A radio-education intervention to improve maternal knowledge of obstetric danger signs

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ABSTRACT

Objective. *To examine whether a radio-education intervention (REI) is associated with improved maternal knowledge of pregnancy danger signs (PDS) in Nicaragua.*

Methods. *This cross-sectional pilot study used pretests and posttests to evaluate whether an REI was associated with improved knowledge of PDS among 77 pregnant and postpartum women in Nicaragua.*

Results. *The total number of PDS identified by study participants increased from 130 before the intervention to 200 after the intervention, an increase of 53.8% (Wilcoxon signed-rank test (z) = –4.18;* P *< 0.00001). The three PDS for which participant knowledge increased significantly after the intervention were 1) swelling of the face and hands, 2) convulsions, and 3) vaginal bleeding. Participants who 1) reported having a sister who had experienced a pregnancy complication, 2) lived in an urban setting, and 3) had more than a sixth-grade education were significantly more likely to score higher on posttests related to knowledge of PDS than those without those attributes (90.9% versus 56.9% [X^2 (degrees of freedom) = 4.60 (1);* P *= 0.043;* n *= 76]; 75% versus 45.9% [X^2 = 6.8 (1);* P *= 0.009;* n *= 77]; and 62.5% (12+ years education) versus 79.3% (6–12 years) versus 50.0% (0–6 years education) versus 25.0% (no education) [X^2 = 8.11 (1);* P *= 0.044;* n *= 77] respectively).*

Conclusions. *Exposure to the REI was associated with a significant increase in the ability to identify PDS. Further studies should establish whether this increase in knowledge of PDS is associated with increases in use of maternity care services and decreases in delays in seeking care.*

Key words Maternal mortality; health education; Nicaragua.

Every day more than 1 000 women die during pregnancy and childbirth, mostly in low-income countries around the world (1). A variety of safe motherhood interventions have been initiated to address maternal mortality to meet Millennium Development Goal 5 (MDG 5), which calls for a three-quarter reduction of maternal mortality ratios (MMRs) from 1995 to 2015 (1). Culturally appropriate, community-based interventions that improve women's knowledge and recognition of pregnancy danger signs (PDS) may increase rapid referral and appropriate treatment of obstetric emergencies to reduce maternal death and achieve MDG 5 goals (2–6).

In Nicaragua, maternal mortality is a grave problem, particularly in the North Atlantic Autonomous Region (RAAN) (7). Research suggests that knowledge of PDS remains low in rural communities and that increased knowledge may improve the use of both essential and emergency obstetric services (5, 8–15). Delays in receiving emergency obstetric care are often described using the "three phases of delay" model (6). Delays may occur in the following stages of care-seeking: identifying an obstetric emergency; reaching a health care facility to receive care; and procuring adequate care once at a health care facility. Community-based interventions improve a woman's

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ability to recognize and perceive the severity of PDS and to seek care without delay (6).

Several studies have shown that community-based interventions increase maternal knowledge of PDS, which results in changes in maternal behaviors, such as increased use of prenatal care and facility-based birth (12–14). A community-based intervention in Eritrea to increase maternal knowledge of PDS and evaluate use of antenatal care and facility-based birth found that women participating in educational sessions had significantly increased knowledge of PDS from baseline, were more likely to complete four antenatal care visits, and had higher rates of facility-based birth (14). In Southern Laos, interviews with mothers found that high maternal pregnancy knowledge was related to significant increases in antenatal care (12). A cross-sectional, mixed-methods study in Zambia found that women who had very good knowledge of PDS were significantly more likely to have a facility-based birth than women who received less PDS health education (13).

There are several published studies showing a positive relationship between REI and female reproductive health. A quasi-experimental, cross-sectional pilot study was conducted using pretests (367) and posttests (233) to determine whether Spanish-language radio broadcasts could increase cervical cancer knowledge and screening behavior in three communities in Honduras (16). The proportions of participants familiar with the term "cervical cancer" and able to identify Pap smears and gynecological exams as components of cervical cancer screening increased from 78% (pre-intervention) to 91% (post-intervention) (P = 0.0004) and from 46% (pre-intervention) to 61% (post-intervention) (P < 0.0001) respectively. Screening among high-risk women and those who had not been screened in two or more years increased significantly from baseline after the radio broadcasts (from 64% to 74% (P = 0.02) and from 30% to 65% (P < 0.0001) respectively).

Rogers et al. (17) developed a quasi-experimental, population-based study to evaluate the effectiveness of a national REI on adoption of family planning (FP) in Tanzania. Using Demographic Health Survey (DHS) data drawn from approximately 17 000 participants who heard radio programming, the authors found significant increases in approval of FP (β = 0.47, P < 0.01) and current use of contraceptives (β = 0.52, P < 0.01). Clinic data on contraceptive use revealed that 25% of new FP adopters cited the radio broadcast as a main factor in their decision. Population-wide, there was an increase in the use of FP methods and a national decline in total fertility, which may be attributable to the national radio campaign, although this is not verifiable.

While REIs appear to be useful tools for increasing women's knowledge and behavior about reproductive health issues, there is a dearth of research describing the efficacy of REI on increasing knowledge of PDS. A review of the literature in PubMed and CINAHL[4] yielded only one publication reporting the effect of REIs on knowledge of PDS in Guatemala (18). The publication described a cross-sectional study conducted from April 1997 to May 1999 in which women living in four Southwestern regions of Guatemala were exposed to pregnancy-related radio broadcasts highlighting PDS as part of three educational interventions delivered simultaneously (radio announcements, education through established women's groups, and health education provided at clinics) to improve knowledge of PDS. Women who heard the radio programming were twice as likely to be aware of PDS in 1997 and 1998 (odds ratio (OR): 2.00; 95% confidence interval (CI): 1.38, 2.90) and almost three times as likely to be aware of PDS in 1999 (OR: 2.94; 95% CI: 1.68, 5.13). Although the study evaluated the effects of REI on women's knowledge of PDS, the use of the multi-faceted educational interventions was a significant limitation in terms of determining the effect of the REIs, as the study participants interviewed at the clinics were likely to have been exposed to more than one educational intervention not limited to radio.

The current study aimed to address the critical gap in research on the impact of REIs on maternal knowledge of PDS in the RAAN, Nicaragua, by assessing the effects of the community-based radio-education program *Mairin Karnakira–Mujer Poderosa*.[5]

[4] Cumulative Index to Nursing and Allied Health Literature.

[5] "Strong woman" in Miskito and Spanish respectively.

Setting

Nicaragua is the largest and poorest nation in Central America (19). Within the RAAN, 71% of the population lives in extreme poverty and 72% live in rural communities (19, 20). The population surrounding the capital city of Puerto Cabezas is composed primarily of Spanish-speaking ladinos (non-indigenous people), and indigenous Miskito people, who make up 37.5% of the overall population (20).

The RAAN is characterized by its limited infrastructure, isolation from central Nicaragua, and poor access to health services. The average distance that an individual must travel from a health center to a hospital is 86 km, and close to half of all inhabitants live more than 5 km from any health center (20).

The most recent World Health Organization (WHO) publication on trends in maternal mortality reported an MMR of 85 per 100 000 people for Latin America overall, and an MMR of 100 per 100 000 people in Nicaragua (21). Rates in the RAAN represent the country's highest, at 401 per 100 000 (7). MMRs may be significantly higher in the RAAN due to under-reporting of maternal deaths, as found in other regions of Nicaragua (22). In addition to these disparaging mortality rates, the RAAN has low rates of maternal health care service use. Only 36% of women in the RAAN completed the recommended four prenatal visits, more than 35% of births are attended without a skilled birth attendant, and approximately 55% of rural women give birth at home (23, 24).

There is one hospital in the RAAN that provides emergency obstetric services in the capital city, Puerto Cabezas. Scattered health clinics exist throughout the rural communities of the RAAN, generally staffed by nurses only and offering limited services. A maternal waiting home in Puerto Cabezas, *Casa Materna,* provides a place where women from rural communities or with high-risk pregnancies may reside during the end of their pregnancy to receive skilled attendance at birth.

Limited literacy in an area of poverty challenges the promotion of health education messages through traditional media outlets. A 2001 DHS estimated that more than 30% of women in the RAAN were illiterate and only 24% of them had attended secondary school

(25). The survey also revealed that only 15.7% of households in the RAAN had televisions, but 63.8% owned a battery-operated radio (25, 26). Compared to only 23.8% of women who watched television once a week, 80% of individuals in rural areas reported listening to the radio, and 72.1% of women living in the RAAN reported listening at least once weekly (25, 26).

Radio-education intervention

This REI was developed in conjunction with Miskito maternal–child health nurses from the Regional Technical Center for Health Education (*Centro de Educación Técnico Regional para la Salud*, CETRS); the regional hospital, *Hospital Nuevo Amanecer*; *Casa Materna;* and the lead author (KAR). Focus groups were held with these nurses to develop culturally appropriate content for nine REI chapters. Following the focus groups, the elicited concepts were developed into a soap opera script. The resulting nine radio-education chapters, which were about 25–30 minutes long and produced in Spanish and Miskito (the most widely spoken indigenous language in the RAAN), covered the following topics: prenatal care; HIV/sexually transmitted infections (STIs); domestic violence; labor and delivery preparation; preeclampsia/eclampsia; hemorrhage; postpartum care; breastfeeding; and family planning. Each chapter included a brief overview of the characters and past events followed by a current story about four pregnant protagonists. Each chapter ended with a review of the key points of the broadcast, an advertisement for *Casa Materna*, promotion of facility-based birth, and a review of PDS.

Below is an English translation of the review of PDS repeated at each broadcast completion:

Remember if any danger sign presents look for help NOW or active your birth plan!

The pregnancy danger signs are: strong headache, swelling in the face and hands, blurry or spotty vision, strong stomach pain, convulsions, bleeding, water, or discharge from the vagina, or high fever. If you note any danger sign look for help at the closest health post or hospital. Discuss the danger signs with your husband and family so they also know what the danger signs are. Any question, ask your midwife, nurse, or doctor or go to the Casa Materna!

Knowing the pregnancy danger signs can save your life and the life of your baby!

I'm a Strong Woman! I know that I need to take good care of myself to be able to take care of my baby and family. You are a strong woman too!

The storyline of the chapters was told using positive, negative, and transitional characters. Rogers et al. (17), described these three character types as follows: positive characters are "good" characters who demonstrate positive health behaviors and are rewarded for them; negative characters are "bad" characters who demonstrate negative health behaviors and are punished, and "transitional" characters who struggle with positive and negative health behaviors but ultimately make the "right" choice. The use of these character types allows for identification with the characters among the study participants to increase role modeling of positive characters' health care behaviors (27). Recordings were completed at *Mar producciones* recording studio (RAAN), using Miskito volunteer actors from the University of the Autonomous Regions of the Caribbean Coast of Nicaragua (*Universidad de las Regiones Autónomas de la Costa Caribe Nicaragüense*, URACCAN) Center for Leadership and School of Medicine (RAAN).

MATERIALS AND METHODS

Study design and procedures

A cross-sectional pretest/posttest design was used to evaluate whether the REI was associated with improved maternal knowledge of PDS. Inclusion criteria for subjects were being female, Spanish- or Miskito-speaking, 15–44 years old, and pregnant or less than six months postpartum. Participants were women recruited from the *Casa Materna* and an urban clinic, *Clínica Verbo*. Individuals volunteered for participation on the same day as they presented for services at the *Casa Materna* or *Clínica Verbo*. Prior to individual interviews, group consent was attained. Socio-demographic information; prenatal care and labor and delivery history; and knowledge, attitudes, and practices related to childbirth were assessed, and pretests and posttests of PDS knowledge were administered to individual study participants.

Following the individual pretests of PDS knowledge, the women were divided into groups of four to six people to listen to one of nine chapters of the REI in Spanish or Miskito. After listening to the program, focus groups about 10–15 minutes long were conducted to allow the researcher to assess the clarity of the chapter's message. Finally, within 60 minutes of listening to the intervention, posttesting with individual study participants was conducted. Participants were compensated with a "newborn bundle" consisting of a cloth diaper, diaper pins, baby clothes, and a gift for the mother.

Pretests and posttests used open-ended questions to determine knowledge of PDS. The questionnaire was piloted at *Casa Materna* for clarity of language. Women were asked the following questions: "Have you heard of danger signs during pregnancy, labor, and delivery, or postpartum?" and "Can you tell me what danger signs you have heard of that can happen to a woman during pregnancy, labor and delivery, or postpartum?" Responses to the open-ended questions were coded and tallied to correspond to the PDS referred to at the end of the REI ("strong headache," "blurry or spotted vision," "swelling in the face and hands," "strong stomach pain," "convulsions," "vaginal bleeding," "vaginal discharge/fluid," and "high fever"). The PDS questionnaire was developed by the research team, adapted from surveys that assess maternal knowledge (8, 12, 16) and impact of REI (27, 28).

The study was approved by the University of California, San Francisco, Committee on Human Research.

Data analysis

A nonparametric test for paired data (Wilcoxon signed-rank test) was used to calculate pretest/posttest scores due to the non-normal distribution of the data. Chi-squared tests were used for categorical variables. When expected cell values were less than 5, a Fisher's exact test was used to correct for small cell size in the chi-squared test. Two-sample Student's *t*-tests with equal variances were used for normally distributed continuous data. Stata statistical software, release 11 (StataCorp LP, College Station, Texas, USA), was used for statistical analysis.

RESULTS

A convenience sample of 77 pregnant and puerperal women who volunteered to participate in the study at the *Casa Materna* and *Clínica Verbo* were interviewed. Focus groups and radio broadcasts (nine each in Miskito and in Spanish) were administered to 38 participants at *Casa Materna* and 39 participants at *Clínica Verbo*. Most participants were from rural settings, in a partnered relationship, had a minimum of a primary education, and were literate (Table 1). In addition, most of the participants had radios in their homes and listened to broadcasts daily (Table 2).

Pregnancy and delivery behavior

Most participants (63, or 82%) were pregnant at the time of the study; 33 (53.4%) were nulliparous, and 14 (22%) were postpartum. Most reported that they had attended four prenatal visits (61.0%) at a health center during their current or most recent pregnancy. A total of 68.8% of women reported that in addition to receiving prenatal care they had visited a traditional birth attendant during their pregnancy. The surveyed women represented a total of 145 cumulative lifetime births: 60.7% at a hospital, 37.2% at home, and 1.1% at a health clinic. Of the 145 deliveries, 10 were self-reported to be associated with obstetric complications, including retained placenta (3 cases); breech presentation (2 cases); postpartum hemorrhage (1 case); preeclampsia (1 case); fetal demise (1 case); threatened preterm labor (1 case); and preterm labor (1 case). Participants also reported seven cases in which a sister had suffered complications during delivery, including high blood pressure or preeclampsia (4 cases); fetal demise (1 report); placenta previa (1 report); and prolonged labor (1 case). In addition, two women reported having a sister die during pregnancy, one due to postpartum hemorrhage and the other to retained placenta.

TABLE 1. Characteristics of pregnant/puerperal participants (*n* = 77) in radio-education intervention to improve maternal knowledge of pregnancy danger signs, North Atlantic Autonomous Region, Nicaragua, September 2010–August 2011

Characteristic	No. (%)
Mean age (SD[a]): 24.6 years (7.5)	
Clinic	
Casa Materna	38 (49.4)
Clinica Verbo	39 (50.6)
Residence	
Urban	37 (48.1)
Rural	40 (51.9)
Marital status	
Single	19 (24.7)
Partnered	36 (46.7)
Married	20 (26.0)
Undisclosed	2 (2.6)
Education	
None	4 (5.2)
1–6 years	36 (46.7)
6–12 years	29 (37.7)
12+ years; some university	8 (10.4)
Literacy	
Literate	63 (81.8)
Illiterate	14 (18.2)
Language	
Spanish only	6 (7.8)
Miskito only	22 (28.6)
Spanish and Miskito	49 (63.6)

[a] Standard deviation.

TABLE 2. Radio behavior and practice among participants (*n* = 77) in radio-education intervention to improve maternal knowledge of pregnancy danger signs, North Atlantic Autonomous Region, Nicaragua, September 2010–August 2011

Behavior/practice	No. (%)
Owns radio	
Yes	57 (74.0)
No	20 (26.0)
Frequency of radio listenership	
Never	8 (10.4)
One time per month	13 (16.9)
One time per week	12 (15.6)
Daily	44 (57.1)
Has heard other pregnancy radio messages	62 (80.5)
Has heard other pregnancy radio messages in last 2 weeks	37 (48.1)

Knowledge of pregnancy danger signs

A total of 130 PDS (from a list of predetermined PDS compiled before the intervention) were correctly identified by participants before the REI (based on pretesting) and a total of 200 PDS were correctly identified after the intervention (based on posttesting), indicating a significant increase (53.8%) in the number of correctly identified PDS after exposure to the REI (Wilcoxon signed-rank test; $z = -4.18$, $P < 0.00001$) (Table 3). There was a significant increase in knowledge/identification of three PDS: swelling of hands and face, convulsions, and vaginal bleeding.

Women who had heard of PDS previously were more likely to score higher on pretests versus those who had not heard of PDS (90.9% versus 56.9%; $P = 0.043$). Women who had experienced an obstetric emergency themselves (Student's t test = –1.18; $P = 0.879$) or who were multiparous versus nulliparous ($X^2 = 3.19$; $P = 0.074$) were not any more likely to score higher on pretesting than other participants. No significant differences were noted between different levels of education (f-test = 1.24; $P = 0.30$) or urban versus rural dwelling (Student's t-test = 1.12; $P = 0.26$) on pretest scores of PDS. Women who 1) had a sister with a pregnancy complication, 2) were urban dwelling, and 3) had a higher level of education were significantly more likely to score higher on the PDS posttest than those without those attributes (90.9% versus 56.9% [X^2 (degrees of freedom) = 4.60 (1); $P = 0.043$; $n = 76$]; 75% versus 45.9% [$X^2 = 6.82$ (1); $P = 0.009$; $n = 77$]; and 62.5% (12+ years education) versus 79.3% (6–12 years) versus 50.0% (0–6 years education) versus 25.0% (no education) [$X^2 = 8.11$ (1); $P = 0.044$; $n = 77$] respectively).

DISCUSSION

REIs have been shown to have a significant impact on women's knowledge and behaviors pertaining to reproductive health. This study fills a gap in research related to REIs and their effect on maternal knowledge of PDS. Similar to findings by Perrier et al. in which women were two to three times more likely to recognize PDS after exposure to radio-based health messages, participants in the current study who heard the REI were significantly more familiar with PDS (Wilcoxon signed-rank test; $z = -4.18$, $P < 0.00001$). The current findings provide an important advantage over those previously reported by only including the effects of REIs rather than those from a collection of interventions. This study adds to the small compendium of research supporting the efficacy of REIs to improve maternal health knowledge of PDS.

There is growing evidence that maternal knowledge of PDS is correlated with increased use of maternal health care services. In this pilot study, women who had previously heard of PDS were more likely to score higher on pretests, but not on posttests, showing probable reten-

TABLE 3. Number (%) of study participants (*n* = 77) able to identify specific pregnancy danger signs (PDS) before and after radio-education program to improve maternal knowledge of PDS, by PDS, North Atlantic Autonomous Region, Nicaragua, September 2010–August 2011[a]

PDS	Participants able to identify the PDS		Test/level of significance	
	Pre-intervention No. (%)	Post-intervention No. (%)	X^2	*P*
Headache	27 (35.1)	43 (55.8)	3.6	0.059[b]
Inflammation of hands and face	8 (10.4)	14 (18.2)	11.8	0.004[c]
Visual changes	7 (9.1)	11 (14.3)	5.1	0.056[c]
Abdominal/epigastric pain	1 (1.3)	7 (9.1)	0.1	1.000[c]
Convulsions	7 (9.1)	10 (13.0)	6.1	0.043[c]
Vaginal bleeding	46 (59.7)	58 (75.3)	5.5	0.019[b]
Vaginal discharge/fluid	12 (15.6)	22 (28.6)	1.2	0.307[c]
Fever	22 (28.6)	35 (45.5)	2.3	0.129[b]

[a] Total number of PDS identified by participants = 130 (pre-intervention) and 200 (post-intervention).
[b] Chi-squared test of differences by specific PDS.
[c] Fisher's exact test (with chi-squared test if expected cell values < 5).

tion of knowledge. Ideally, increases in a woman's ability to identify a PDS will increase rates of maternity care use and decrease delays in receiving emergency obstetric care. Future studies should evaluate whether knowledge learned from REIs can translate into increases in antenatal care and facility-based birth in Nicaragua similar to those seen following interventions in Eritrea, Southern Laos, and Zambia.

Urban-dwelling women and those who achieved greater than a sixth-grade education scored higher on posttests of knowledge of PDS. This is likely related to women's exposure to health information in an urban environment and ability to learn and retain new information. Level of education and urban versus rural effects on the use of maternity care have been well documented (29). Consistently, studies have found a strong relationship between skilled attendance at birth and facility-based birth with higher levels of maternal education. This relationship is correlated with higher baseline knowledge, increased access to information, confidence, higher earnings, and ease of communication with husband and health care members (29). Urban-residing women also have higher rates of maternity care service use versus their rural counterparts, secondary to accessibility to services, quality, and traditional beliefs regarding health care (29, 30). REIs may be an effective tool to complement maternal education in urban environments to increase the use of maternity care services and prevent delays in emergency care. Promoting health education through REIs in rural environments may be an effective method of reaching populations with lower levels of education and limited access to health care.

Contrary to the assumption of differences between nulliparous and multiparous women, personal experience with pregnancy did not predict higher baseline knowledge of PDS; multiparous women were not found to have more knowledge of PDS than nulliparous women. This unanticipated finding may be related to normal birth outcomes. Women who have previously had an uncomplicated birth are not likely to learn or retain information related to PDS.

This study found significant increases in knowledge of select PDS, including swelling of hands and face, convulsions, and vaginal bleeding, after the intervention. Increases in knowledge regarding individual PDS can be difficult to assess due to the structure of most REIs (individual chapters of programming promoting different types of knowledge, with each participant exposed to only one chapter). This limitation may have affected the number and variety of PDS women were able to recall in the current study. However, the fact that the same message listing all PDS was played at the end of each chapter of the intervention may have reduced the effects of this limitation. It is possible that a cumulative increase in maternal knowledge of individual PDS would have resulted if the women had listened to the complete REI series. Ideally, to have the greatest impact, the target group should be exposed to the entire series of an REI. Future studies should incorporate this change and evaluate knowledge of PDS at broadcast completion.

In this pilot study, women with a sister who experienced an emergency were significantly more likely to score higher on posttests than women who had experienced an emergency themselves. This may be related to the traditional art of storytelling. Storytelling can be an effective method of health promotion as knowing a story may affect an individual's ability to internalize and recall health information (31). The radio soap opera model was based on Bandura's social cognitive theory, which suggests that individuals learn new behaviors by observing and imitating behaviors of others (27, 28). This theoretical framework substantiates the art of storytelling to teach maternal health information in which the stories of others act as influential teachers of health behaviors.

The goal of REIs is not only that listeners learn through the characters' stories but also that they discuss the characters' decisions (and their effects) in their communities, further disseminating knowledge and thus potentially affecting health behaviors in a positive way.

Limitations

One limitation of this study is that the convenience sample comprised urban- and rural-dwelling women who were actively seeking health care. Women already seeking maternity care may have different baseline knowledge of pregnancy and PDS than women who choose not to seek care. One of the goals of REIs is to improve knowledge among individuals in communities with limited or no access to pregnancy care. Use of pretesting and posttesting before and after nationalized broadcasts of REIs is recommended for assessing the effects and reach of this type of educational intervention in remote regions in Nicaragua that have barriers to receipt of maternity care services.

Another limitation involves retention of maternal health knowledge of PDS. In the current study, participants were posttested immediately after the intervention. Future studies should assess long-term retention of knowledge of PDS at later intervals and with repeat exposure. Results from this study are encouraging in that an REI was shown to increase knowledge of PDS among women who listen to the radio on a

regular basis. REIs may be an effective alternative method of maternal health education in the region as well as other rural/limited-resource areas worldwide with access to radios and high listenership. To have the greatest impact, REIs must motivate women to change their behavior when they are faced with a PDS, and storytelling in the form of a radio soap opera may be a potent influencer. It is plausible that REIs can reach a broader audience of women and their families who may not access regular prenatal care. Content of REIs may also reach male listeners, who have an influential role in health care decision-making, and this may thus lead to reduced delays in seeking care. Prior research has illustrated that knowledge of PDS may improve the use of both essential and emergency obstetric services. Future studies should measure long-term retention of knowledge of PDS gained through REIs and the impact on use of obstetric care services and maternal morbidity and mortality.

Conclusion

Timely identification of PDS and the use of emergency obstetric services are critical means by which maternal mortality can be reduced in low-income countries. REIs are an effective method to improve maternal knowledge of PDS and decrease delays in care, leading to reductions in morbidity and mortality. In the current study, women had significantly higher knowledge of PDS after listening to the REI. Future studies should investigate the link between increased awareness of PDS and changes in maternal behaviors that promote safe birth.

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Conflict of interest. None.

REFERENCES

1. World Health Organization. 2010. Maternal deaths worldwide drop by third. Available from: http://www.who.int/mediacentre/news/releases/2010/maternal_mortality_2010091 5/en/ Accessed 20 April 2012.
2. Callister LC. Global maternal mortality: contributing factors and strategies for change. MCN Am J Matern Child Nurs. 2005;30(3):184–92.
3. Campbell OM, Graham WJ; Lancet Maternal Survival Series steering group. Strategies for reducing maternal mortality: getting on with what works. Lancet. 2006;368(9543): 1284–99.
4. Kidney E, Winter HR, Khan KS, Gülmezoglu AM, Meads CA, Deeks JJ, et al. Systematic review of effect of community-level interventions to reduce maternal mortality. BMC Pregnancy Childbirth. 2009;9:2. doi: 10.1186/1471-2393-9-2.
5. Sibley L, Buffington ST, Beck D, Armbruster D. Home based life saving skills: promoting safe motherhood through innovative community-based interventions. J Midwifery Womens Health. 2001;46(4):258–66.
6. Thaddeus S, Maine D. Too far to walk: maternal mortality in context. Soc Sci Med. 1994;38(8):1091–110.
7. Consejo Regional Autónomo Atlántico Norte; Gobierno Regional Autónomo del Atlántico Norte Secretaría de Salud (NI). Modelo de atención intercultural de salud de la Región Autónoma Atlántico Norte, MASIRAAN. Bilwi, RAAN: CRAAN/Comisión de GRAAN Secretaría de Salud; 2008.
8. Kumbani L, McInerney P. The knowledge of obstetric complications among primigravidae in a rural health centre in the district of Blantyre, Malawi. Curationis. 2002;25(3):43–54.
9. Lubbock LA, Stephenson RB. Utilization of maternal health care services in the department of Matagalpa, Nicaragua. Rev Panam Salud Publica. 2008;24(2):75–84.
10. Nuraini E, Parker E. Improving knowledge of antenatal care (ANC) among pregnant women: a field trial in central Java, Indonesia. Asia Pac J Public Health. 2005;17(1):3–8.
11. Pembe AB, Urassa DP, Carlstedt A, Lindmark G, Nyström LG, Darj E. Rural Tanzanian women's awareness of danger signs of obstetric complications. BMC Pregnancy Childbirth. 2009;9:12. doi: 10.1186/1471-2393-9-12.
12. Phoxay C, Okumura J, Nakamura Y, Wakai S. Influence of women's knowledge on maternal health care utilization in southern Laos. Asia Pac J Public Health. 2001;13(1):13–9.
13. Stekelenburg J, Kyanamina S, Mukelabai M, Wolffers I, van Roosmalen J. Waiting too long: low use of maternal health services in Kalabo, Zambia. Trop Med Int Health. 2004;9(3): 390–8.
14. Turan JM, Tesfagiorghis M, Polan ML. Evaluation of a community intervention for promotion of safe motherhood in Eritrea. J Midwifery Womens Health. 2011;56(1):8–17.
15. White K, Small M, Frederic R, Joseph G, Bateau R, Kershaw T. Health seeking behavior among pregnant women in rural Haiti. Health Care Women Int. 2006;27(9):822–38.
16. Perkins RB, Langrish S, Stern LJ, Simon CJ. A community-based education program about cervical cancer improves knowledge and screening behavior in Honduran women. Rev Panam Salud Publica. 2007;22(3):187–93.
17. Rogers EM, Vaughan PW, Swalehe RM, Rao N, Svenkerud P, Sood S. Effects of an entertainment-education radio soap opera on family planning behavior in Tanzania. Stud Fam Plann. 1999;30(3):193–211.
18. Perreira KM, Bailey PE, de Bocaletti E, Hurtado E, Recinos de Villagrán S, Matute J. Increasing awareness of danger signs in pregnancy through community- and clinic-based education in Guatemala. Matern Child Health J. 2002;6(1):19–28.
19. Central Intelligence Agency (US). The world factbook: Nicaragua. Washington: CIA Office of Public Affairs; 2012. Available from: https://www.cia.gov/library/publications/the-world-factbook/geos/nu.html Accessed 20 April 2012.
20. Ministerio de Salud (NI). Red de Servicios de Salud. Puerto Cabezas, RAAN: MINSA-SILAIS; 2011.
21. World Health Organization. Trends in maternal mortality: 1990 to 2008. Estimates developed by WHO, UNICEF, UNFPA and the World Bank. Geneva: WHO; 2010.
22. Benagiano G, Thomas B; International Federation of Gynecology and Obstetrics. Safe motherhood: the FIGO initiative. Int J Gynaecol Obstet. 2003;82(3):263–74.
23. World Health Organization. Countries: Nicaragua—statistics [Internet]. Geneva: WHO; 2006. Available from: http://www.who.int/countries/nic/en/ Accessed 20 April 2012.
24. Ministerio de Salud (NI). Indicadores de salud materno infantil por SILAIS, Nicaragua año 2007. Managua: MINSA; 2007. Available from: http://www.minsa.gob.ni/index.php?option=com_content&view=

article&id=1002 &Itemid=163 Accessed 20 April 2012.
25. Instituto Nacional de Estadisticas y Censos, Ministerio de Salud (NI). Encuesta Nicaraguense de demografia y salud: características y situación de las mujeres. Managua/Nicaragua: INEC/MINSA; 2002. Available from: http://www.measuredhs.com/pubs/pdf/FR135/03Chapter3.pdf Accessed 20 April 2012.
26. Instituto Nacional de Estadisticas y Censos, Ministerio de Salud (NI). Encuesta Nicaraguense de demografia y salud: características de la población y de los hogares. Managua: INEC/MINSA; 2002. Available from: http://www.measuredhs.com/pubs/pdf/FR135/02Chapter2.pdf Accessed 20 April 2012.
27. Vaughan PW, Rogers EM. A staged model of communication effects: evidence from an entertainment-education radio soap opera in Tanzania. J Health Commun. 2000;5(3):203–27.
28. Vaughan PW, Regis A, St. Catherine E. Effects of an entertainment-education radio soap opera on family planning and HIV prevention in St. Lucia. Int Fam Plann Perspectives. 2000;26(4):148–57.
29. Gabrysch S, Campbell OM. Still too far to walk: literature review of the determinants of delivery service use. BMC Pregnancy Childbirth. 2000;9:34. doi: 10.1186/1471-2393-9-34.
30. Say L, Raine R. A systematic review of inequalities in the use of maternal health care in developing countries: examining the scale of the problem and the importance of context. Bull World Health Organ. 2007;85(10):812–19.
31. Haigh C, Hardy P. Tell me a story—a conceptual exploration of storytelling in healthcare education. Nurse Educ Today. 2011;31(4):408–11.

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RESUMEN

Una intervención de educación por radio para mejorar el conocimiento materno de los signos de peligro obstétrico

Objetivo. Analizar si una intervención de educación por radio se asocia con un mejor conocimiento materno de los signos de peligro durante el embarazo (SPE) en Nicaragua.

Métodos. Este estudio piloto transversal evaluó si la intervención se asociaba con un mejor conocimiento de los SPE en 77 mujeres embarazadas o puérperas de Nicaragua mediante evaluaciones previas y posteriores a la intervención.

Resultados. El número total de SPE reconocidos por las participantes en el estudio aumentó de 130 antes de la intervención a 200 después de esta, un aumento de 53,8% (prueba de los rangos con signo de Wilcoxon (z) = –4,18; $P < 0,00001$). Los tres SPE cuyo conocimiento aumentó significativamente entre las participantes después de la intervención fueron 1) la hinchazón de la cara y las manos, 2) las convulsiones y 3) la hemorragia vaginal. Las participantes que 1) notificaron que tenían una hermana que había presentado una complicación del embarazo, 2) vivían en un entorno urbano y 3) tenían un nivel educativo superior al sexto grado tenían significativamente más probabilidades de obtener una mayor puntuación en las evaluaciones posteriores relacionadas con el conocimiento de los SPE que las que no cumplían esas condiciones (90,9 frente a 56,9% [X^2 (grados de libertad) = 4,6 (1); $P = 0,043$; $n = 76$]; 75 frente a 45,9% [$X^2 = 6,8$ (1); $P = 0,009$; $n = 77$]; y 62,5% (más de 12 años de formación) frente a 79,3% (6 a 12 años), frente a 50,0% (0 a 6 años), frente a 25,0% (sin formación) [$X^2 = 8,1$ (1); $P = 0,044$; $n = 77$], respectivamente).

Conclusiones. La exposición a la intervención de educación por radio se asoció con un aumento significativo de la capacidad de reconocer los SPE. Sería preciso llevar a cabo otros estudios para establecer si este aumento de conocimientos en materia de SPE se asocia con un incremento en el uso de los servicios de atención a la maternidad y una disminución de las demoras en la búsqueda de atención.

Palabras clave Mortalidad materna; educación en salud; Nicaragua.