

BMJ Open Relationship between implementing interpersonal communication and mass education campaigns in emergency settings and use of reproductive healthcare services: evidence from Darfur, Sudan

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ABSTRACT

Objectives: (1) To examine changes in women's awareness and utilisation of reproductive healthcare services in emergency settings following provision of interpersonal communication (IPC) and mass education campaigns, and (2) to describe factors associated with reproductive healthcare service use in internally displaced person (IDP) camps.

Setting: Three camps containing 88 984 IDPs in Darfur, Sudan.

Participants: 640 women aged 15–49 who had experienced pregnancy in the camp during the previous 2 years were enrolled in each of two independent cross-sectional surveys 26 months apart.

Interventions: IPC and mass education campaigns where community health workers disseminated information by home/shelter visits, clinic sessions, public meetings and other means to raise awareness and promote reproductive healthcare service use.

Primary outcome measures: Awareness of the existence of antenatal care (ANC) and tetanus toxoid (TT) vaccination services, reception of ANC and TT vaccination, place of delivery and use of postnatal care (PNC).

Results: The percentage of women who received home visits, and attended in-clinic sessions and public meetings increased from 61.6% to 86.7%, from 43.0% to 68.8%, and from 3.8% to 39.8%, respectively, between the initial and follow-up surveys. More women were aware of ANC (OR 18.6, 95% CI 13.1 to 26.5) and TT vaccination (OR 3.2, 95% CI 2.4 to 4.4) in the follow-up than the initial survey, after multivariable adjustment. More women received ≥ 3 ANC visits (OR 8.8, 95% CI 6.4 to 12.0) and ≥ 3 doses of TT (OR 2.5, 95% CI 1.9 to 3.3), delivered at a healthcare facility (OR 5.4, 95% CI 4.0 to 7.4) and received a PNC visit (OR 5.5, 95% CI 4.0 to 7.7) in the follow-up than in the initial survey, after multivariable adjustment.

Strengths and limitations of this study

- This study described an improvement in women's awareness and utilisation of reproductive healthcare services in emergency settings following provision of interpersonal communication and mass education campaigns.
- An interpersonal communication and mass education campaign was shown to be feasible even in a resource-limited setting when conducted by people familiar with local traditions and dialects.
- As physical and social contact between men and women is culturally forbidden in Darfur, data were collected by trained female interviewers familiar with local socio-cultural traditions and dialects as well as the data collection protocol.
- Although changes from the initial to the follow-up survey could have been influenced by unmeasured factors, multivariable analysis minimised any differences.
- A control group was not allocated because of ethical considerations, so it is not possible to prove a causal relationship between the interventions and changes in the six measured outcome indicators; however, the control of potential confounders by multivariate statistics provided reliable findings.
- Measurement error due to reliance on self-reported information caused information bias in the effect estimates; the direction of this bias is difficult to estimate.

Conclusions: Awareness about and utilisation of reproductive healthcare services were higher in the follow-up survey. An integrated IPC and mass education campaign is effective for improving women's reproductive health in emergency settings.

INTRODUCTION

Internally displaced persons (IDPs) are defined as those who have been forced or obliged to leave their homes to avoid the effects of armed conflict, civil violence or disasters, and who have not crossed international borders.^{1 2} Armed conflict and displacement typically lead to increased poverty, breakdown of services, disruption of civil society and a rise in violence, all of which profoundly affect women's health. In conflict areas, reproductive healthcare for IDPs is very important but conflict and displacement usually result in diminished capacity to satisfy these needs.¹⁻⁴

The prenatal and postnatal periods are critical for saving the lives of mothers and children. Reproductive healthcare services that should be provided during these periods are often neglected during humanitarian relief provision, despite their recognition as a human right in international law.^{1 3 5 6} The Interagency Working Group on Reproductive Health for Refugees launched a field manual in 1995⁷ and the Sphere Project released guidelines for minimum standards of reproductive health in 2000,⁸ but challenges remain. For example, emergency settings affected by continuous movement, insecurity and logistical barriers hinder local and international efforts to deliver and maintain appropriate services, and obstruct coordination between different agencies.⁷ Limited resources, poor socio-economic characteristics, attacks on healthcare facilities and looting of medical supplies are underlying problems that result in decreased access to services and poor maternal outcomes.^{9 10}

Many factors affect the availability, access to and use of reproductive healthcare services. Few studies on reproductive healthcare interventions in conflict-affected settings have been published in Sudan.^{11 12} However, evidence-based approaches to provide feasible and helpful interventions for IDP women have yet to be discussed.

Since 2003, the Darfur region in Western Sudan has experienced ongoing violent civil wars. The conflict has been marked by widespread atrocities including ethnic cleansing.¹³ It is estimated that around 400 000 people in the Darfur region have died and more than 2 million have been left vulnerable to emergency settings.^{14 15} The maternal mortality ratio (MMR) in West Darfur State in the Darfur region was 1056 deaths/100 000 live births in 2006, while the MMR in Northern State and Khartoum State, which are relatively stable, was 94 and 311 deaths/100 000 live births, respectively.¹⁶ Save the Children raised concerns about healthcare for mothers and children in Darfur in 2004.¹⁷ IDP women in the Darfur region were unable to properly use reproductive healthcare services because of socio-cultural barriers and their unfamiliarity with modern healthcare services.¹⁸ For example, people in the Darfur region have culturally diverse backgrounds, belong to different African and Arab tribes and ethnic groups and speak more than 24 local dialects.¹⁹ However, the mass media

is mainly in Arabic which makes it difficult to use it to promote health education. According to workers in IDP camps in Darfur, most Darfur women feel shy of and don't like to be medically examined by men; however, women doctors are not generally available in clinics. Before the crisis, women in Darfur had only minimal access to healthcare: a woman in labour was assisted only by the village midwife and was surrounded by her female relatives and family,²⁰ and so tended to be anxious about using modern healthcare services.

In response to this situation, interventions to encourage behavioural change in IDP women in camps in the Darfur region, including interpersonal communication (IPC) and mass education campaigns, were started in March 2006, as was the provision of antenatal care (ANC), institutional delivery services and postnatal care (PNC). IPC focuses on establishing a direct relationship between the provider and client, in-depth discussion and mutual understanding on healthcare issues.²¹

The objectives of this study were: (1) to examine changes in women's awareness of the availability of ANC or tetanus toxoid (TT) vaccination services, and if they received ≥ 3 ANC visits, ≥ 3 TT vaccine doses, institutional delivery and ≥ 1 PNC visit, from an initial to a follow-up survey carried out 26 months apart during which time IPC and mass education campaigns were undertaken; and (2) to describe factors associated with the use of reproductive healthcare services in IDP camps.

METHODS

Setting

The study population consisted of IDP women living in Krending, Krenik and Habillah IDP camps in Western Darfur, Sudan. There were 21 990, 40 403 and 26 591 IDPs in each of the three camps, respectively, as of January 2007.

Intervention

Reproductive healthcare services were provided in the three camps from January 2005. The programme included free ANC, institutional delivery services and PNC. Since March 2006, interventions were carried out to link the IDP women with healthcare facilities and to increase their utilisation of reproductive healthcare services by installing one primary healthcare clinic/10 000 IDPs and disseminating information via IPC and mass education campaigns.

The IPC campaign consisted of home/shelter visits, in-clinic sessions and counselling, while the mass education campaign included video shows, posters, role-playing, public meetings, drama, monologues, popular songs and the distribution of pamphlets on reproductive health. Various mass education campaigns were conducted at general sites such as markets, schools and other public spaces. Information was disseminated via trained maternal community health workers (MCHWs)

selected from among local healthcare staff and intensively trained for 3 weeks as key informants on essential components of reproductive health. Each MCHW was expected to visit 287 women in total and educate 20 women per day for 3 working days a week.

Study design

The initial and follow-up surveys were conducted in the three camps in February 2007 and April 2009, which were 11 and 37 months after the start of the interventions, respectively. As reproductive healthcare services for IDP women were urgently needed and the interventions were non-invasive, all women were included in the interventions. So instead of having an intervention control group, two independent surveys were conducted and changes in outcomes were analysed.

Participants and data collection

Sample size calculation was based on relative precision,²² with an assumed design effect of 1.6 to control the 95% CI for the proportion of ANC use between 0.15 and 0.25. The estimated required sample size was 640 married women of child bearing age (15–49 years). The estimated number of married women of child-bearing age in the three camps was 17 796. Individual participants were selected independently in each survey through a two-stage sampling strategy. Thirty-two clusters were selected in the three camps, using probabilities proportional to the number of shelters. Then from each selected cluster, 20 home/shelters were randomly selected for both the initial and the follow-up surveys independently, yielding 640 home/shelters for each survey. Our study targets were women aged 15–49 years in the selected shelters who had lived in a camp for 2 years before the survey and had experienced pregnancy in a camp during this time. When two or more eligible women were identified in a selected shelter, the youngest woman was enrolled. When a woman in the listed shelter was unavailable, another eligible woman from the nearest shelter was approached and enrolled in the study.

A structured interview was carried out after confidentiality was assured. Interviewers were women who had completed secondary schooling and were familiar with the culture and fluent in local dialects. All interviewers participated in a 5-day training programme that covered clustering, interviewing and obtaining respondent consent. Participants were informed they could opt out of the study at any point during the interview.

Measurements

A questionnaire was developed based on the Reproductive Health Response in Conflict, the Health Needs Assessment instrument of the Reproductive Health Response in Conflict Consortium,²³ and the Field Tools and Monitoring and Evaluation Toolkit²⁴ after consultation with the Federal Ministry of Health. The questionnaire was translated into Arabic and back-

translated into English to ensure the accuracy of the translation. The same standardised questionnaire was used in both the initial and follow-up surveys.

Study variables

For each survey, information was collected on women's socio-economic characteristics including age, education, employment and camp of residence. Their participation in campaign activities was identified, including receiving visits from healthcare workers in the home/shelter, and attendance at in-clinic educational sessions, counselling sessions, video presentations or public meetings. The following were examined: women's awareness of the existence of ANC and TT vaccination services in the camps (yes, no), the use of reproductive healthcare services, number of ANC visits (none, 1–2, ≥ 3), TT vaccine doses (none, 1–2, ≥ 3) and number of PNC visits (never, ≥ 1) during the first week after delivery; and pregnancy history including number of living children (1–3, ≥ 4), experience of abortion in the last 2 years (yes, no), bleeding during the last pregnancy (yes, no) and fever or excessive vomiting during the last pregnancy (yes, no).

Outcome variables

Six binary (yes, no) variables were used as outcome variables in the analysis: (1) women's awareness regarding the existence of ANC and (2) TT vaccination services in the camp; (3) receiving ≥ 3 ANC visits;²⁵ (4) receiving ≥ 3 TT vaccine doses;²⁶ (5) institutional delivery; and (6) attending ≥ 1 PNC visit.²⁷

Statistical analysis

Differences in women's socio-economic profiles, participation in campaign activities, awareness of the existence of ANC and TT vaccination services, use of reproductive healthcare services, and pregnancy histories between the initial and follow-up surveys were examined using Pearson χ^2 tests. The adjusted OR between each dependent variable and the survey phase was assessed by multivariate logistic regression analysis for the sample as a whole after adjustment with other variables. Multivariate models also provided ORs adjusted for age, education, employment, camp of residence, number of living children, and participation in IPC and mass education campaigns, for each survey phase separately.

Multivariate logistic regression models were further used to investigate the association between each dependent variable with covariates regardless of the survey phase after merging the data sets of the two surveys together.

All analyses were conducted using SPSS V.18.0. A p value of ≤ 0.05 was considered to indicate significance.

Ethical considerations

The study protocol was reviewed and approved by the Institutional Research Board of the University of Khartoum. Approval was obtained from the Federal

Ministry of Health of Sudan, the Humanitarian Aid Commission and the State Ministry of Health of West Darfur. Only those participants who voluntarily provided verbal informed consent were included in the study.

RESULTS

Information from 640 participants who consented to participate in the study was obtained in both the initial and follow-up surveys. Table 1 shows the descriptive statistics for the initial and follow-up surveys. There was a significant increase in participation in the IPC and mass education campaigns between the two surveys. The percentages of women aware of ANC and TT vaccination and using reproductive healthcare services also significantly increased from the initial to the follow-up survey.

Table 2 shows the adjusted ORs of being aware of ANC and TT vaccination. Overall, women were significantly more likely to be aware of the existence of ANC (OR 18.6) or TT vaccination (OR 3.2) services in the follow-up survey than in the initial survey. Educational attainment was significantly associated with awareness of ANC in the initial phase but not in the follow-up phase. Significant associations between receiving home visits or attendance at public meetings and awareness of ANC and TT vaccination were found in the follow-up phase but not in the initial phase.

Table 3 shows the adjusted ORs for use of reproductive healthcare services. Overall, women were more likely to report ≥ 3 ANC visits (OR 8.8), to receive ≥ 3 TT doses (OR 2.5), to deliver at a healthcare facility (OR 5.4) and to report ≥ 1 PNC visit (OR 5.5) in the follow-up than the initial survey. Educational attainment was significantly associated with the use of reproductive healthcare services in both the initial and follow-up phases except for PNC visits in the follow-up phase. Significant associations were found between receiving home visits and TT vaccinations in the follow-up phase, institutional delivery in the follow-up phase, and PNC visits in both phases. Associations between attending in-clinic sessions or attendance at public meetings and use of reproductive healthcare services were significant in the initial phase but not in the follow-up phase, except for the association between attendance at public meetings and PNC visits.

Table 4 shows factors associated with women's awareness of ANC and TT vaccination and use of reproductive healthcare services regardless of survey phase.

DISCUSSION

Findings from the repeated cross-sectional studies indicated a significant increase in the reception of IPC and mass education campaigns and an increase in awareness and use of reproductive healthcare services among IDP women. IPC campaigns, where displaced women were visited in their homes/shelters or in-clinic sessions were held to provide them with reproductive health information, accompanied by a mass education campaign to

Table 1 Characteristics of women by survey phase

| Characteristics | Survey phase | | p Value |
|--|--------------|-----------|---------|
| | Initial | Follow-up | |
| | N=640 | N=640 | |
| | Per cent | Per cent | |
| Socio-economic information | | | |
| Age, years | | | 0.818 |
| <20 | 18.0 | 19.2 | |
| 20–30 | 35.9 | 35.2 | |
| 31–40 | 38.9 | 39.5 | |
| >40 | 7.2 | 6.1 | |
| Education | | | 0.559 |
| Informal/none | 57.3 | 59.1 | |
| Basic | 34.1 | 31.4 | |
| Secondary and above | 8.6 | 9.5 | |
| Employment status | | | <0.001 |
| Yes | 54.1 | 67.0 | |
| No | 45.9 | 33.0 | |
| Camp of residence | | | NA |
| Krending | 25.0 | 25.0 | |
| Krenik | 46.9 | 46.9 | |
| Habillah | 28.1 | 28.1 | |
| Participation in campaign activities | | | |
| IPC campaign | | | |
| Received home visits | | | <0.001 |
| Yes | 61.6 | 86.7 | |
| No | 38.4 | 13.3 | |
| Attended in-clinic session | | | <0.001 |
| Yes | 43.0 | 68.8 | |
| No | 57.0 | 31.3 | |
| Attended counselling | | | <0.001 |
| Yes | 1.4 | 35.3 | |
| No | 98.6 | 64.7 | |
| Mass education campaign | | | |
| Attended video presentations | | | <0.001 |
| Yes | 0.3 | 17.3 | |
| No | 99.7 | 82.7 | |
| Attended public meetings | | | <0.001 |
| Yes | 3.8 | 39.8 | |
| No | 96.2 | 60.2 | |
| Awareness | | | |
| Awareness of ANC services | | | <0.001 |
| Yes | 14.2 | 78.6 | |
| No | 85.8 | 21.4 | |
| Awareness of TT vaccination | | | <0.001 |
| Yes | 24.1 | 58.4 | |
| No | 75.9 | 41.6 | |
| Major reproductive healthcare services | | | |
| Number of ANC visits | | | <0.001 |
| None | 38.9 | 5.9 | |
| 1–2 | 42.8 | 28.6 | |
| ≥3 | 18.3 | 65.5 | |
| Doses of tetanus vaccine | | | <0.001 |
| None | 27.2 | 10.0 | |
| 1–2 | 51.9 | 46.2 | |
| ≥3 | 20.9 | 43.8 | |
| Place of delivery | | | <0.001 |
| Home | 74.1 | 36.9 | |
| Healthcare facility | 25.9 | 63.1 | |
| Postnatal care visit | | | <0.001 |
| ≥1 | 48.4 | 83.0 | |
| Never | 51.6 | 17.0 | |
| Pregnancy history | | | |
| Number of living children | | | 0.052 |
| 1–3 | 16.4 | 20.6 | |
| ≥4 | 83.6 | 79.4 | |
| Continued | | | |

Continued

Table 1 Continued

| Characteristics | Survey phase | | p Value |
|---|------------------------------|--------------------------------|---------|
| | Initial N=640 Per cent | Follow-up N=640 Per cent | |
| Abortion in the last 2 years | | | |
| Yes | 23.8 | 9.2 | <0.001 |
| No | 76.3 | 90.8 | |
| Bleeding during last pregnancy | | | |
| Yes | 16.9 | 13.4 | 0.086 |
| No | 83.1 | 86.6 | |
| Fever or excessive vomiting during last pregnancy | | | |
| Yes | 20.3 | 10.6 | <0.001 |
| No | 79.7 | 89.4 | |

p Values were obtained from χ^2 tests comparing categorical variables between the initial and follow-up survey. The same number of participants was selected from each camp in both the initial and follow-up surveys. ANC, antenatal care; IPC, interpersonal communication; NA, not applicable; TT, tetanus toxoid.

reach women in public spaces, were associated with awareness and utilisation of services. Educational attainment was partly associated with awareness and the use of reproductive healthcare services.

The study was conducted by female interviewers familiar with the interview protocol, cultural traditions and dialects in the camps. The selection of interviewers was based on the socio-cultural context of the study settings. Physical and social contact between men and women is culturally prohibited in Darfur, and women are very shy to speak in front of men. These communication barriers were overcome by employing female interviewers in this study. Their rigorous training, the supervision of fieldwork, and coordination with local stakeholders facilitated the collection of reliable data. The face-to-face communication during interviews and the participation of tribal leaders, who are respected by IDPs, as facilitators of the survey encouraged women to take part. The completion of interviews with 640 participants in each survey (100% of the required sample size) was the result of good communication with communities.

At 94.1%, the percentage of women in the Darfur IDP camps in 2009 who received at least one ANC visit in the follow-up phase was much higher than the 74.3% reported in a Sudanese national household health survey in non-emergency settings in 2010.²⁸ A similar percentage of 76.7% was found in the 2005 Demographic Health Survey in Ethiopia.²⁹ In both Sudan and Ethiopia, awareness-raising campaigns using mass media were carried out, but other approaches using IPC or mass gatherings in public spaces were usually not utilised. Services for IDPs in the present study areas were provided free of charge, while women in Sudan and Ethiopia generally had to pay for ANC services.^{28 30} The differences in the findings suggest the IPC and mass education campaigns in West Darfur are useful when services are provided free of charge in emergency settings.

The percentage of women who received ≥ 3 TT doses increased from 20.9% to 43.8% in this study; however, these percentages were lower than a reported national average of 54.7%.¹⁶ In the IDPs of West Darfur, health-care workers reported that rumours that TT was contaminated with anti-fertility drugs were possibly circulating. If this was the case, then women would have been less likely to seek TT vaccination despite efforts encouraging them to do so.

The percentage of institutional delivery increased from 25.9% to 63.1%. Even in the initial phase, this percentage was higher than the Sudanese national average of 20.5%.¹⁶ More than half of the women in rural areas in Sudan do not have access to even basic midwifery services.³¹ However, in IDP camps in West Darfur, free and accessible delivery healthcare has been available since January 2005, likely prompting greater use by the women.

The medical staff providing reproductive healthcare in the present study were local midwives acting as mediators between the community and healthcare facilities. They helped to build trust with participants and encouraged them to undergo institutional delivery. Midwives carried out outreach PNC and encouraged women to visit healthcare facilities for further medical care. A report from refugee camps in Guinea reported the language barrier between Guinean staff and refugee clients and a complete lack of essential services as challenges.³² The success of the present interventions was in part due to appropriate service provision and the availability of services in the camp.

Face-to-face communication to provide information can facilitate behaviour change.^{21 33} Especially in the follow-up phase, IPC during visits to women's homes/shelters significantly improved awareness and use of services. On the other hand, IPC during in-clinic sessions was significantly associated with outcome variables in the initial phase but not generally in the follow-up phase. This difference between home visits and in-clinic sessions is likely due the involvement of men. During homes visits, MCHWs can establish rapport with their clients, observe socio-economic conditions and encourage the involvement of husbands so that they then support their wives to start using reproductive healthcare services. However, only women attended in-clinic sessions, with men rarely involved. Compared with other locations, the home is the most appropriate place to ensure privacy for women when discussing their health concerns.^{34–36} Visiting women at their home/shelters should be prioritised in order to raise awareness and encourage the use of reproductive healthcare services in emergency settings.

Conducting public meetings is one method of mass education. However, the majority of participants in IDP camps were male; women are traditionally less likely to attend such gatherings because it is believed that men and women should be separated in public. Nevertheless, an increase in the percentage of women participating in public meetings from 3.8% in the initial phase to 39.8%

Table 2 Adjusted ORs of women's awareness of antenatal care (ANC) and tetanus toxoid (TT) vaccination among all women, and by survey phase

| | Awareness of ANC | | | | Awareness of TT vaccination | | | |
|--------------------------------------|------------------|----------------------|------------------------|---------------------|-----------------------------|----------------------|---------------------|--------------------|
| | Per cent | | OR (95% CI) | | Per cent | | OR (95% CI) | |
| Survey phase | | | | | | | | |
| Initial | 14.2 | | 1.0 | | 24.1 | | 1.0 | |
| Follow-up | 78.6 | | 18.6 (13.1 to 26.5)*** | | 58.4 | | 3.2 (2.4 to 4.4)*** | |
| | Survey phase | | | | Survey phase | | | |
| | Initial | | Follow-up | | Initial | | Follow-up | |
| | Per cent | OR (95% CI) | Per cent | OR (95% CI) | Per cent | OR (95% CI) | Per cent | OR (95% CI) |
| Socio-economic information | | | | | | | | |
| Age, years | | | | | | | | |
| <20 | 13.0 | 1.0 | 79.7 | 1.0 | 30.4 | 1.0 | 54.5 | 1.0 |
| 20–30 | 17.0 | 3.1 (1.1 to 8.7)* | 77.3 | 0.9 (0.3 to 2.4) | 21.7 | 0.7 (0.3 to 1.6) | 62.7 | 2.8 (1.2 to 6.5)* |
| 31–40 | 13.3 | 2.2 (0.7 to 6.7) | 77.9 | 0.7 (0.3 to 2.1) | 21.7 | 0.7 (0.3 to 1.6) | 57.7 | 1.9 (0.8 to 4.6) |
| >40 | 8.7 | 1.7 (0.4 to 7.8) | 87.2 | 1.5 (0.4 to 6.1) | 32.6 | 1.4 (0.5 to 4.1) | 51.3 | 1.2 (0.4 to 3.7) |
| Educational attainment | | | | | | | | |
| Informal/none | 4.6 | 1.0 | 77.8 | 1.0 | 9.5 | 1.0 | 52.9 | 1.0 |
| Basic | 23.9 | 2.9 (1.4 to 5.9)** | 76.1 | 0.8 (0.5 to 1.2) | 42.2 | 3.4 (1.9 to 6.2)*** | 61.2 | 1.3 (0.9 to 1.9) |
| Secondary and above | 40.0 | 4.7 (1.9 to 11.9)** | 91.8 | 2.1 (0.8 to 5.6) | 49.1 | 3.1 (1.4 to 6.9)** | 83.9 | 3.1 (1.5 to 6.6)** |
| Employment status | | | | | | | | |
| No | 8.8 | 1.0 | 69.7 | 1.0 | 16.0 | 1.0 | 52.1 | 1.0 |
| Yes | 18.8 | 0.9 (0.5 to 1.6) | 83.0 | 1.8 (1.1 to 2.9)* | 30.9 | 0.8 (0.5 to 1.3) | 61.5 | 1.0 (0.7 to 1.5) |
| Camp of residence | | | | | | | | |
| Krending | 18.1 | 1.0 | 82.5 | 1.0 | 20.0 | 1.0 | 49.4 | 1.0 |
| Krenik | 15.0 | 0.7 (0.4 to 1.4) | 80.7 | 0.5 (0.3 to 0.9)* | 27.0 | 1.4 (0.8 to 2.4) | 61.7 | 1.5 (1.0 to 2.4) |
| Habillah | 9.4 | 0.4 (0.2 to 0.8)* | 71.7 | 0.3 (0.2 to 0.6)*** | 22.8 | 1.2 (0.6 to 2.2) | 61.1 | 1.3 (0.8 to 2.1) |
| Number of living children | | | | | | | | |
| 1–3 | 16.2 | 1.0 | 79.5 | 1.0 | 25.7 | 1.0 | 56.8 | 1.0 |
| ≥4 | 13.8 | 0.4 (0.2 to 1.1) | 78.3 | 1.0 (0.4 to 2.7) | 23.7 | 1.4 (0.6 to 3.3) | 58.9 | 0.7 (0.3 to 1.7) |
| Interpersonal communication campaign | | | | | | | | |
| Received home visit | | | | | | | | |
| No | 13.4 | 1.0 | 50.6 | 1.0 | 23.2 | 1.0 | 28.2 | 1.0 |
| Yes | 14.7 | 1.5 (0.9 to 2.6) | 82.9 | 3.5 (2.1 to 6.0)*** | 24.6 | 1.5 (1.0 to 2.3) | 63.1 | 3.2 (1.9 to 5.4)** |
| Attended in-clinic sessions | | | | | | | | |
| No | 3.3 | 1.0 | 68.0 | 1.0 | 7.1 | 1.0 | 41.0 | 1.0 |
| Yes | 28.7 | 7.7 (3.6 to 16.4)*** | 83.4 | 1.3 (0.8 to 2.0) | 46.5 | 6.6 (3.7 to 11.8)*** | 66.4 | 1.9 (1.2 to 2.8)** |
| Mass education campaign | | | | | | | | |
| Attended public meetings | | | | | | | | |
| No | 14.0 | 1.0 | 71.9 | 1.0 | 24.4 | 1.0 | 47.8 | 1.0 |
| Yes | 20.8 | 2.9 (0.9 to 9.3) | 88.6 | 2.6 (1.5 to 4.4)*** | 16.7 | 0.9 (0.3 to 2.9) | 74.5 | 2.1 (1.4 to 3.1)** |

Per cent, percentage of mothers reporting outcome per subcategory. OR adjustment was performed for all variables listed in the table.

*p<0.05; **p<0.01; ***p<0.001.

in follow-up phase indicated significant behavioural change in a male-dominated society.

The results of this study showed mass education was significantly associated with increased awareness in the follow-up survey but was not associated with service utilisation, while IPC was significantly associated with both awareness raising and utilisation. A mass education intervention can raise awareness; however, adoption of IPC in addition to mass education is recommended to increase service utilisation. IPC facilitates communication in a personalised environment and enables healthcare workers to provide advice based on individual socio-economic and cultural backgrounds.

The educational attainment of women is associated with the use of reproductive healthcare services in

emergency settings and in developing countries.^{11 30 37} Better education facilitates access to information, improves attendance at health education sessions and increases knowledge of reproductive healthcare services.^{38 34} Interestingly, in the follow-up phase of the present study, the association between education and awareness of ANC disappeared, and the magnitude of the ORs between education and place of delivery or PNC visits was reduced. This finding may be because the awareness-raising campaigns had achieved equal awareness of reproductive healthcare services regardless of women's educational level.

Associations between the age of the women and the use of reproductive healthcare services were not significant except for use of ANC in the follow-up phase. The

Table 3 Adjusted factors associated with antenatal care (ANC) visits, tetanus toxoid (TT) vaccination, place of delivery and postnatal care (PNC) among all women, stratified by survey phase according to socio-economic characteristics and exposure to information

| | ANC visits* | | TT vaccination† | | Place of delivery‡ | | PNC visits§ | |
|--|-------------|----------------------|-----------------|----------------------|--------------------|---------------------|-------------|---------------------|
| | Per cent | OR (95% CI) | Per cent | OR (95% CI) | Per cent | OR (95% CI) | Per cent | OR (95% CI) |
| Survey phase | | | | | | | | |
| Initial | 18.3 | 1.0 | 20.9 | 1.0 | 25.9 | 1.0 | 48.4 | 1.0 |
| Follow-up | 65.5 | 8.8 (6.4 to 12.0)*** | 43.8 | 2.5 (1.9 to 3.3)*** | 63.1 | 5.4 (4.0 to 7.4)*** | 83.0 | 5.5 (4.0 to 7.7)*** |
| Stratification by survey phase | | | | | | | | |
| | Initial | | Follow-up | | Initial | | Follow-up | |
| | Per cent | OR (95% CI) | Per cent | OR (95% CI) | Per cent | OR (95% CI) | Per cent | OR (95% CI) |
| Socio-economic information | | | | | | | | |
| Age, years | | | | | | | | |
| <20 | 15.7 | 1.0 | 48.0 | 1.0 | 17.4 | 1.0 | 30.9 | 1.0 |
| 20–30 | 19.6 | 2.0 (0.8 to 5.1) | 76.0 | 6.5 (2.4 to 17.3)*** | 23.0 | 1.3 (0.5 to 3.0) | 46.2 | 2.1 (0.9 to 4.8) |
| 31–40 | 18.1 | 1.7 (0.6 to 4.4) | 67.6 | 5.0 (1.8 to 13.6)** | 21.7 | 1.0 (0.4 to 2.4) | 50.2 | 2.3 (1.0 to 5.4) |
| >40 | 19.6 | 1.7 (0.5 to 5.7) | 46.2 | 2.2 (0.7 to 6.9) | 15.2 | 0.7 (0.2 to 2.3) | 28.2 | 1.0 (0.3 to 3.0) |
| Educational attainment | | | | | | | | |
| Informal/none | 9.8 | 1.0 | 60.8 | 1.0 | 10.6 | 1.0 | 37.3 | 1.0 |
| Basic | 25.2 | 1.8 (1.0 to 3.2) | 73.6 | 1.9 (1.3 to 2.9)** | 32.1 | 2.3 (1.3 to 4.1)** | 53.7 | 2.0 (1.4 to 2.9)*** |
| Secondary and above | 47.3 | 2.8 (1.2 to 6.4)* | 67.2 | 1.5 (0.8 to 2.7) | 45.5 | 3.0 (1.4 to 6.8)** | 50.8 | 1.4 (0.8 to 2.5) |
| Employment status | | | | | | | | |
| No | 12.2 | 1.0 | 70.1 | 1.0 | 10.5 | 1.0 | 29.9 | 1.0 |
| Yes | 23.4 | 1.0 (0.6 to 1.7) | 63.2 | 0.7 (0.5 to 1.0) | 29.8 | 1.9 (1.2 to 3.2)* | 50.6 | 2.0 (1.4 to 3.0)** |
| Camp of residence | | | | | | | | |
| Krending | 11.3 | 1.0 | 76.9 | 1.0 | 17.5 | 1.0 | 42.5 | 1.0 |
| Krenik | 19.0 | 2.0 (1.1 to 3.7)* | 62.0 | 0.6 (0.4 to 1.0)* | 24.3 | 1.4 (0.8 to 2.4) | 51.0 | 1.1 (0.7 to 1.7) |
| Habillah | 23.3 | 2.8 (1.5 to 5.5)** | 61.1 | 0.5 (0.3 to 0.9)* | 18.3 | 1.1 (0.6 to 2.0) | 32.8 | 0.6 (0.4 to 1.1) |
| Number of living children | | | | | | | | |
| 1–3 | 16.2 | 1.0 | 55.3 | 1.0 | 14.3 | 1.0 | 33.3 | 1.0 |
| ≥4 | 18.7 | 0.9 (0.4 to 2.3) | 68.1 | 0.5 (0.2 to 1.2) | 22.2 | 1.9 (0.8 to 4.7) | 46.5 | 1.1 (0.5 to 2.4) |
| Interpersonal communication (IPC) campaign | | | | | | | | |
| Received home visit | | | | | | | | |
| No | 16.7 | 1.0 | 65.9 | 1.0 | 21.1 | 1.0 | 27.1 | 1.0 |
| Yes | 19.3 | 1.4 (0.9 to 2.2) | 65.4 | 1.0 (0.6 to 1.7) | 20.8 | 1.1 (0.7 to 1.8) | 46.3 | 2.1 (1.2 to 3.7)** |
| Attended in-clinic sessions | | | | | | | | |
| No | 9.0 | 1.0 | 63.5 | 1.0 | 12.3 | 1.0 | 42.0 | 1.0 |
| Yes | 30.5 | 3.4 (1.9 to 6.2)*** | 66.4 | 1.2 (0.8 to 1.8) | 32.4 | 1.9 (1.1 to 3.2)* | 44.5 | 0.9 (0.6 to 1.3) |
| Mass education campaign | | | | | | | | |
| Attended public meetings | | | | | | | | |
| No | 17.7 | 1.0 | 63.9 | 1.0 | 19.8 | 1.0 | 40.5 | 1.0 |
| Yes | 33.3 | 3.2 (1.2 to 8.5)* | 67.8 | 1.4 (0.9 to 2.1) | 50.0 | 3.8 (1.5 to 9.3)** | 48.6 | 1.4 (0.9 to 2.1) |

Per cent, percentage of mothers reporting outcome per subcategory. OR adjustment was performed for socio-economic characteristics and exposure to information variables.

*p<0.05; **p<0.01; ***p<0.001.

*At least 3 versus <3 ANC visits.

†At least 3 versus <3 TT doses.

‡Delivery at healthcare facility versus at home.

§≥1 versus no postnatal care visit.

Table 4 Adjusted ORs of being aware of antenatal care (ANC) services and tetanus toxoid (TT) vaccination, place of delivery and postnatal care (PNC) among all women, independent of survey phase

| | Awareness of ANC* | | Awareness of TT vaccination† | | ANC visits‡ | | TT vaccination§ | | Place of delivery¶ | | PNC visits** | |
|---|-------------------|---------------------|------------------------------|---------------------|-------------|---------------------|-----------------|---------------------|--------------------|-----------------------|--------------|----------------------|
| | Per cent | OR (95% CI) | Per cent | OR (95% CI) | Per cent | OR (95% CI) | Per cent | OR (95% CI) | Per cent | OR (95% CI) | Per cent | OR (95% CI) |
| Socio-economic information | | | | | | | | | | | | |
| Age, years | | | | | | | | | | | | |
| <20 | 47.5 | 1.0 | 42.9 | 1.0 | 32.4 | 1.0 | 24.4 | 1.0 | 43.3 | 1.0 | 69.7 | 1.0 |
| 20–30 | 46.8 | 1.6 (0.8 to 3.2) | 42.0 | 1.3 (0.7 to 2.4) | 47.5 | 3.6 (1.9 to 6.8)*** | 34.5 | 1.7 (0.9 to 3.1) | 44.6 | 1.0 (0.5 to 1.7) | 69.7 | 0.9 (0.5 to 1.6) |
| 31–40 | 45.8 | 1.3 (0.6 to 2.8) | 39.8 | 1.1 (0.6 to 2.0) | 43.0 | 2.9 (1.5 to 5.6)** | 36.1 | 1.7 (0.9 to 3.1) | 46.8 | 1.0 (0.6 to 1.8) | 65.3 | 0.7 (0.4 to 1.3) |
| >40 | 44.7 | 1.5 (0.6 to 3.7) | 41.2 | 1.1 (0.5 to 2.4) | 31.8 | 1.8 (0.8 to 4.0) | 21.2 | 0.8 (0.4 to 1.9) | 34.1 | 0.6 (0.3 to 1.4) | 35.3 | 0.2 (0.1 to 0.4)*** |
| Educational attainment | | | | | | | | | | | | |
| Informal/none | 41.7 | 1.0 | 31.5 | 1.0 | 35.7 | 1.0 | 24.2 | 1.0 | 33.0 | 1.0 | 54.4 | 1.0 |
| Basic | 48.9 | 1.3 (0.9 to 1.9) | 51.3 | 2.1 (1.6 to 2.9)*** | 48.4 | 2.1 (1.5 to 2.8)*** | 42.5 | 2.2 (1.7 to 3.0)*** | 54.2 | 3.0 (2.2 to 4.1)*** | 80.0 | 4.0 (2.8 to 5.7)*** |
| Secondary and above | 67.2 | 3.2 (1.7 to 5.7)*** | 67.2 | 2.8 (1.7 to 4.5)*** | 57.8 | 2.5 (1.5 to 4.1)*** | 48.3 | 2.1 (1.3 to 3.4)** | 83.6 | 12.8 (7.0 to 23.1)*** | 87.1 | 5.5 (2.9 to 10.5)*** |
| Employment status | | | | | | | | | | | | |
| No | 34.3 | 1.0 | 31.1 | 1.0 | 36.4 | 1.0 | 18.6 | 1.0 | 34.5 | 1.0 | 59.0 | 1.0 |
| Yes | 54.3 | 1.5 (1.0 to 2.1)* | 47.9 | 1.0 (0.7 to 1.3) | 45.4 | 0.9 (0.6 to 1.2) | 41.3 | 2.1 (1.5 to 2.8)*** | 51.1 | 0.9 (0.7 to 1.2) | 70.1 | 0.8 (0.6 to 1.1) |
| Camp of residence | | | | | | | | | | | | |
| Krending | 50.3 | 1.0 | 34.7 | 1.0 | 44.1 | 1.0 | 30.0 | 1.0 | 35.3 | 1.0 | 66.3 | 1.0 |
| Krenik | 47.8 | 0.7 (0.4 to 1.0)* | 44.3 | 1.6 (1.1 to 2.2)** | 40.5 | 1.0 (0.7 to 1.4) | 37.7 | 1.2 (0.9 to 1.7) | 49.5 | 2.0 (1.4 to 2.8)*** | 64.2 | 0.9 (0.7 to 1.3) |
| Habillah | 40.6 | 0.3 (0.2 to 0.5)*** | 41.9 | 1.2 (0.8 to 1.8) | 42.2 | 1.0 (0.7 to 1.5) | 25.6 | 0.7 (0.5 to 1.1) | 44.4 | 1.4 (0.9 to 2.0) | 67.8 | 1.1 (0.7 to 1.6) |
| Number of living children | | | | | | | | | | | | |
| 1–3 | 51.5 | 1.0 | 43.0 | 1.0 | 38.0 | 1.0 | 24.9 | 1.0 | 42.2 | 1.0 | 68.4 | 1.0 |
| ≥4 | 45.3 | 0.6 (0.3 to 1.3) | 40.8 | 1.1 (0.6 to 1.9) | 42.8 | 0.7 (0.4 to 1.3) | 34.0 | 1.4 (0.8 to 2.5) | 45.1 | 1.7 (1.0 to 3.0) | 65.1 | 1.7 (0.9 to 3.0) |
| Interpersonal communication (IPC) campaign | | | | | | | | | | | | |
| Received home visit | | | | | | | | | | | | |
| No | 23.0 | 1.0 | 24.5 | 1.0 | 29.3 | 1.0 | 22.7 | 1.0 | 30.5 | 1.0 | 48.6 | 1.0 |
| Yes | 54.6 | 2.0 (1.4 to 2.9)*** | 47.1 | 1.8 (1.3 to 2.5)*** | 46.3 | 1.1 (0.8 to 1.6) | 35.7 | 1.4 (1.0 to 1.9) | 49.4 | 1.3 (1.0 to 1.8) | 71.7 | 2.0 (1.5 to 2.8)*** |
| Attended in-clinic sessions | | | | | | | | | | | | |
| No | 26.2 | 1.0 | 19.1 | 1.0 | 28.3 | 1.0 | 22.8 | 1.0 | 30.1 | 1.0 | 76.6 | 1.0 |
| Yes | 62.4 | 2.9 (2.0 to 4.1)*** | 58.7 | 3.7 (2.7 to 5.0)*** | 52.6 | 1.7 (1.3 to 2.4)*** | 39.9 | 1.2 (0.9 to 1.7) | 55.9 | 1.4 (1.0 to 1.8)* | 51.9 | 1.6 (1.1 to 2.2)** |
| Mass education campaign | | | | | | | | | | | | |
| Attended public meetings | | | | | | | | | | | | |
| No | 36.3 | 1.0 | 33.4 | 1.0 | 35.5 | 1.0 | 27.8 | 1.0 | 38.0 | 1.0 | 61.1 | 1.0 |
| Yes | 82.8 | 1.8 (1.2 to 2.9)** | 69.5 | 1.5 (1.0 to 2.1)* | 64.9 | 1.0 (0.7 to 1.4) | 48.7 | 1.3 (0.9 to 1.8) | 68.1 | 1.2 (0.9 to 1.8) | 82.1 | 0.9 (0.6 to 1.3) |

Per cent, percentage of mothers reporting outcome per subcategory. OR adjustment was performed for all variables listed in the table in addition to the survey phase.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

*Aware versus not aware of ANC.

†Aware versus not aware of TT vaccination.

‡At least 3 versus <3 ANC visits.

§At least 3 versus <3 of TT doses.

¶At healthcare facility versus at home.

**≥1 versus no postnatal care visit.

observed increases across all ages implies success in raising women's awareness and encouraging them to seek reproductive healthcare services regardless of their age. Parity is generally associated with the use of reproductive healthcare services; studies showed multiparous women are less likely to use ANC services or deliver at healthcare facilities.^{39 40} However, our study did not show any associations between number of living children (a proxy for parity) and use of services. Another report from Darfur also indicated parity was not associated with ANC use.¹¹ In the present study, the percentage of women receiving IPC and mass education campaigns was similar regardless of the number of living children or of women's ages. Women in West Darfur IDP camps continued to participate in the campaigns even if they had already experienced a number of pregnancies. The reasons of this lack of association between number of children and use of reproductive healthcare services should be explored by qualitative studies in the future.

Strengths, limitations and generalisability

The employed MCHWs were selected from the same camp as the women they visited, and were well-educated and familiar with the socio-cultural norms and traditions of the IDPs and with local dialects. They played a vital role in disseminating maternal healthcare information, which would also have been spread through social contact. In addition, the training the MCHWs received, their active communications with tribal leaders, and field monitoring by team leaders resulted in complete data collection from 640 participants in each phase.

The following potential limitations should be borne in mind when interpreting the current findings. First, a control group was not allocated for ethical reasons, so it is not possible to prove a causal relationship between the interventions and changes in the six measured outcome indicators. Any changes could have been influenced by conditions external to the interventions. For example, the constant influx of displaced women into the camps might have influenced overall exposure to the interventions and lowered awareness and service use as a whole in the follow-up survey. Therefore, to reduce the influence of this population influx, our samples were restricted to women who had lived in the camp for at least 2 years. Further, potential changes in the quality of services and the community's capacity to use these services might have attracted more pregnant women to the services in the follow-up than in the first survey.

Second, the findings are based on self-reports due to the unavailability of systematic data from healthcare records, ANC and vaccination cards, or intervention activity logs. Therefore, the obtained information could be subject to random and non-random misclassification due to differences in the comprehension of individual participants, and in cues for recall. The magnitude of the changes between the two surveys might be underestimated in our study. Generally non-random misclassification leads to underestimation of ORs, while differential

misclassification might have overestimated the ORs in this study; it is difficult to evaluate the overall magnitude of information bias in this study.

People continue to live in emergency settings in Darfur: according to The United Nations High Commissioner for Refugees (UNHCR), the number of displaced people is estimated to rise from 2 329 100 in January 2015 to 2 596 640 in December 2015.⁴¹ Evidence-based findings from this study assume that the strategy of implementing IPC and mass education campaigns, despite movement of IDPs, fragile security situations and logistical barriers, could be effective and actionable in other conflict-affected settings with a similar mixed socio-cultural environment. Interventions in humanitarian relief settings either by local or international organisations should consider the local socio-cultural context of beneficiaries.

CONCLUSION

This study revealed considerable increases in the awareness and utilisation of reproductive healthcare services in emergency settings in Darfur, Sudan following awareness-raising activities carried out by community workers familiar with the socio-cultural norms and dialects spoken in the IDP camps. Higher educational attainment was partly associated with the outcomes. IPC helped to raise both awareness and reproductive healthcare service use, while a mass education campaign improved awareness. The results are generalisable to other conflict-affected settings with a similar mixed socio-cultural environment. IPC and mass education campaigns which respect local socio-cultural norms are effective for improving women's awareness and utilisation of reproductive healthcare services in emergency settings.

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Patient consent Obtained.

Ethics approval The Federal Ministry of Health of Sudan approved this study.

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Data sharing statement No additional data are available.

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