Disseminating Maternal Health Information to Rural Women: A User Centered Design Framework

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Abstract

The delivery of primary health information to rural women is a considerable challenge for government and private sectors in rural India. This paper illustrates how by applying the proposed user centered framework dissemination of maternal health information to rural women can be improved. First, the paper presents baseline study to obtain existing knowledge level of women and design requirements for a Primary Health Information System (PHIS). Second, the paper presents a brief description of the PHIS system which was deployed in a village for sixteen months in rural India. Third, the paper explains longitudinal study conducted post intervention of PHIS to measure the impact of PHIS on the knowledge level and health behaviour of rural women in comparison to the baseline study. The results indicate that by following the proposed user centered approach to design the PHIS, a significant improvement in knowledge level of rural women and positive changes in health practices are achieved.

Introduction

Disseminating maternal health information to rural women cannot be addressed by simply giving away computers and installing internet connections in rural areas. Recent literature on use of Information and Communication Technology (ICT) for disseminating health information have fallen short in terms of the following information dissemination factors: First, owing to the lack of knowledge about existing social beliefs related to health practices, the impact of health information system (HIS) in educating rural users has been limited. Furthermore, application of both traditional and ICT-based health interventions such as showing films to villagers or broadcasting radio programs, and traditional media such as paper pamphlets, posters have been less effective in improving the health practices of rural users[1,2,3]. Second, the content and the design of the HIS do not encourage regular use. One of the reasons for this is the non-persuasive setting of health interventions, which results in an information gap between rural women and critical primary health information [4,5]. Third, the content offered through the HIS deployed for rural users is mainly based on content developed for urban users. This result in a mismatch between information offered to and required by the rural users. In particular, women-related personal health issues such as maternal health and menses have not been addressed [6,7]. This paper tackles the above issues which deals with designing primary health Information system (PHIS): *How to design and develop PHIS maximizing information dissemination, thereby stimulating users to adopt positive health practices?*. Towards addressing the above research issues the paper proposes a user centered design framework to design a primary health information system. Application of this framework is illustrated by a development and evaluation case of PHIS for rural women in India. The PHIS was developed to disseminate maternal health information to improve their knowledge level.

Method: User Centered Design Framework

In order to achieve efficient information transfer and higher user acceptance, a user centered design framework to develop ICT interventions is proposed [6]. The framework integrates methods and theories from relevant scientific disciplines to support the main stages of the development process (Fig. 1). The two components can be understood as: Component A: User-centered phase of the design and development cycle. This phase comprises three stages: exploratory research, creative design research, and evaluative research. Component B: Theoretical framework. This component explains the selection criteria and the application of the theories that have been adapted to guide the design and development cycle followed in component A. Three stages of the user-centered design framework have been supported by the theories of planned behavior [9], persuasive technology [10], and diffusion theory [11] (this is not included in this paper). In the proposed framework, these theories complement one another in the understanding of user behavior and information requirements, and they are expected to contribute to successful adoption of an ICT intervention.

Phase 1: Exploratory Research

Exploratory research was conducted to investigate the social beliefs, health practices and the knowledge level of the baseline group related to menses and maternal health. These findings led to the

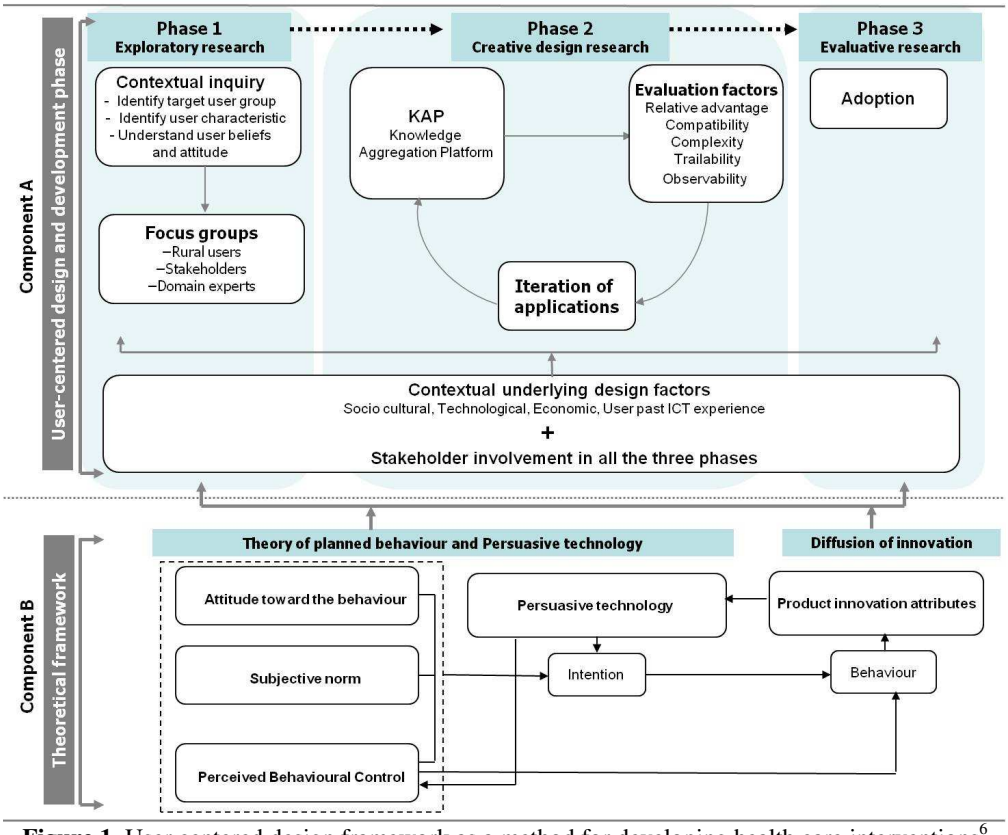

Figure 1. User centered design framework as a method for developing health care interventions[6]

identification of design requirements in terms of content, form and user interaction of the PHIS.

Procedure: The contextual inquiry method[12] was selected for conducting the baseline study. The inquiry included structured interviews that were conducted to identify social beliefs and practices related to menses and maternal health. To investigate the attitude of rural women towards health behavior, the questionnaire was based on the three variables from the theory of planned behavior: *attitude toward the behavior, subjective norm, and perceived behavioral control.*

Participants: exploratory research was conducted with (n=120) rural women. The study participants were selected from (n=7) villages with a population of between 2500 and 6000. These villages were considered as a sampling frame from where baseline study participants were selected. In the selection process, community health doctors and health workers assisted in finding participants. The age of the participants ranged between 12 and 60 and included the following age groups: (1) age group 1 (12-21 yr), adolescent girls, (2) age group 2 (22-40 yr) young married women, (3) age group 3 (40 yr and above), married women with school going children, mothers-in-law or women with daughters of marriageable age. A division was made in literacy levels: 1) level 0 - never attended school; 2) level 1- attended primary school, and 3) level 2- attended secondary school and higher.

Analysis: Interviews were transcribed from the local language into English and key statements were extracted. The key statements were semantically chunked and an affinity diagram of all the key statements was made by following the methodology suggested [12]. Affinity diagram is a tool that gathers large amounts of language data (ideas, opinions, issues) and organizes them into groupings based on their natural relationships. Social beliefs and practices (n=37) relating to menses and maternal health were identified. The semantic grouping of beliefs and practices revealed 3 clusters for the menses category and 3 clusters for the maternal health category (Fig.2). To obtain the mean knowledge level, the absolute number of beliefs and practices identified in each cluster were added and divided by the total number of beliefs and practices within that cluster. Thus, the values obtained for the mean knowledge level were always between 0 (= less informed) and 1 (well-informed). The effect of age and literacy on the

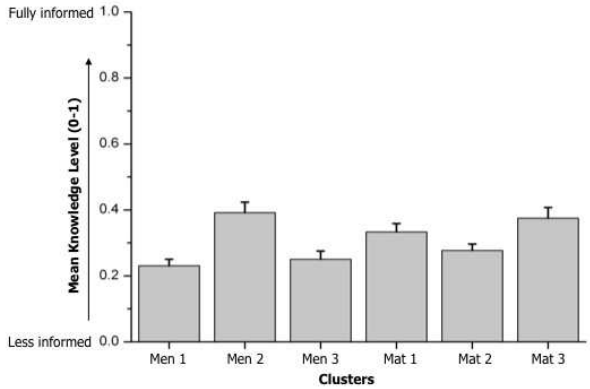

Figure 1. Knowledge level of positively informed participants for clusters: menses and maternal health

knowledge level of participants relating to menses and maternal health was analyzed by multiple analysis of variance (MANOVA). Age and literacy are the independent variables and the two clusters (maternal and menses) are dependant variables.

Results: *Knowledge level of rural women related to menses and maternal health:* The MANOVA results revealed that the age and literacy level of the participants had no significant effect on the knowledge level related to menses and maternal health. Fig 2. depicts the knowledge level of positively informed participants for two categories: menses and maternal health, with a mean knowledge level between 0 (less informed) and 1 (fully informed). The graph represents 3 clusters related to the menses category: Men1 (societal stigma), Men2 (menstrual practice), Men3 (menstruation phenomena), and 3 clusters related to the maternal health category: Mat1 (nutritional habit), Mat2 (maternal health phenomena), Mat3 (delivery practices). The results illustrate relatively low scores for the knowledge levels for all the clusters. Low scores for the societal stigma category indicate that the knowledge level related to menstruation is low.

Phase 2: Creative Design Research

Design requirements obtained from baseline study led to the design and development of PHIS (Fig.3). The details about PHIS have been reported in [7].The PHIS focused on explaining the biological phenomena of menstruation and the causes, symptoms and primary treatment of menstrual disorders, and on disseminating maternal health information on the biological phenomena of conception and pre- and post-natal care. The regional language, Gujarati, was used to display the content. Content was developed targeting the social beliefs and practices that were identified from baseline study. The PHIS set-up consist of a 21-inch monitor, a customized icon-based

Figure 3. Village women operating the Primary Health Information System (PHIS)

keyboard and a trackball. PowerPoint software was selected for information presentation because of its flexible, simple interface[13]. Another reason for selecting PowerPoint was also because the content can be easily updated by the local PHIS operators. The information was represented in audio-visual format. Three village women were trained and appointed as operators. They were responsible for providing assistance to rural women in interactive sessions, and regularly updating the PHIS content. The rural women asked several questions during the PHIS sessions, which were noted down by the operators. Every one or two weeks, local doctors and health workers helped the PHIS operators to answer these questions. The answers were updated on the PowerPoint slide. Where possible, the author provided the necessary visuals to match the answers. When the women again visited the PHIS, the operator opened the particular slide to answer their previously asked questions. The PHIS was physically located in the community hall at a pilot village in western India.

Phase 3: Evaluative Research

This section describes the longitudinal study that is part of the evaluative research phase of the proposed user-centered design framework. A longitudinal study was conducted to (a) investigate the impact of the PHIS In terms of shaping the health behavior of rural women. (b) investigate difference in knowledge level of rural women relating to menses and maternal health between the baseline and intervention group.

Procedure: The aim of the study was to ascertain the impact of the knowledge gained from the PHIS on the participant's daily health practices Observations of participants interacting with the PHIS during the intervention (not included in this paper) and follow-up interviews with (n=120) participants were conducted over a period of 16 months while the PHIS was in use. The study was conducted by PHIS operators and community health workers. The community health worker was a neutral entity who was responsible for ensuring that the interviews were

conducted without personal bias. The follow-up interview sessions were conducted by visiting the home of each participant. The same questionnaire as the one used in the baseline study was used in order to analyze the participant's knowledge about menses and maternal health, and changes in their health practices. Additionally, a control group study was conducted to determine whether the potential difference in the knowledge level of women participants in the intervention group was the result of external factors such as health campaigns by government or non-government organizations. For example, if the knowledge level of the control group was found to be similar to that of the baseline group then it is certain that there were no external factors that influenced the knowledge level, and the changes in the intervention group can be attributed to the PHIS intervention.

Participants: (n=120) were selected for the longitudinal study. The selection criteria remained same as baseline study. Participants (n=50) were randomly selected from the baseline villages for a control group study.

Analysis: In order to obtain comparative data, the results from the follow-up studies were compared with the results of the baseline study. The same procedure as in the baseline study was followed when analyzing the data. The participants were asked to respond (yes/no) to the questions in the questionnaire and explain their views about the identified beliefs or practices related to menses and maternal health. Key statements were extracted from the transcribed data. To compare the data between the baseline study and the intervention study, 6 clusters (3 clusters for the menses category, and 3 clusters for the maternal health category) as identified from the baseline study data were used to analyze the data. It means that the key statements were semantically grouped for the 6 clusters identified. For analysis purposes, the nominal responses were coded as (1= fully informed) and (0= less informed).

To test a significant difference ($p<.05$) between age groups by literacy level, a MANOVA was performed on 6 clusters belonging to the 2 categories: menses and maternal health. For performing the MANOVA, the age groups as mentioned in baseline study were considered. The participants were clustered in three age groups to ascertain whether the social beliefs and practices differed across age groups - adolescent girls, young married women, and older women in the villages.

Results: The findings from the control group study indicated that the change in knowledge level determined from the comparison between the intervention and baseline group was not subject to influence from external factors. The results indicate significant differences in the knowledge levels of participants belonging to the intervention group when compared with the baseline groups and control groups. Fig.4 presents the mean knowledge levels for each cluster with a mean score between 0 = less informed, and 1 = fully informed. The three bars represent the knowledge level of the participants in the baseline, control and intervention groups. Higher ratings in the intervention group for all 6 clusters can be observed when compared with the baseline group and the control group. This was corroborated by the MANOVA omnibus test outcomes on the Menses category (Wilk's =0.18; F=335; $p<0.001$) and Maternal Health category (Wilk's =0.32; F=154; $p<0.001$), showing a significant difference between the groups in both cluster categories. For the baseline group, the graph indicates relatively low scores for knowledge level for all the clusters.

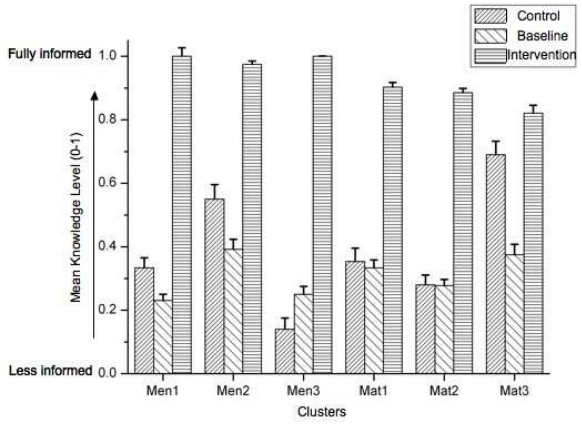

Figure 4. Estimated marginal means ratings ± SEM for all clusters in the beliefs and practices categories with a mean score between (0= less informed , 1 = fully informed)

The MANOVA outcome between the control group and the baseline group showed no significant differences in the clusters except for the delivery practices cluster (Mat3) (F=168; $p<0.001$), where participants in the control group were significantly more knowledgeable than participants in the baseline group. The improvement in knowledge about delivery practices could be attributed to the government schemes that had been introduced in the last two years. These schemes focused on increasing the institutionalization rate of child delivery in rural areas. Apart from the delivery practices cluster (Mat 3), the responses from the control group (n=50) again confirm the findings obtained from the baseline group (n=120) about existing social beliefs and practices

relating to menses and maternal health. Further, it can be inferred from the responses of the control group that the high knowledge level of the participants belonging to the intervention group can be attributed to the PHIS intervention and not to other external influences that might have influenced the knowledge level of the intervention group.

Discussion

*Impact on knowledge level***:** The results from the longitudinal study indicate significant differences in the knowledge level related to menses and the maternal health of rural women in the intervention group compared with the baseline groups and control groups. Due to improved information dissemination through the PHIS, social beliefs and health practices related to menses and maternal health were positively shaped in the intervention group. The significant impact of the intervention could be attributed to the design approach followed when designing the PHIS , where social cues from persuasive technology were applied in the design of PHIS for shaping social beliefs and the health attitude of women participants.

Impact on change in health-related practices: The results indicated a positive change in health practices relating to menses and maternal health among the participants. The changes in health practices were observed in terms of improved nutritional practices, improved personal hygiene, institutional child delivery and disposing of used cotton cloths during menstruation. These changes can be attributed to the fact that information related to menses and maternal health was consistently disseminated to the participants. The content was dynamically updated by the operators in line with the information needs and the existing health practices of the participants.

Conclusions

The paper proposed a user centered framework as a solution to engage end users into the development process of health information system. The results indicate an improvement in the knowledge level of rural women after interacting with the PHIS. The results confirm the importance of understanding user needs, and existing social beliefs and practices related to health issues as an important criterion for improving information dissemination. The results lead to the conclusion that the necessary information relating to personal health that is consistently reinforced and is in compliance with existing social beliefs and practices may lead to a change in health-related practices. Additionally, disseminating information that is specifically designed for women and through an intervention that encourages them to interact in groups to discuss their personal health issues, may lead to positive changes in their health practices. This paper should be considered as an example of how a bottom-up approach that involves users in the content development and the design process could lead to user-centered development of health information systems.

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