focus then it's important to acknowledge the issues with measurement validity when coverage of intake is measured using HH surveys & extended recalls about specific number of pills - the 12% intake of 100+ is likely based on recall that is highly subject to bias.

Response: We have addressed (Introduction, Pg 4, 2<sup>nd</sup> paragraph) the inherent recall bias associated with all quantitative data with respect to ANC and IFA, since most surveys rely on mother's recall of this information, up to 5 years prior to the survey.

#### **Methods**

- The FGD appears to be the core of the study in terms of the results reported. Considering changing the subtitle before the FGD paragraph to be more descriptive e.g. "FGD with RA to assess their experience with the map"

Response: Thank you for this suggestion. Please see changes made to Results section (Pg 8) to include the subtitle "Focus Group Discussion with RAs to assess their experience with timeline maps".

#### **Conclusions**

- Authors state "In this study, we used timeline mapping to understand in greater detail the key events during pregnancy and how these events influenced IFA consumption, from a pregnant woman's perspective." However, these are not the results presented. Rather the results are related to the RA experience using map. This ties back to comments about the introduction and needing to be clearer about the actual aims.

Response : We appreciate these comments. Please see changes made on Pg 15 (last paragraph) to better reflect the aims of this study.

**Competing Interests:** No competing interests were disclosed.

Reviewer Report 21 October 2019

<https://doi.org/10.21956/gatesopenres.14183.r27817>

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### Eva C. Monterrosa

Global Alliance for Improved Nutrition, Basel, Switzerland

I would like to thank the Authors for proactively seeking to examine the feasibility of a qualitative data collection tool. This type of research is critically needed to advance implementation science in nutrition. To strengthen this paper, I recommend the following changes before this manuscript is indexed.

#### Introduction

- Clarity of objective. Please define what you mean by implementation study. Is this a feasibility study to assess its usability for data collection and analysis to achieve your objectives? Is this an exploratory study to examine the acceptability (e.g., field-friendliness) of tool among field staff doing qualitative research?
- Please further elaborate on the context for the research methodology. For example, the authors might want to consider the skill level needed to conduct high quality interviews and how this tool might provide the structure that a discussion guide might lack for a less experienced staff. Another good point to make is that participatory methods not only support data collection through reflexivity but also empower participants.

#### Methods

- The timeline is a tool to construct a chronological narrative of events – something the authors have noted. As such, it is both an elicitation technique for constructing event-based narratives organized in chronological order, as well as a data visualization tool because text data is made visible to the interviewee in a way that interviewer notes or voice recordings are not. Please distinguish this point in the methods section. The articles cited in the methods are a combination of the timeline method and graphic elicitation which is the use of drawings, pictures or symbols to tell stories about events and to construct deeper, richer narratives/meanings.
  1. I'm having trouble seeing how the present tool is a graphic elicitation technique. If yes, please clarify/justify how the graphics (squares, circles, lines) helped with constructing a richer, deeper narrative that would not have been possible through a standard interview guide? Otherwise I think what we have is a data visualization tool and this distinction needs to be clear.
  2. Would illiterate women be as reflexive of their personal experiences with the map you have constructed, which is text heavy? If all women were literate, please add this as a limitation of your study or generalizability of your results only to this group of women.
- Please describe more fully who the RAs were? What other jobs were they working? Did any of them have qualitative research experience?
- How long, on average, did the interview last?
- Who were the participants – age, education, income bracket.

#### Results

- The results section needs a bit of tightening so that it aligns more closely with the revised objectives. For example, I don't know why certain 'background' information was included because it does not seem relevant for the replicability and generalizability of this tool. E.g., 'unknown' information & Understanding support systems and key influencers sections. Does this relate to the fact that they also have a job as nutrition counsellors? The support system info would have been retrieved in a standard interview.
- How much did they use the semi-structured interview guide? Were the questions even needed?
- For each RA, how many of timeline maps did they need to do to feel comfortable with using the tool? (i.e., what was the learning curve?)
- Some of the results/recommended changes to do not align with improving the tool, such as:
  1. having the MIL in the room while PW is interviewing
  2. Pre-drawn boxes for when pregnant women should have their four ANC check-ups. This would bias the tool.
- It wasn't clear if these were one-on-one interviews or group interviews. Please check the text because in some places it seems that group interviews are implied (i.e., 'they would open up, discuss amongst each other and speak on their own'...)

## Discussion

- Please discuss the overall quality of the interview with regards to having achieved your objective. Did the researchers retrieve better information?
- Presence of social desirability - RAs noted that some of the participants may have misrepresented, misremembered. This idea needs to be better outlined in the discussion section. How do qualitative researchers address validity of the findings?
- Please comment how this tool might have alternative application to research. For example it could be used by front line staff to deliver nutrition counselling and to support greater client empathy. This use might be tested in future studies.
- Check for repetition in text.

## **Is the rationale for developing the new method (or application) clearly explained?**

Partly

## **Is the description of the method technically sound?**

Partly

## **Are sufficient details provided to allow replication of the method development and its use by others?**

Partly

## **If any results are presented, are all the source data underlying the results available to ensure full reproducibility?**

Partly



**Are the conclusions about the method and its performance adequately supported by the findings presented in the article?**

Partly

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Qualitative research; maternal and child nutrition; India

**I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.**

Author Response 15 Jun 2020

**Deepa Sankaran**, University of Manitoba, Winnipeg, Canada

#### Introduction

- Clarity of objective. Please define what you mean by implementation study. Is this a feasibility study to assess its usability for data collection and analysis to achieve your objectives? Is this an exploratory study to examine the acceptability (e.g. field-friendliness) of tool among field staff doing qualitative research?

Response: Thank you for this query. This paper sought to describe the feasibility and acceptability of a novel qualitative data visualization tool, as part of a larger implementation study seeking to improve iron and folic acid tablet adherence among pregnant women. For further clarity, we have modified the objective as stated in the Introduction (Pg. 5, 2<sup>nd</sup> paragraph).

- Please further elaborate on the context for the research methodology. For example, the authors might want to consider the skill level needed to conduct high quality interviews and how this tool might provide the structure that a discussion guide might lack for a less experienced staff. Another good point to make is that participatory methods not only support data collection through reflexivity but also empower participants.

Response: We appreciate these suggestions and have included these points in the publication in several places (Pg.6, 1<sup>st</sup> paragraph; Pg. 7, 2<sup>nd</sup> paragraph in Methods; Pg.13, 2<sup>nd</sup> paragraph in Discussion)

#### Methods

- I'm having trouble seeing how the present tool is a graphic elicitation technique. If yes, please clarify/justify how the graphics (squares, circles, lines) helped with constructing a richer, deeper narrative that would not have been possible through a standard interview guide? Otherwise I think what we have is a data visualization tool and this distinction needs to be clear.

Response: In our paper, we sought to describe timeline mapping as a qualitative visualization tool using a pre-prepared diagram. RAs shared that the tool helped guide the participants' narrative since they could see boxes with information being filled out right in front of them. As such, we agree that the tool functions as a data visualization tool, and not a graphic elicitation tool. We

acknowledge that some of the references cited in the discussion section could be misleading. We have edited this section to reflect that timeline mapping is a qualitative visualization tool on pages 13-14 (References in the 1<sup>st</sup> and 2<sup>nd</sup> paragraph of the Discussion).

- Would illiterate women be as reflexive of their personal experiences with the map you have constructed, which is text heavy? If all women were literate, please add this as a limitation of your study or generalizability of your results only to this group of women.

Response: We have included some information on participant literacy in the discussion section (pg 15, 2<sup>nd</sup> paragraph) and re-organized previous sections to further clarify the effect of literacy on participation. Briefly, there was an almost equal ratio of literacy levels among women who were interviewed. According to the RAs, the level of participation was similar across participants because of the visual nature and structure of the timeline map. Due to the tool's visual nature, the participants could understand the sequence of events being noted down which kept the conversation going.

- Please describe more fully who the RAs were? What other jobs were they working? Did any of them have qualitative research experience?

Response: As suggested, we have included a description of the RAs in the methods section (pg 7, 1<sup>st</sup> and 2<sup>nd</sup> paragraph in Methods). Briefly, the RAs were frontline staff of the nutrition project based at a sub-block level. Their primary responsibility was to mentor and provide on-the-job support to Government of India frontline workers (namely the Anganwadi workers and the ASHAs) to deliver high quality maternal, infant and young child nutrition services. All six RAs were post-graduate, having more than 2 years of experience in working at the community level. They are trained in Maternal, Infant and Young Child Nutrition in the larger project.

## Results

- How much did they use the semi-structured interview guide? Were the questions even needed?

Response: We have included a description of how the interview guides were used on Page 13, 2<sup>nd</sup> paragraph in Discussion. Briefly, RAs reported using the interview guides in all the interviews. The guide was created to ensure that the RAs asked participants key questions around ANC care-seeking, pregnancy and IFA receipt and consumption. RAs also reported using the interview guide as a checklist during the interviews to ensure they did not inadvertently omit any of these key questions. However, RAs were trained to encourage participants to narrate their experiences around a certain topic, for instance, the timing of their first ANC check-up.

- For each RA, how many of timeline maps did they need to do to feel comfortable with using the tool? (i.e., what was the learning curve?)

Response: During the in-class training sessions, all RAs took turns interviewing one another using the interview guides and practiced filling out the timeline maps. After this, prior to actual data collection, the RAs practiced interviewing at least two pregnant women in their catchment areas using the timeline maps. A debrief was held after their practice sessions to respond to any queries or concerns. We've revised our methods to include this information (Pg.7, 2<sup>nd</sup> paragraph in Methods).

## Discussion

- Please discuss the overall quality of the interview with regards to having achieved your objective. Did the researchers retrieve better information?

Response: With respect to the quality of the information retrieved, using the timeline maps produced more nuanced information which ultimately helped design program implementation strategies to improve IFA consumption among pregnant woman (data not shown). With respect to interviewers' skills, this has been addressed on Pg 13 (2<sup>nd</sup> paragraph in Discussion). We explored using project staff as interviewers for the first time. Project staff were already experts in rapport-building, which plays a key role during the interview process. It also had the unintended consequence of making our project staff more empathetic and compassionate in their routine counselling activities. We have not addressed this per se in the discussion since we do not present any data from the timeline maps. However, we have re-iterated in the discussion (Pg. 15 last paragraph) that this study explored field-friendliness of timeline maps.

- Presence of social desirability - RAs noted that some of the participants may have misrepresented, misremembered. This idea needs to be better outlined in the discussion section. How do qualitative researchers address validity of the findings?

Response: This has been expanded upon in the discussion (Pg 14, last paragraph) with respect to how visual methods can address validity/trustworthiness of their findings.

- Please comment how this tool might have alternative application to research. For example, it could be used by front line staff to deliver nutrition counselling and to support greater client empathy. This use might be tested in future studies.

Response: We appreciate the reviewer's suggestion of including alternative applications of the tool in the future. When this feedback was taken back to the RAs, they came up with a number of recommendations for future use. They suggested using the tool for nutrition counselling where frontline workers could use an 'ideal' timeline map depicting all the health services that pregnant women should receive during the course of their pregnancy to create greater awareness in the community. They also suggested using it as a training tool while training/mentoring Government of India frontline workers. Please see Pg.17 (last paragraph) for edits.

**Competing Interests:** No competing interests were disclosed.