

# Effect of a maternal and child health handbook on maternal knowledge and behaviour: a community-based controlled trial in rural Cambodia

Satoko Yanagisawa,<sup>1\*</sup> Ayako Soyano,<sup>2</sup> Hisato Igarashi,<sup>3</sup> Midori Ura<sup>4</sup> and Yasuhide Nakamura<sup>5</sup>

<sup>1</sup>School of Nursing and Health, Aichi Prefectural University, Togoku, Kamishidami, Moriyama-ku, Nagoya, Aichi, 463-8502, Japan, <sup>2</sup>School of Nursing, Saku University, 2384 Iwamura, Saku, Nagano, 385-0022, Japan, <sup>3</sup>School of Health Sciences, Shinshu University, 3-1-1 Asahi, Matsumoto, Nagano, Japan, <sup>4</sup>Department of Laboratory Medicine, Shinshu University Hospital, 3-1-1 Asahi, Matsumoto, Nagano, 390-8621, Japan, and <sup>5</sup>Graduate School of Human Sciences, Osaka University, 1-2 Yamadaoka, Suita, Osaka, 565-0871, Japan

\*Corresponding author: Aichi Prefectural University, Togoku, Kamishidami, Moriyama-ku, Nagoya, Aichi 463-8502, Japan.  
E-mail: [sayanagi@nrs.aichi-pu.ac.jp](mailto:sayanagi@nrs.aichi-pu.ac.jp)

---

**Accepted** 26 November 2014

Maternal and child health (MCH) handbooks are comprehensive home-based booklets designed to integrate MCH records. Although empirical evidence suggests the handbooks are more effective than current card-type records, this has not been scientifically demonstrated. The objectives of this study were to evaluate the impact of the MCH handbook on maternal knowledge and behaviour as measured by antenatal care (ANC) attendance, delivery with skilled birth attendants (SBAs) and delivery at a health facility. The Cambodian version of the MCH handbook was developed and introduced in two health centres, and two other health centres served as controls. Pre-intervention and post-intervention surveys were conducted with 320 women from the intervention areas and 320 women from the control areas who had given birth within 1 year before the survey. We evaluated the impact of the handbook by using difference-in-differences (DID) analysis and calculated adjusted odds ratios for pre–post changes in key indicators by using logistic regression. In addition, we interviewed multiparous women, health staff and health volunteers to assess the acceptance and cultural appropriateness of the handbook. Content analysis was performed with the English-translated transcriptions. The DID analyses revealed that all key indicators increased in the intervention group against counterfactual assumptions. The intervention also increased maternal knowledge of all topics addressed except for the risk of severe bleeding after delivery; this may be attributable to the influence of cultural belief. Logistic regression showed that the intervention increased ANC attendance, delivery with SBAs and delivery at a health facility, even after adjusting for maternal age, education and economic conditions. The qualitative data indicated that the handbook was well received and culturally appropriate. Thus, the MCH handbook is a reasonable and superior alternative to current card-type maternal records.

**Keywords** Antenatal care, difference-in-differences analysis, home-based record, maternal and child health (MCH) handbook, maternal outcome, skilled birth attendant

---

## KEY MESSAGES

- This study was the first to examine the effectiveness of a maternal and child health (MCH) handbook in Cambodia. The results indicated that the MCH handbook positively influenced the promotion of antenatal care attendance, delivery with skilled birth attendants and delivery at a health facility.
- The MCH handbook was associated with increased healthcare knowledge in mothers.
- The qualitative data indicated that the handbook was well received and culturally appropriate.
- The MCH handbook is a reasonable and superior alternative to current card-type maternal records.

## Introduction

Home-based health records are personal records of health data and information that are maintained by laypersons at home. Since the World Health Organization (WHO) first introduced a prototype of home-based maternal records (World Health Organization 1994), the effectiveness of such records has been evaluated and confirmed (Shah *et al.* 1993; Essen *et al.* 1994; Osterlund *et al.* 2005). Moreover, the WHO suggested that home-based maternal records would be an effective community-level tool for pregnancy and postpartum care (Gertler *et al.* 2011). The organization also recommended the distribution of birth and emergency cards for childbirth care, child health records and immunization cards for newborn care, and advocacy materials and counselling cards for infancy and childhood care (Gertler *et al.* 2011). Although each card and record has a specific and independent purpose, this system nevertheless results in multiple cards for each child, which can be confusing for mothers and health care providers. Although simple cards and thin books are easily produced, they are also easily misplaced.

Maternal and child health (MCH) handbooks are comprehensive home-based booklets intended to integrate all the previously described records into one book. MCH handbooks generally include records of antenatal care (ANC), labour and delivery, postpartum care, newborn and child care, immunizations and family planning. The handbooks also contain information for mothers on how to properly care for themselves and their children, including pictorial information for illiterate mothers. Thus, the handbooks contain MCH care records and information for the entire period between pregnancy and early childhood.

The effectiveness of MCH handbooks has been evaluated in developing countries in Asia (Isaranurag 2009; Gertler *et al.* 2011; Baequni and Nakamura 2012) and Africa (World Health Organization Regional Office for Africa 2012). Empirical results indicate that booklet-type records retain the advantages of card-type records, are welcomed by mothers and are feasible to implement, even in low-income countries. However, scientific evidence supporting the benefits of the handbooks is minimal. Using ecological data in Indonesia, Osaki *et al.* (2009) showed that the MCH handbook improved immunization coverage. Because the MCH handbook was provided as part of a provincial program in the intervention by Osaki *et al.*, all surveyed mothers should have received the handbook. Therefore, comparisons were made between mothers who retained the handbook and those who lost or failed to receive it due to program failure.

A recent study in the Palestinian Authority demonstrated that the MCH handbook improved maternal knowledge on exclusive breastfeeding and the risks associated with membrane rupture during pregnancy, especially among less-educated women (Hagiwara *et al.* 2013). However, because the handbook was rapidly accepted by many MCH centres, the size of the control groups was one-fourth that of the intervention groups, suggesting that those centres had some difficulties releasing the handbook. This study also lacked other comparable home record systems, consequently indicating the need for a study with a direct comparison between the handbook and other types of records.

Therefore, we conducted a quasi-experimental study of the effectiveness of the MCH handbook in Cambodia. There are several types of MCH-related home-based records in Cambodia, including the child growth card, the tetanus immunization card and the vitamin A intake record. The Mother Health Record is another record based on the WHO's prototype record (World Health Organization 1994) and serves as a substitute for hospital-based medical records for health professionals. Because this record contains only words and medical terms, many mothers (especially those with minimal education) do not understand what was recorded.

We developed a Cambodian version of the MCH handbook that comprised the records and information mentioned in the preceding text and introduced it in two health centre catchment areas. Two other health centres were assessed as controls. The objectives of this study were to evaluate the impact of the MCH handbook on maternal knowledge and behaviour and to investigate the acceptance and feasibility of the handbook.

## Methods

### Study area

This study was conducted in two districts in Kampong Cham Province, Cambodia: Ponhea-Krek-Dombae (PKD) and Memut. PKD has a population of 205 000, with 1 referral hospital and 16 health centres. Memut is situated east of PKD and has a population of 134 000; it has 1 referral hospital and 10 affiliated health centres. We purposely selected an intervention health centre and a control health centre in each district to ensure they were matched in terms of population, midwifery status (full-time vs part-time and secondary vs primary midwives), accessibility to main roads (especially during the rainy season) and performance of MCH activities (ANC, immunization and under-five clinic coverage).

### Development of the MCH handbook

The Cambodian version of the MCH handbook was based on the Indonesian and Japanese handbooks. The cultural appropriateness of the handbook was assessed through feedback from physicians and nurses working for a local nongovernmental organization, individual interviews and focus groups with mothers, nurses and midwives. We revised the original version of the MCH handbook in accordance with this feedback to produce a trial version.

Training sessions on handbook use were conducted in the intervention areas for medical personnel (physicians, nurses and midwives), village health volunteers (VHVs) and traditional birth attendants (TBAs). The trial version of the MCH handbook was then introduced to the participating centres in January 2008. Mothers who received ANC at the intervention health centres and outreach programs in affiliated villages received the handbook and health education using the handbook. A researcher visited the health centres every month and monitored handbook use.

In the control areas, the standard Cambodian Child Health Card (child growth card) and Mother Health Record were used. As part of typical MCH services in Cambodia, all mothers in the control areas received these records as well as the tetanus immunization card and the vitamin A-intake record.

### Study population

To evaluate the impact of the MCH handbook on maternal knowledge and behaviour, we conducted prospective pre-intervention and post-intervention surveys and compared the results between the intervention and control areas. Because the frequency of ANC visits among mothers in the studied areas was low (in our pre-intervention survey, 48.1% obtained ANC  $\leq 2$  times during pregnancy), we foresaw difficulties in conducting follow-up to evaluate the knowledge and behaviours of individual pregnant women. Therefore, we decided to evaluate the impact of the handbook on the community as a whole.

The subjects were women who had given birth 1 year before the survey. The number of women of reproductive age (15–49 years) living in the intervention and control areas was estimated based on the Cambodia Demographic and Health Survey (CDHS) (National Institute of Public Health *et al.* 2006) and the 2008 General Population Census (National Institute of Statistics 2009). Women of reproductive age comprised approximately one-fourth of the rural population (24.8% in the CDHS and 26.5% in the General Population Census), corresponding to 7,670 and 7,060 women in the intervention areas and control areas, respectively. The CDHS estimated the crude birth rate in the rural areas to be 2.6% of the population. However, this was found to be an underestimation when compared with the actual number of deliveries reported by monthly statistics at the health centres; thus, we estimated the crude birth rate to be 3.0%. As a result, there were 920 deliveries in the intervention areas and 847 deliveries in the control areas.

### Sampling design

The sample was designed to provide representative estimates of health indicators in the intervention and control areas.

We conducted two-stage cluster sampling: the first stage consisted of probability-proportionate-to-size sampling, and the second stage consisted of simple random sampling. Within each area (two areas for intervention and two areas for control), 16 clusters of households were selected with probability proportionate to size. Within each cluster, a systematic random sample of 10 households was drawn. A total of 160 women were selected from each area, resulting in 320 women from the intervention areas and 320 from the control areas. In case the survey team could not meet the designated woman, we paid another visit to the woman. If the woman was not available the second time, she was replaced by the nearest woman who met the criteria.

The sample size was calculated by using the following formula to estimate the prevalence of key indicators [i.e. ANC attendance and delivery with skilled birth attendants (SBAs) as 50%]:

$$n = \frac{Z_a^2 Xp(1-p)}{d^2},$$

$n$ =required minimum sample size for simple/systematic random sampling.

$Z_a$ =confidence level at 95% (1.96).

$p$ =estimated prevalence of an indicator in the research area.

$d$ =desired accuracy.

Both quantitative and qualitative data were collected to evaluate the intervention. The quantitative data were collected by using pre-intervention and post-intervention surveys. The key indicators for evaluation were maternal behaviours (i.e. ANC attendance, deliveries attended by SBAs and deliveries at health facilities). Additional indicators included maternal knowledge of danger signs during pregnancy and delivery, prevention of anaemia, prevention of intestinal parasites, mother-to-child human immunodeficiency virus (HIV) transmission, early breastfeeding practice and child immunization.

Interviewers were recruited from health professionals in Cambodia and trained by an author together with a Cambodian counterpart who had both a medical and an epidemiological background. The pre-intervention survey was conducted from June 2007 to July 2007, and the post-intervention survey was conducted from May 2009 to June 2009.

The qualitative aspect of the study assessed the cultural appropriateness of the MCH handbook and explored the potential obstacles and effects associated with its implementation. The subjects included multiparous women, midwives, nurses, VHVs and TBAs in the intervention areas. The inclusion criteria for subjects were as follows: (1) multiparous women who had used both the current records and the MCH handbook; (2) midwives and nurses in the intervention areas who had experience using both the current records and the MCH handbook and (3) VHVs and TBAs in the intervention areas who were trained to provide health education to mothers using the MCH handbook.

Twelve months after the MCH handbook was introduced, guided individual interviews were conducted with 20 multiparous women who had used both the standard Child Health Card/Mother Health Record and the MCH handbook,

8 midwives and nurses who worked at health centres and 10 VHVs and TBAs in the intervention areas. The interviews were recorded after obtaining oral consent from the participants. Women were selected from those living in villages near the health centres due to travel difficulties. For nurses and midwives, all of those who were working in the intervention areas were included. In the intervention areas, each village had appointed VHVs and TBAs who were assigned to collect information on deaths and births. They met regularly at health centres; therefore, participants were recruited at this regular meeting.

### Data analysis

The survey data from the intervention and control areas were compared between pre-intervention and post-intervention using difference-in-differences (DID) analysis. DID analysis is commonly used to compare outcome changes over time between a treated population and a control population, which consequently assesses the impact of a given variable. This approach combines two comparisons, pre-and-post comparisons and comparisons between the intervention and control groups, to estimate the effect of interventions against counterfactual assumptions (Gertler *et al.* 2011).

We also calculated adjusted odds ratios (ORs) for pre–post changes in the four key indicators (ANC attendance at least once, ANC attendance four times or more, delivery with SBA and delivery at health facilities) in the intervention and control groups by using logistic regression. We examined the association between the key indicators and background variables. Those variables that showed a constant significant association in all groups with the four indicators were considered to be confounding factors and adjusted in the regression analysis; they were age, literacy and availability of electricity. IBM SPSS version 21 was used for statistical analysis.

The qualitative data were transcribed in Khmer and then translated into English. Content analysis was performed by using the English-translated data. The data were coded and classified into categories by comparing the differences and similarities between the codes.

Ethical approval was obtained from the author's institute and the Ministry of Health Cambodia.

## Results

### Sociodemographic characteristics

The sociodemographic characteristics of the respondents are summarized in Table 1. The intervention and control groups were similar in age distribution and marital status. Farming was the most common occupation among respondents and their husbands in both the intervention and control groups. A greater percentage of respondents and their husbands in the intervention groups worked part-time, relative to the control groups. In addition, many husbands of women in the control groups were merchants and office or factory workers.

The average number of years of schooling was significantly lower in the intervention groups than the control groups (one-way analysis of variance and Bonferroni test,  $P < 0.05$ ). Literacy was also significantly lower among the pre-intervention groups

than among the comparison groups. The change in literacy between the pre-intervention and post-intervention groups was greater for the intervention groups than for the control groups. Finally, asset ownership was significantly lower in the intervention groups than in the control groups.

### Effect of the intervention

The DID analyses for key indicators are presented in Table 2. When the changes in the control groups were set as counterfactual assumptions, the results showed that all key indicators improved in the intervention groups. Moreover, the effect of the intervention on deliveries attended by SBAs was especially high.

The effect of the intervention on maternal knowledge of danger signs during pregnancy and delivery is indicated in Table 3. This information was presented in the MCH handbook with words or words and pictures. The intervention increased respondent knowledge of all subjects except for severe bleeding after birth. The effect of the intervention on knowledge of symptoms of placenta accreta was, although positive, less than one point.

Table 4 lists the effect of the intervention on knowledge and behaviour relating to anaemia, parasites, HIV infection, and early breastfeeding. In all four items, the intervention effect was positive and ranged from 6.2 to 9.9 points.

### Logistic regression analysis

Because there were differences in literacy and economic conditions between the pre-intervention and post-intervention groups as well as the intervention and control groups, we performed logistic regression to calculate adjusted ORs by controlling for these confounders (Table 5). In intervention areas, the intervention significantly increased ANC attendance by four visits or more, delivery with SBAs and delivery at a health facility. In control areas, the only significant pre–post change was delivery at a health facility. Compared with the intervention areas (OR: 2.499, confidence interval: 1.746–3.578), the OR for delivery at a health facility was smaller in the control areas (OR: 1.866, confidence interval: 1.343–2.593).

### Qualitative analysis

Qualitative data were collected from multiparous women, health centre nurses and midwives, VHVs and TBAs in the intervention areas. The sociodemographic characteristics of the participants are summarized in Table 6. The mean age of mothers in the intervention areas was 26.8 years (range: 21–33 years). All the participants were married. Sixteen were farmers, and the others were merchants, day workers and homemakers. Eight participants had no formal education, seven participants had received primary education and five participants had received secondary and higher education.

The mean age of health centre staff was 37.5 years (range: 25–53 years). Four were male, and four were female. Four were secondary nurses, three were primary midwives and one was a primary nurse. Three had >5 years of experience working at a health centre and five had >10 years of experience.

The mean age of VHVs and TBAs was 50.8 years (range: 29–56 years). Four were male, and six were female; all of them were farmers. Two had no formal education, two had received primary education, two had received secondary

**Table 1** Sociodemographic characteristics of women in intervention and control areas

Sociodemographic Characteristics	Intervention				Control			
	Pre (N = 320)		Post (N = 320)		Pre (N = 320)		Post (N = 320)	
	n	(%)	n	(%)	n	(%)	n	(%)
Age (mean [SD]) <sup>a</sup>	26.7	[6.25]	27.3	[6.47]	26.4	[5.93]	27.0	[6.07]
Marital status <sup>b</sup>								
Married	307	(95.9)	290	(90.6)	307	(95.9)	304	(95.0)
Other	13	(4.1)	30	(9.4)	13	(4.1)	16	(5.0)
Occupation of husband <sup>c</sup>								
Farmer	226	(70.6)	201	(62.8)	189	(59.1)	180	(56.3)
Occasional worker	36	(11.3)	71	(22.2)	28	(8.8)	49	(15.3)
Merchant	11	(3.4)	16	(5.0)	30	(9.4)	25	(7.8)
Office/factory worker	11	(3.4)	1	(0.3)	35	(10.9)	26	(8.1)
Other	36	(11.3)	31	(9.7)	38	(11.9)	40	(12.5)
Occupation of respondent <sup>d</sup>								
Farmer	207	(64.7)	143	(44.7)	181	(56.6)	130	(40.6)
Homemaker	40	(12.5)	104	(32.5)	75	(23.4)	131	(40.9)
Merchant	35	(10.9)	27	(8.4)	29	(9.1)	25	(7.8)
Occasional worker	31	(9.7)	38	(11.9)	12	(3.8)	11	(3.4)
Other	7	(2.2)	8	(2.5)	23	(7.2)	23	(7.2)
Years of school attendance <sup>2b</sup> (mean [SD]) <sup>a</sup>	4.7	[2.63]	5.2	[2.44]	5.3	[2.57]	5.6	[2.47]
Literacy <sup>b</sup>								
Cannot read at all	180	(56.3)	100	(31.3)	139	(43.4)	144	(45.0)
Can read parts of/entire sentences	140	(43.8)	220	(68.7)	181	(56.6)	176	(55.0)
Household assets <sup>b</sup>								
Telephone	53	(16.6)	97	(30.3)	98	(30.6)	134	(41.9)
Motorbike	149	(46.6)	237	(74.1)	190	(59.4)	246	(76.9)
Television	124	(38.8)	131	(40.9)	151	(47.2)	167	(52.2)
Electricity	85	(26.6)	114	(35.6)	84	(26.3)	158	(49.4)

Note: SD, standard deviation.

<sup>a</sup>Analysis of variance.

<sup>b</sup>Chi-square test.

<sup>c</sup>Chi-square test between farmer and others.

<sup>d</sup>Chi-square test between farmer, homemaker and others.

**Table 2** Effect of intervention on key indicators (DID)

Key indicators	Intervention (%)		Control (%)		Difference	Assumption <sup>a</sup>	Effect
	Pre (N = 320) a	Post (N = 320) b	Pre (N = 320) c	Post (N = 320) d			
Frequency of ANC					b - a	d - c	(b - a) - (d - c)
At least once	83.8	90.6	81.3	81.3	6.8	0.0	6.8
Four times or more	33.1	45.3	29.4	39.7	12.2	10.3	1.9
Delivery with SBA	53.8	77.2	56.6	67.8	23.4	11.2	12.2
Delivery at health facilities	51.3	74.1	34.1	52.5	22.8	18.4	4.4

<sup>a</sup>Counterfactual assumption.

\* $P < 0.05$ .

\*\* $P < 0.01$ .

education and four had completed high school. Two had <5 years of experience, four had between 5 and 9 years of experience and four had >10 years of experience as health volunteers.

All the mothers reported that they preferred the MCH handbook to the current record system. This opinion was shared by all of the health centre staff, VHVs and TBAs. The reasons why respondents preferred the MCH handbook were

**Table 3** Effect of intervention on maternal knowledge of danger signs during pregnancy and delivery (DID)

Knowledge items	Intervention (%)		Control (%)		Difference	Assumption <sup>a</sup>	Effect
	Pre (N = 320) a	Post (N = 320) b	Pre (N = 320) c	Post (N = 320) d			
Danger signs during pregnancy							
Swelling	16.6	48.1	24.7	43.8	31.5	19.1	12.4
Persistent vomiting	1.9	22.5	2.5	5.0	20.6	2.5	18.1
Severe headache or blurred vision	0.9	17.8	1.3	12.2	16.9	10.9	6.0
Convulsion	0.3	4.4	2.5	3.8	4.1	1.3	2.8
Bleeding from vagina	18.1	58.4	26.9	47.5	40.3	20.6	19.7
PROM	0.0	16.6	0.3	5.6	16.6	5.3	11.3
Danger signs during delivery							
Prolonged labour	9.4	30.3	16.9	31.9	20.9	15.0	5.9
Severe bleeding after birth	6.6	10.0	10.6	19.1	3.4	8.5	-5.1
Malpresentation	5.9	13.1	10.6	11.3	7.2	0.7	6.5
Placenta accreta	0.6	4.4	0.6	3.8	3.8	3.2	0.6
Convulsions	0.9	4.4	3.4	3.1	3.5	-0.3	3.8

Note: PROM, premature rupture of membrane.

<sup>a</sup>Counterfactual assumption.

**Table 4** Effect of intervention on maternal knowledge and behaviour on anaemia, parasites, MTCT of HIV and early breastfeeding (DID)

Knowledge items	Intervention (%)		Control (%)		Difference	Assumption <sup>a</sup>	Effect
	Pre (N = 320) a	Post (N = 320) b	Pre (N = 320) c	Post (N = 320) d			
Know at least one method to prevent anaemia	61.6	85.3	70.9	88.4	23.7	17.5	6.2
Know at least one mode of transmission of intestinal parasites	32.8	60.6	50.9	68.8	27.8	17.9	9.9
Know that HIV can be transmitted from mother to child	69.1	87.5	81.9	92.8	18.4	10.9	7.5
Early breastfeeding	23.8	40.0	30.0	40.0	16.2	10.0	6.2

<sup>a</sup>Counterfactual assumption.

**Table 5** Adjusted effect of the intervention on key indicators

Key indicators	Intervention		P	Control		P
	Adjusted OR <sup>a</sup>	95% CI		Adjusted OR <sup>a</sup>	95% CI	
Frequency of ANC						
At least once	1.476	0.876–2.486		0.813	0.537–1.232	
Four times or more	1.546	1.086–2.200	*	1.277	0.902–1.808	
Delivery with SBA	2.613	1.805–3.782	**	1.092	0.763–1.562	
Delivery at health facilities	2.499	1.746–3.578	**	1.866	1.343–2.593	**

Note: CI, confidence interval.

<sup>a</sup>Adjusted with age, literacy and economic status (electricity).

\*P < 0.05.

\*\*P < 0.01.

organized into four categories: appearance (attractive and durable), practical information (useful health information, more illustrations, usable for health education), convenience (easy to read/keep/carry, combined maternal and child records) and long-term value (can be used for future children).

All of the mothers mentioned that the size of the book and its illustrations were appropriate. When we showed the mothers the handbook's illustrations, all were able to correctly identify the meanings of the illustrations. Some of the educated mothers reported difficulty with certain terms, such as 'white

**Table 6** Sociodemographic characteristics of interview participants

Sociodemographic characteristics	Mothers	Health centre staff	VHVs and TBAs
Number	20	8	10
Mean age (range)	26.8 (21–33)	37.5 (25–53)	50.8 (29–56)
Sex			
Male	0	4	4
Female	20	4	6
Education			
None	8	0	2
Primary school	7	0	2
Secondary school	4	4	2
High school	1	3	4

discharge'. Some respondents stated that, while understandable, some words required additional information to explain the underlying reason for the depicted event. Illiterate mothers reported that some content was difficult to understand; however, after additional explanations from nurses and midwives, they were able to understand the material and recall what was taught by looking at the illustrations.

We asked the mothers if they had shown the handbook to their husbands. Of the 20 mothers who responded to this question, 17 had shown it to their husbands. Some husbands showed interest and commented that the book was useful and contained meaningful illustrations. Some husbands explained the contents of the handbook to their wives and advised them to obtain ANC, avoid salty food, or refrain from working too hard.

We asked the health centre staff, VHVs and TBAs whether they used the handbook for health education; all of them answered in the affirmative. Some VHVs mentioned that it was initially difficult to use the handbook for health education; they were nonetheless able to provide health education using the handbook, however, and no longer found it difficult at the time of the interviews. Others mentioned that while the handbook was useful, health education was difficult because some mothers were reluctant to listen to the advice of the VHVs because it was inconsistent with their cultural beliefs.

## Discussion

This study was the first to examine the effectiveness of the MCH handbook in Cambodia. Both the quantitative and qualitative results indicated that the MCH handbook positively influenced the promotion of ANC attendance, delivery with SBAs and delivery at a health facility. Further, the MCH handbook was associated with increased healthcare knowledge in mothers.

The DID analyses revealed that the MCH handbook effectively promotes the key indicators examined in our study (i.e. ANC attendance, delivery with SBAs and delivery at health facilities). The effect of the handbook on these variables was robust, even after controlling for sociodemographic indicators, except for ANC attendance at least once.

In Thailand (Aihara *et al.* 2006) and Bangladesh (Bhuiyan *et al.* 2006; Kusumayati and Nakamura 2007), use of an MCH

handbook was associated with ANC acquisition. Our results were consistent with these findings, because use of the handbook was associated with an increase in ANC by more than four visits. However, the number of first-time ANC visits was not significantly greater after controlling for confounding factors. This may have been due to an already high level of coverage before the intervention. Although DID analysis indicated a positive impact of the intervention on this variable, the high existing level of coverage may have resulted in an increase that was too small to reach statistical significance.

The effect of the MCH handbook on delivery with SBAs and at health facilities has not been well explored. Baequni and Nakamura (2012) conducted a meta-analysis of five studies and found that the MCH handbook positively increased the likelihood of delivery at a health facility but did not increase SBA attendance. Osaki *et al.* (2013) found that ownership of an MCH handbook was associated with SBA-assisted delivery; however, the study compared women who owned the MCH handbook with those who received but misplaced it, indicating a possible selection bias whereby those who retained the handbook might have initially been more concerned with their childbirth. A recent study of MCH handbook effectiveness in Palestine (Hagiwara *et al.* 2013) using DID analysis showed that use of the handbook improves maternal health-seeking behaviour. However, in Palestine, the MCH handbook represented the first standardized home-based maternal and child record for the country; thus, a comparison could not be made between card-type home-based records and the MCH handbook.

Our study revealed that the MCH handbook significantly increases the likelihood of delivery with SBAs and at health facilities, even after adjusting for maternal age, education level and economic status. This improvement may have resulted from handbook distribution and enhanced communication between respondents and health professionals (Hagiwara *et al.* 2013).

Previous studies showed that the MCH handbook increases the likelihood of exclusive breastfeeding (Pandara 2006) and child immunization (Osaki *et al.* 2009, 2013). Handbook use is also associated with greater knowledge of the risks of membrane rupture (Hagiwara *et al.* 2013), ANC information, proper nutrition during pregnancy and child health care (Baequni and Nakamura 2012). Our study corroborates these results, indicating the advantage of the MCH handbook over current card-type or prototype maternal and child records.

The effect of the intervention on knowledge items ranged from  $-5.1$  to  $19.7$ . This may have been because some information was conveyed only in words, whereas other information contained illustrations. The quality of the illustrations may have also influenced respondent attention to certain items. In particular, respondents who received the handbook were not significantly more cognizant of the risk of severe bleeding after birth. The local belief system might have influenced this result. In rural Cambodia, people traditionally believe that maternal bleeding is necessary after delivery. It is thought that if a woman does not sufficiently bleed, the stagnant blood in her uterus will cause illness. Even though severe bleeding is presented pictorially in the handbook as a risk during pregnancy and the postpartum period, the message might not be strong enough to alter public opinion.

The qualitative analysis demonstrated that the attractive appearance of the handbook appealed to mothers who otherwise would not have obtained ANC. Moreover, as respondents became familiar with the midwives during the ANC appointments, they were more likely to have an SBA-assisted delivery. Increased ANC attendance also provided more opportunities for health professionals to provide mothers with health education regarding the importance of delivery with SBAs.

These findings may have resulted from the dual effects of the handbook: the health education provided by health professionals using the handbook and the illustrations that enable the effective conveyance of information to all mothers, irrespective of literacy level. Written material that contains similar health-related information to that relayed in health facilities may facilitate the recollection and comprehension of such information in mothers (Murira *et al.* 1996). Corroboratively, previous studies showed that educational materials, such as booklets and pamphlets, considerably improved maternal knowledge and beliefs (McMaster *et al.* 1996; Brown and Smith 2004; Thompson and Harutyunyan 2009).

The qualitative results of the effectiveness of the MCH handbook were remarkably positive. Almost all of the mothers and health workers preferred the handbook to the current record, thereby indicating adequate acceptance (similar to other home-based or consumer-held health records) (Mahomed *et al.* 2000; De Clercq *et al.* 2003). Respondents reported that they preferred the handbook because of the attractive appearance, practical health content, convenience of combined records and long-lasting value as a source of health information.

In Cambodia, different organizations have developed a variety of health cards and records for MCH programs, aiming for a specific health intervention at a time. They included the Child Health Card (growth monitoring and immunization record), Mother Health Record (ANC and delivery record), tetanus toxoid immunization card, birth control pill booklet and others. Some are focused on maternity and others on children. Some were developed as a medical record for professional use, whereas others were for laypeople. Although simple cards seem to be inexpensive and easy to produce, this can cause an overlap of programs, and the aggregation of various card productions may result in high cost. They also create confusion and inconvenience to mothers. Because maternal records and child records are kept separately, there is a lack of continuum of care from perinatal to infant care.

The MCH handbook combines information about both mothers and children. It records information about pregnancy, delivery and the postpartum period for mothers. It also records growth monitoring, immunization and childhood illnesses until a child reaches the age of 5 years. Thus, it acts as a bridging tool between mothers and children as well as prenatal to postnatal care.

Qualitative study results showed that women noticed the value of the handbook and wanted to keep it longer as a reference for child rearing and their own health. Some mothers showed it to their husband or daughters to read the educational section. It is not only for mothers and children but also for their family. Therefore, mothers would like to have the handbook durable and covered.

This study revealed that the MCH handbook is potentially more effective than a prototypical home-based maternal record

in terms of health education material. The handbook is acceptable and feasible to implement and worth providing in developing countries.

There were several limitations to this study. First, reassessments could not be conducted on all mothers because of the low initial frequency of repeated ANC visits. Therefore, we evaluated the community rather than individual subjects. This led to a cross-sectional study and made it difficult to conclude the effect of the intervention at an individual level. However, as mentioned in the preceding text, the study revealed the effectiveness of the MCH handbook at a population level. When the proportion of mothers who attended ANC four times or more increased, individual-level evaluations with paired samples would be performed. In addition, the intervention was conducted 1½ years before the evaluation. This may not have been a sufficient period for the intervention to have a significant impact on the community as a whole. Finally, for the qualitative study, the answers of the participants might be biased in favour of the handbook because they had been informed of the usefulness of the handbook. However, the fact that some mothers living outside the intervention areas visited the intervention health centres and asked for the handbook showed the popularity of the handbook. At the request of both health professionals and mothers, we decided to introduce the handbook to the control areas after the study was completed.

Despite these limitations, efforts were made to maintain the quality of the quasi-experimental design throughout the intervention period. The results of both the quantitative and qualitative studies indicate that the MCH handbook may confer greater benefits than traditional home-based records.

## Conclusions

We developed a Cambodian version of the MCH handbook and compared its effect with that of a prototypical home-based maternal record. Approximately 20 years have passed since the first home-based maternal record was introduced, so policy makers should consider more effective alternatives, such as the MCH handbook. Consistent and widespread dissemination of the MCH handbook may markedly improve maternal knowledge and behaviour and consequently promote safe delivery and child health in Cambodia.

## Acknowledgements

The authors express special thanks to Mr Hang Vuthy, an Operations Manager at Save the Children Cambodia. He was the chief researcher in Cambodia and was devoted throughout this MCH handbook project. Without him, the handbook would not have been realized. While he would have been named as a primary researcher on this article, he passed away before this manuscript was written, to our great sorrow. They also gratefully acknowledge Save the Children Cambodia, who assisted us at every stage of the project. They acknowledge Dr Oum Sophal, the former rector of University of Health Sciences, who gave us useful advices and facilitated all process of the research.

## Funding

This work was supported by Grants-in-Aid for Scientific Research from the Ministry of Education, Culture, Sports, Science and Technology in Japan (grant number: C 18390599).

*Conflict of interest statement:* None declared.

## Ethical approval

Ethical approval was obtained from the ethics committee of Shinshu University in Japan and the Ministry of Health in Cambodia.

## References

- Aihara Y, Isaranurug S, Nanthamongkolchai S, Voramongkol N. 2006. Effect of the maternal and child health handbook on maternal and child health promoting belief and action: Thailand case. *Journal of International Health* **21**: 123–7.
- Baequni , Nakamura Y. 2012. Is maternal and child health handbook effective?: meta-analysis of the effects of MCH handbook. *Journal of International Health* **27**: 121–7.
- Bhuiyan SU, Nakamura Y, Qureshi NA. 2006. Study on the development and assessment of maternal and child health (MCH) handbook in Bangladesh. *Journal of Public Health and Development* **4**: 45–60.
- Brown HC, Smith HJ. 2004. Giving women their own case notes to carry during pregnancy. *The Cochrane Database of Systematic Reviews*. CD002856.
- De Clercq PA, Hasman A, Wolffenbuttel BH. 2003. A consumer health record for supporting the patient-centered management of chronic diseases. *Medical Informatics and the Internet in Medicine* **28**: 117–27.
- Essen B, Laurell L, Pena R, Ostergren PO, Liljestrand J. 1994. Antenatal cards—what should they contain? *Journal of Tropical Pediatrics* **40**: 130–2.
- Gertler PJ, Martinez S, Premand P, Rawlings LB, Vermeersch CMJ. 2011. *Impact Evaluation in Practice*. Washington, DC: The World Bank.
- Hagiwara A, Ueyama M, Ramlawi A, Sawada Y. 2013. Is the maternal and child health (MCH) handbook effective in improving health-related behavior? Evidence from Palestine. *Journal of Public Health Policy* **34**: 31–45.
- Isaranurug S. 2009. Maternal and child health handbook in Thailand. *Journal of International Health* **24**: 61–6.
- Kusumayati A, Nakamura Y. 2007. Increased utilization of maternal health services by mothers using the maternal and child health handbook in Indonesia. *Journal of International Health* **22**: 143–51.
- Mahomed K, Mason E, Warndorf T. 2000. Home-based mother's record: operational feasibility, understanding and usage in a rural community in Zimbabwe. *Tropical Doctor* **30**: 155–9.
- McMaster P, McMaster HJ, Southall DP. 1996. Personal child health record and advice booklet programme in Tuzla, Bosnia Herzegovina. *Journal of the Royal Society of Medicine* **89**: 202–4.
- Murira N, Munjanja SP, Zhanda I, Lindmark G, Nystrom L. 1996. Health education for pregnancy care in Harare. A survey in seven primary health care clinics. *The Central African Journal of Medicine* **42**: 297–301.
- National Institute of Public Health, National Institute of Statistics (CAMBODIA), ORC Macro. 2006. *Cambodia Demographic and Health Survey. 2005*. Phnom Penh: National Institute of Public Health, National Institute of Statistics, ORC Macro.
- National Institute of Statistics. 2009. *General Population Census of Cambodia 2008: National Report of Final Census Results*. Phnom Penh: National Institute of Statistics, Ministry of Planning, Cambodia.
- Osaki K, Hattori T, Kosen S. 2013. The role of home-based records in the establishment of a continuum of care for mothers, newborns, and children in Indonesia. *Global Health Action* **6**: 1–12.
- Osaki K, Hattori T, Kosen S, Singgih B. 2009. Investment in home-based maternal, newborn and child health records improves immunization coverage in Indonesia. *Transactions of the Royal Society of Tropical Medicine and Hygiene* **103**: 846–8.
- Osterlund CS, Dosa NP, Arnott Smith C. 2005. Mother knows best: medical record management for patients with spina bifida during the transition from pediatric to adult care. *AMIA Annual Symposium Proceedings* 580–4.
- Pandara VE. 2006. *Utilization of MCH Handbook and Exclusive Breastfeeding among Mothers of Children 6 to 12 Months Old in Manado, Indonesia*. Bangkok: Master of Primary Health Care Management. Mahidol University.
- Shah PM, Selwyn BJ, Shah K, Kumar V. 1993. Evaluation of the home-based maternal record: a WHO collaborative study. *Bulletin of the World Health Organization* **71**: 535–48.
- Thompson ME, Harutyunyan TL. 2009. Impact of a community-based integrated management of childhood illnesses (IMCI) programme in Gegharkunik, Armenia. *Health Policy and Planning* **24**: 101–7.
- World Health Organization. 1994. Home-based maternal records: guidelines for development, adaptation and evaluation. Geneva: WHO.
- World Health Organization Regional Office for Africa. 2012. *Kenya Hosts 8th International Conference on MCH Handbook*. <http://www.afro.who.int/fr/kenya/press-materials/item/5082-kenya-hosts-8th-international-conference-on-mch-handbook.html>, accessed 12 April 2014.