POPULATIONS AT RISK ACROSS THE LIFESPAN: CASE STUDIES

A cross-sectional study of community-based maternal and child health interventions involving Women's Health Volunteer Groups in rural Myanmar

Michiko Oguro, PhD, and Shigeko Horiuchi, PhD

Women's Health and Midwifery, St. Luke's International University, Tokyo, Japan

Correspondence to:

Michiko Oguro, Women's Health and Midwifery, St. Luke's International University, 10-1 Akashi-cho, Chuo-ku, Tokyo 104-0044, Japan. E-mail: michiko-oguro@slcn.ac.jp

ABSTRACT   *Objective:* This study identified the relationship between interventions with womens health volunteer groups in two Myanmar villages and maternal and child health outcomes. *Design and Sample:* This cross-sectional study included 188 women aged 15–49 years old with at least one ≤5-year-old child. The women were randomly selected from two control and two experimental villages. *Measures:* Data were collected via structured interview with a questionnaire based on the UNICEF Multiple Indicator Cluster Survey. *Results:* Logistic regression analyses confirmed that womens health volunteer group intervention was related to the participants receiving any antenatal care (OR: 6.99, $p < .01$) and having knowledge regarding danger signs during the perinatal period (OR: 15.08, $p < .001$), modern contraceptive methods (OR: 44.52, $p < .001$), acceptable first aid (OR: 14.04, $p < .001$), and malaria prevention (OR: 40.30, $p < .001$). A skilled midwife had the most significant relationship with patients receiving any antenatal care (OR: 65.18, $p < .001$). Distance from urban area negatively related to appropriate disposal of the childs stool (i.e., flushed in a latrine; OR: 7.51, $p < .05$). *Conclusions:* This study shows that womens health volunteer groups may positively affect the diffusion of the need to seek antenatal care and health knowledge in rural Myanmar. The importance of skilled midwives is also highlighted, especially in resource-limited settings.

Key words: community-based intervention, maternal and child health, participatory approach, lay health workers, program evaluation, Myanmar.

Background

More than 287,000 pregnant and parturient women die every year worldwide, and most of them live in rural areas of developing countries (World Health Organization, 2012). Myanmar has a relatively high maternal mortality rate of 140 maternal deaths per 100,000 live births in urban populations, which increases to 363 per 100,000 live births in rural populations (Ministry of Health,

Myanmar, 2012). Several reports have described the effectiveness of community mobilization via women's organizations in low-resource settings, where community residents act as core players in solving their own challenges (Manandhar et al., 2004; O'Rourke, Howard-Grabman, & Seoane, 1998). These women's group interventions use a participatory learning and action cycle guided by a facilitator, who leads a cycle of meetings to identify

and prioritize maternal and child health challenges (Houweling et al., 2011; Morrison et al., 2010). In Myanmar, there are several reports regarding the use of lay maternal health workers, although there is great variation across programs in terms of the different societies and cultures involved (Htoo Htoo, 2010; Japanese Organization for International Cooperation in Family Planning, 2013; Mullany et al., 2008; Teela et al., 2009). We established women's health volunteer groups in rural Myanmar and investigated the relationship between women's health volunteer groups and community-based maternal and child health.

Socio-environmental factors relevant in Myanmar. Myanmar is one of the poorest countries in Southeast Asia, with a per capita gross domestic product of $1,105 and a poverty rate of 37.5%, one of the highest in the region (World Bank Group, 2014). Among ASEAN (Association of Southeast Asian Nations) countries, Myanmar has the second-highest infant (41 per 1,000 live births) and under-5 mortality rates (52 per 1,000 live births), prevalence of severe underweight (5.6%), and prevalence of HIV infection (0.6%) (UNICEF, 2014).

In 2012, of an estimated total population of 52.8 million, 39.7 million (75%) resided in rural areas with limited access to health care services (UNFPA, 2014). The rate of antenatal care (at least four visits) in rural areas is 68% compared to 90% in urban areas. Skilled attendance at delivery is 63% in rural areas compared to 90% in urban areas; the infant mortality rate is 43 and 25 per 1,000 live births in rural and urban areas, respectively (Population Reference Bureau, 2015). Increasing access to basic health services in rural areas could have a large impact on maternal and child health. However, government expenditures on health are the lowest globally and account for only 1.3% of the total government expenditure (about US$ 2 per person per year) (World Bank Group, 2014).

Midwives play a pivotal role in improving the quality of services for pregnant women, new mothers, and newborns, especially in rural areas. The Ministry of Health, Myanmar has set a national target of at least one midwife in each village; the reality continues to lag behind the ideal.

Although the youth literacy rate in Myanmar (96%) is higher than those in regional neighbors Cambodia (87%) and Laos (72%), as are secondary school gross enrollment rates, about 25% of students leave basic education after primary school (World Bank Group, 2014).

Women's group intervention. During September 2003, the Women's Health Volunteer Group (WVG) program was introduced in two Myanmar villages to improve maternal and child health in a rural area of Meiktila Township, Mandalay Division, Myanmar, as part of a nongovernmental organization project (Oguro & Horiuchi, 2006). The two experimental villages were selected based on their distance from the nearest urban area, with experimental village 1 (E1) being relatively close to the urban area (~10 miles), and experimental village 2 (E2) being relatively far from the urban area (~22 miles). The WVGs were established by organizing women and training them using a participatory approach. Our program supported the WVGs in developing independent activities between September 2003 and March 2008.

To become a WVG member, each woman had to be (a) a resident, (b) literate, (c) 18–50 years old and willing to participate in the group, (d) interested in local health and social issues, and (e) trusted by the community. The WVG members had three major responsibilities: (a) planning and managing safe maternal habits: WVG members created lists of children and pregnant mothers to receive regular checkups and immunization services, (b) implementation: WVG members mobilized pregnant mothers and children to receive antenatal care and immunization when health care workers visited the village, and (c) monitoring: WVG members monitored the mothers and children until the next immunization or childbirth. Each member was responsible for ~15 households. These criteria were selected after discussions with the village authorities.

International and local facilitators visited the WVGs at least twice per month during the first year to participate in meetings and provide training and feedback. The facilitators occasionally used participatory rural appraisal tools (e.g., a resource map, seasonal calendar, and daily schedule) to guide the discussions and used storytelling to describe maternal and child health challenges. Through the meetings and training, the WVG members identified and prioritized maternal and child health issues,

and demonstrated that the WVG activities were increasing their confidence and gradually promoting the desired changes (Oguro, 2012). In the follow-up survey, they revealed what they gained by fulfilling an appointed WVG role, such as acquisition of new knowledge, application of new knowledge, the satisfaction of being relied on by villagers, and enjoyment (Tsuchiya, Oguro, Eto, Osumi, & Horiuchi, 2007). Learning was a joy, and the enriching experience led to more self-confidence and greater trust between the WVG members and village inhabitants (Horiuchi, Kataoka, Eto, Oguro, & Mori, 2006).

At 3 years after the WVGs were established, their activities included: (a) educating pregnant women and mothers regarding the necessity of health checks and immunizations and helping them attend these appointments; (b) early detection of abnormal signs and symptoms during the perinatal period; (c) managing the family planning fund, which allowed women who could not afford birth control to borrow money at no interest; (d) providing first aid to injured people (e.g., for injuries that were sustained during agricultural work); and (e) educating women regarding appropriate sanitation and malaria prevention. An ongoing evaluation of the outcomes of this program was initiated to assess the sustainability of the WVG activities at the end of the program (March 2008).

Research question

Our research question was: how did WVG interventions in a rural area of Myanmar relate to outcome variables for maternal and child health?

Over the last decade, many studies have addressed the effects of women's groups practicing participatory learning and action, compared with usual care, on birth outcomes in low-resource settings (Azad et al., 2010; Colbourn et al., 2013; Fottrell et al., 2013; Lewycka et al., 2013; Manandhar et al., 2004; More et al., 2012; Tripathy et al., 2010). In Myanmar, all such programs have been implemented among internally displaced communities in the eastern border regions (Mullany et al., 2008; Teela et al., 2009) and among an ethnic group in eastern Myanmar (Htoo Htoo, 2010; Japanese Organization for International Cooperation in Family Planning, 2013). Little has been reported on the evaluation of community-based interventions involving women health volunteers in rural areas

among the ethnic majority Bamar people, who represent ~70% of the population. Therefore, our study can provide basic data and contribute to improving the health system in Myanmar.

Methods

Design and Sample

We used a cross-sectional design to identify the relationship between interventions with the WVGs in two Myanmar villages and maternal and child health outcomes. The outcomes we identified were focused on improvements in knowledge and awareness of health behaviors among mothers who were of reproductive age. This study was performed in accordance with the ethical principles of doing no harm, voluntary participation, anonymity, and protection of private and personal information. The study design was reviewed and approved by our institutional ethics review board.

Participants. Participants were selected via random sampling, using the following selection criteria: 15–49 years old, living in the experimental or control villages, at least one ≤5-year-old child, able to communicate in the Myanmar language, and no serious mental illness. The target number of participants was set at 50 individuals per village (i.e., 200 individuals from four villages).

Study setting. Villages E1 and E2 served as the experimental villages; villages C1 and C2 served as the control villages for E1 and E2, respectively. As the presence of a midwife in the village was considered an important factor that would affect the study outcomes, the control villages were selected based on the presence of a midwife (as well as their distance from the urban area). The experimental villages had previously been selected based on their distance from the urban area, as we assumed that distance to an urban area (i.e., a hospital) would affect health care outcomes. Villages E1 and C1 were relatively close to the urban area (~10 miles) and E2 and C2 were relatively far from the urban area (~22 miles).

Study periods. The WVG program was conducted from 2003 to 2008; this study was part of the project evaluation at the end of the project in

2008. The data collection period for analysis was from February to March 2007.

Measures

Data collection. We collected data for five variables: (a) antenatal care (ANC) and childbirth care, (b) knowledge of danger signs during the perinatal period, (c) knowledge of contraception, (d) accepting first aid, and (e) health behaviors. All data were collected via structured interviews using a questionnaire, which was developed to evaluate the participants' knowledge or awareness regarding the five variables. This questionnaire was based on the UNICEF Multiple Indicator Cluster Survey (UNICEF, 2012a,b) and also included themes regarding the country, culture, and survey goals. The validity of the questions was evaluated by two specialists in this field; consensus was used to determine which items were included in the questionnaire. The final questionnaire contained 102 questions, including 31 items regarding background characteristics, 16 items regarding ANC, 9 items regarding danger signs during the perinatal period, 10 items regarding contraception use, 3 items regarding accepting first aid, and 33 items regarding health behaviors.

Study procedures. Potential participants were identified using the village map and selected via random sampling. We also recruited study collaborators, who were all graduate students at Meiktila University, which is the nearest university to the study villages. The study collaborators completed a 5-day training program that was administered by one of the authors before data collection. The training program was developed to address the questionnaire's contents, sampling and survey implementation, communication skills, and ethical considerations. The study collaborators then visited the prospective participants, explained the aims of the study, and arranged an appointment to administer the questionnaire if the participants consented. If a participant could not complete the questionnaire due to illiteracy, the collaborator input the participant's response on the questionnaire on her behalf after she answered verbally. All data were collected between February and March 2007; the experimental villages were evaluated before the control villages. The data were then translated from Myanmar to English by native

Myanmar speakers who could also speak English (as indicated by a TOEFL score of 500).

Analytic strategy

Data analysis. The Mann-Whitney U test, chi-square test, and Fisher's exact test were used to compare the outcomes between the experimental and control villages. Multiple logistic regression analyses were performed to identify the relationship between the WVGs and the outcome variables. We calculated the variance inflation factor for the variables to check for collinearity before inclusion in the analyses. Differences were considered statistically significant at a p-value of $<.05$, and SPSS software (version 22.0; SPSS Inc., Chicago, IL, USA) was used for all analyses.

Results

Baseline characteristics

The baseline characteristics of the villages are shown in Table 1. More than half of the women in E1 were employed in the sewing industry, while the remaining women worked as farmers. The midwife characteristics were similar for E2 and C2, although the midwife characteristics were different for E1 and C1. The midwife in village C1 had married a resident, settled with her family in the village, and lived there for 15 years. All other midwives were young and had recently been assigned to the village as their first posting (≤ 3 years of experience). Among the 188 participants, 38 women were from C2 (the control for E2) and 50 women were from each of the three remaining villages. Only 38 women from C2 were included because no other women fulfilled the inclusion criteria. The sociodemographic characteristics (e.g., age, education level, and economic status) were similar between the four villages.

Questionnaire findings

Antenatal and childbirth care. Village C1 had a significantly higher proportion of participants who had received ANC at least once during the last pregnancy, compared to E1 ($\chi^2 = 15.17$, $p < .001$). In contrast, E2 had a significantly higher proportion of participants who had received ANC, compared to C2 ($\chi^2 = 24.43$, $p < .001$) (Table 2). Village C1 had a higher proportion of participants

who had received the tetanus toxoid immunization at least twice during their last pregnancy (vs. E1) for the purpose of protecting them and their newborn infants against tetanus, although there was no significant difference between E2 and C2 ($\chi^2 = 0.91$, $p = .38$). C1 had a higher frequency of a skilled birth attendant (midwives, nurses, and medical doctors) being present at participants' last birth compared to E1 ($\chi^2 = 29.68$, $p < .001$). There was no significant difference in the presence of a skilled birth attendant at last birth between E2 and C2 ($\chi^2 = 2.98$, $p = .08$).

Knowledge of danger signs during the perinatal period. The participants in E1 and E2 were more aware of possible danger signs during pregnancy and childbirth (E1–C1: $z = -4.06$, $p < .001$; E2–C2: $z = -7.04$, $p < .001$).

Contraception. Women from E1 and E2 were more aware of the different types of modern contraceptive methods (pills, hormonal injections that prevent pregnancy for 3 months [Depo-Provera], condoms, intrauterine device, and sterilization) compared to women from C1 and C2 (E1–C1: $z = -4.25$, $p < .001$; E2–C2: $z = -7.48$, $p < .001$).

First aid. All responses in this section were categorized by the women as acceptable (washing the wound, seeking the care of a midwife or women's health volunteer) or unacceptable

TABLE 1. *Baseline characteristics*

	Experimental 1 (n = 50)	Control 1 (n = 50)	p-value	Experimental 2 (n = 50)	Control 2 (n = 38)	p-value
Characteristics of the study fields						
Population/households	1,023/210	1,433/300		1,458/215	892/83	
Distance from urban area (miles)	10	14		23	41	
Main industry	Farming, sewing	Farming		Farming	Farming	
Health resource						
SHC	✓	✓		✓	✓	
AMW	✓					
TBA	✓	✓		✓	✓	
CHW	✓			✓	✓	
Other						
Retired army medic	✓					
Unqualified practitioner	✓	✓		✓	✓	
Traditional healer	✓	✓		✓	✓	
Characteristics of the midwives						
Age	20s	40s		20s	20s	
Years of service	3	15		1	2	
Residence classification	Single	Living with her family		Single	Single	
Characteristics of the participants						
Mean age (standard deviation)	32.2 (6.4)	31.8 (6.9)	.730	33.0 (6.7)	32.0 (7.1)	.442
Education level[a]						
<primary school	41	40	.798	48	36	1.000
>primary school	9	10		2	2	
Economic status[b]						
Poor	28	26	.608	27	14	.093
Middle-class	17	21		19	23	
Rich	5	3		4	1	

Notes. SHC = sub-rural health center (run by a midwife and a grade 2 public health supervisor at the village level); AMW = auxiliary midwife; TBA = traditional birth attendant; CHW = community health worker.
[a]Education level was categorized as primary (no schooling or <5 years; in Myanmar, primary education lasts 5 years) or >primary (at least completion of primary education).
[b]Economic status was estimated based on participants' possessions and the suggestions of the midwives and village authorities, as poor (having only a bamboo mat and pot), middle-class (having a bicycle or oxcart), or rich (having a television or generator).

TABLE 2. *Study Findings*

Characteristics	Experimental 1 (n = 50)	Control 1 (n = 50)	p-value	Experimental 2 (n = 50)	Control 2 (n = 38)	p-value
Antenatal and childbirth care						
Any antenatal care	33	49	<.001	47	18	<.001
Received tetanus immunization ≥2 times during last pregnancy[a]	33	50	.001	47	29	.379
Skilled attendant at last birth	20	45	<.001	8	12	.084
Knowledge of danger signs during the perinatal period						
Number of danger signs recalled, 27 items (SD)	7.90 (3.07)	4.70 (1.88)	<.001	13.92 (3.88)	4.37 (2.62)	<.001
Contraception						
Number of modern methods[b] recalled (SD)	4.06 (1.37)	2.82 (1.08)	<.001	5.16 (1.00)	2.00 (0.77)	<.001
First aid[c]						
Acceptable treatment answered[d]	45	7	<.001	33	5	<.001
Health behaviors						
Care for sick <5-year-old child						
Has your child had a fever during the last 2 weeks?	5	17	.004	4	9	.066
Did you seek advice or treatment for the illness outside of your home?	1	13	.039	0	9	.001
Has your child had a cough or difficulty breathing during the last 2 weeks?	11	20	.052	4	9	.066
Did you seek advice or treatment for the illness outside of your home?	3	2	1.000	1	3	.400
Sanitation						
What was done to dispose of the stool?						
Appropriate method[e]	26	22	.106	21	4	.002
Inappropriate method[f]	3	9		13	17	
Number of correct precautions against malaria recalled (eight items)						
Mean (SD)	2.64 (0.985)	1.28 (0.784)	<.001	2.72 (1.011)	0.58 (0.522)	<.001

Notes. SD = standard deviation.
[a]Received tetanus immunization ≥2 times during last pregnancy: the purpose of giving the vaccine to pregnant women is to protect them from tetanus and to protect their newborn infants against neonatal tetanus.
[b]Modern methods: pills, hormonal injections hormonal injections that prevent pregnancy for 3 months (Depo-Provera), condoms, intrauterine device, sterilization.
[c]First aid: for injuries that were sustained during agricultural work.
[d]Acceptable treatment: wash the wound; seek care of midwife or women's health voluntary group.
[e]Appropriate method: flushed in a latrine.
[f]Inappropriate method: left in the open, thrown into garbage.

treatment (applying dirt and saliva, tomato, salt, or AJINOMOTO [monosodium glutamate]) for injuries that were sustained during agricultural work. The experimental villages had a significantly higher proportion of participants who answered that they received acceptable first aid treatment (E1–C1: χ^2 = 57.85, p < .001; E2–C2: χ^2 = 24.57, p < .001).

Health behaviors. *Care for sick ≤5-year-old children*—Compared to E1, significantly more children in C1 had experienced a fever during the 2-week period before questioning (χ^2 = 4.22, p = .004), and significantly more children in C1 were treated during their illness (χ^2 = 5.29, p = .04). Although the frequency of children with fever in C2 was higher than that in E2, there were

no significant differences between E2 and C2 (χ^2 = 4.22, p = .066). There was no significant difference in the number of children who had a cough or difficulty breathing during the 2-week period before questioning between E1 and C1 (χ^2 = 2.99, p = .052) or between E2 and C2 (χ^2 = 3.07, p = .066).

Sanitation—All responses regarding the disposal of the children's stools were categorized as appropriate (flushed in a latrine) or inappropriate (left in the open or thrown into garbage). Appropriate disposal was significantly more common in E2 compared to C2 (χ^2 = 10.11, p = .002), although there was no significant difference in stool disposal between E1 and C1 (χ^2 = 3.407, p = .106).

Number of correct precautions against malaria recalled—The experimental villages were significantly more knowledgeable regarding malaria prevention compared to their respective control villages (E1–C1: z = −6.25, p < .001; E2–C2: z = −7.65, p < .001).

A post hoc power analysis was conducted using G*3Power 3.1.9.2 (Faul, Erdfelder, Lang, & Buchner, 2007) to determine whether the study was sufficiently powered to detect significant differences between both experimental and control groups (E1-C1 group and E2-C2 group). All post hoc analyses revealed more than 98% power to detect significant differences between both experimental and control groups, given the high effect size, which was more than 0.67 for the chi-square test and more than 1.25 for the Mann-Whitney U test. Thus, the study was adequately powered.

The relationship between WVGs and the six outcome variables selected based on goodness-of-fit test. Table 3 lists the relationship between the WVGs and the outcome variables (any antenatal care, knowledge of danger signs, knowledge of modern contraceptive methods, acceptable first aid, appropriate stool disposal, and knowledge of malaria prevention), which were chosen based on the goodness-of-fit test and used as the dependent variables for the regression analyses. The independent variables included having a WVG, having a skilled midwife, educational level, economic status, and distance from the urban area. However, we did not include distance from the urban area in the analysis of any ANC, as it was not considered a barrier to access, given that a midwife was present in all four villages. We also omitted distance from the urban area for the analyses of knowledge of danger signs and modern contraceptive methods, because the independent variables were not significantly different when this distance was included in the analyses. Similarly, we did not include presence of a skilled midwife in the analysis of malaria prevention, as the presence of midwife was considered irrelevant because midwives are not responsible for malaria prevention in the communities.

The results of these analyses revealed that WVG related to five outcome variables. Compared to the participants in the control villages, the participants in the experimental villages were sevenfold more likely to receive ANC (odds ratio [OR]: 6.99, 95% confidence interval [CI]: 2.25–21.66), 15.1-fold more likely to know at least two danger signs during pregnancy (OR: 15.08, 95% CI: 3.85–59.63), 44.5-fold more likely to know about ≥4 modern contraceptive methods (OR: 44.52, 95% CI: 5.54–357), 14-fold more likely to accept first aid (OR: 14.04, 95% CI = 2.99–65.94), and 40.3-fold more likely to know ≥2 malaria prevention measures (OR: 40.30, 95% CI: 13.33–121.86). Interestingly, presence of a skilled midwife had the most significant relationship with mothers' receiving ANC from a midwife (OR: 65.18, 95% CI: 7.19–590.69); distance from the urban area negatively related to appropriate disposal of the child's stool (OR: 7.51, 95% CI: 1.58–35.53).

Discussion

The presence of women health volunteers was associated with positive effects on rural mothers' knowledge of danger signs during the perinatal period, modern contraceptive methods, first aid, and malaria prevention. This may be because the WVG members facilitated the public and/or private exchange of information with the villagers, which would increase and reinforce the mothers' knowledge. Results on our process evaluation (Oguro & Horiuchi, 2012; Tsuchiya et al., 2007) support these findings regarding the effectiveness of the WVG program on mothers' capacity and behavior. The WVGs were associated with the opportunity to receive ANC, which is consistent with previous studies (Lewycka et al., 2013; Manandhar et al., 2004).

TABLE 3. *Logistic Regression Analysis of the Relationship between the WVGs and the Six Outcome Variables Selected Based on the Goodness-of-Fit Test*

Independent variables	Dependent variables					
	Any antenatal care (n = 133) OR (95% CI)	Knowledge of danger signs (n = 136) OR (95% CI)	Knowledge of modern contraceptive methods (n = 125) OR (95% CI)	Acceptable first aid (n = 136) OR (95% CI)	Appropriate disposal of child's stool (n = 80) OR (95% CI)	Knowledge of malaria prevention (n = 136) OR (95% CI)
WVG	6.99 (2.25–21.66)**	15.08 (3.85–59.63)***	44.52 (5.54–357.00)***	14.04 (2.99–65.94)***	3.57 (0.53–23.65)	40.30 (13.33–121.86)***
Skilled midwife	65.18 (7.19–590.69)***	0.41 (0.07–2.32)	8.13 (0.88–75.02)	0.22 (0.02–1.69)	1.31 (0.11–14.53)	—
Educational level	1.00 (0.36–2.79)	1.02 (0.29–3.50)	1.50 (0.83–2.69)	0.47 (0.11–1.90)	1.00 (0.22–4.53)	0.81 (0.22–2.97)
Economic status	1.43 (0.61–3.38)	1.16 (0.46–2.90)	1.31 (0.68–2.55)	0.37 (0.13–1.03)	1.37 (0.45–4.18)	0.73 (0.27–1.98)
Distance from urban area	—	—	—	3.31 (0.86–12.68)	7.51 (1.58–35.53)*	1.93 (0.64–5.80)
Goodness of fit (χ^2)	27.17***	63.62***	41.42***	80.78***	15.23**	73.19***
Hosmer-Lemeshow test	0.93	0.99	0.33	0.73	0.98	0.48
% of correct classifications	84.2	80.9	75.2	84.6	73.8	83.8

Notes. Dependent variables: received any antenatal care during last pregnancy (yes = 1, no = 0), knowledge of ≥2 danger signs during the perinatal period (yes = 1, no = 0), knowledge of ≥4 modern contraceptive methods (yes = 1, no = 0), acceptable first aid (yes = 1, no = 0), appropriate disposal of child's stool (yes = 1, no = 0), and correctly described ≥2 precautions against malaria (yes = 1, no = 0). Independent variables: WVG present (yes = 1, no = 0), skilled midwife present (yes = 1, no = 0), educational level (>primary school = 1, ≤primary school = 0), economic status (middle and upper class = 1, poor = 0), and distance from urban area (close to urban area = 1, far from urban area = 0).
OR = odds ratio; CI = confidence interval; WVG = Women's Health Volunteer Group.
*p < .05, **p < .01, ***p < .001.

Thus, women's health volunteers can play a role in the diffusion of the importance of seeking antenatal care and health knowledge in rural areas. While not a substitute for health care professionals, they can be an effective complementary component of the health care team if integrated into the existing health system.

The presence of a skilled midwife had the most significant relationship with women receiving ANC (OR: 65.18). All villages in this study had a midwife, although village C1 had a midwife who had lived there for 15 years, while the other three villages (C2, E1, and E2) had relatively inexperienced midwives (≤3 years of experience). Our results indicate that >90% of mothers who had a skilled midwife opted for a skilled birth attendant being present at their last birth, and that 100% of these women received a tetanus immunization at least twice during their last pregnancy. These findings support the importance of skilled midwives especially in rural areas. Professional experience can promote better outcomes after ANC. Inexperienced midwives or poor-quality care can substantially affect the effectiveness of midwifery care (UNFPA, 2014), even if the midwife is readily available, accessible, and accepted by the local mothers. Rural Myanmar has a serious shortage of health care professionals (Kanchanachitra et al., 2011), which is a common challenge in developing countries. Having an adequate quantity and quality of midwives should be considered in tandem in other countries, especially in resource-limited settings.

Distance from the urban area was related to appropriate stool disposal, which indicates that proximity to an urban area may affect sanitation behaviors. Given that our study was conducted in only rural villages, it is possible that there are differences in sanitation behaviors between rural areas that are related to their proximity to urban areas.

We could not generate a regression equation for the incidences of pediatric fever, cough, or difficulty breathing and seeking related treatment. These events were relatively infrequent in both E–C pairs. As these issues may be related to the relatively small sample size, future studies should use larger samples to evaluate these factors.

In the logistic regression analyses, we omitted distance from the urban area for the analyses of knowledge of danger signs, contraception use, and ANC. We believe that this approach was valid, as these three outcomes are generally maternal and child health issues unlikely to be related to access to an urban area. In contrast, we included distance from the urban area for the analyses of acceptable first aid, appropriate stool disposal, and malaria prevention, as these issues may not be specifically related to maternal and child health.

There is controversy regarding whether single interventions or multifaceted interventions are best suited for community health workers (Haines et al., 2007) like the WVG. Our intervention through participatory approach led to multifaceted WVG roles, both preventive (e.g., educating mothers regarding antenatal care and malaria prevention) and curative (e.g., providing first aid for injuries), which was associated with the diffusion of the need to seek antenatal care and health knowledge in mothers with children under 5. Our findings reinforce the concept that multifaceted work by community health workers may be more effective than single-component interventions in low-resource settings. This finding may contribute to the promotion of public health, especially when public health nurses consider community-based interventions that involve community health workers in low-resource settings.

Midwifery and public health nursing are inseparable elements of community health, especially maternal-child health. In the case of Myanmar, midwives act as both midwives and public health nurses and play a central role in maternal-child health in communities. It is necessary to take steps to ensure that skilled midwives are available in all communities.

This study contained four important limitations. First, our findings may not be generalizable to all communities in rural Myanmar, as only two experimental villages were evaluated. There is a need to expand these interventions to other communities in different divisions and states in Myanmar. Second, the long-term effects of the WVGs have not been evaluated in Myanmar. Third, we did not limit the scope of the inclusion criteria to primiparous mothers, who are the most vulnerable to maternal mortality assuming they have no prior pregnancy experience and knowledge. Thus, the results may be potentially affected by the participants' knowledge and experiences. Fourth, we did not closely consider other multilevel factors including capacity for health care provision, social

networks, and community support in the four study villages. They may also have affected the results; further study is needed to confirm our findings while addressing these variables.

The aim of this study was to identify the relationship between community-based interventions that involved women's health volunteer groups in two Myanmar villages and the outcomes related to maternal and child health. Our findings indicate that the WVGs related to rural mothers' knowledge of danger signs during the perinatal period, modern contraceptive methods, first aid, and malaria prevention, as well as their receiving any ANC. However, the presence of a skilled midwife had the most significant relationship with the mothers receiving ANC. Therefore, women health volunteers can play a role in the diffusion of the importance of seeking antenatal care and health knowledge in rural Myanmar, and proper quantity and quality of midwives should be considered in tandem in other countries, especially in resource-limited settings.

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