

Maternal and Child Health Handbook use for maternal and child care: a cluster randomized controlled study in rural Java, Indonesia

Keiko Osaki^{1,2}, Tomoko Hattori², Akemi Toda², Erna Mulati³, Lukas Hermawan⁴, Kirana Pritasari⁵, Saptawati Bardosono⁶, Soewarta Kosen⁷

¹Japan International Cooperation Agency, Tokyo, Japan

²Japan International Cooperation Agency, Jakarta, Indonesia

³Directorate of Medical Device and Household Product Inspection, Ministry of Health, Jakarta, Indonesia

⁴Directorate of Family Health, Ministry of Health, Jakarta, Indonesia

⁵Agency for Development and Empowerment of Human Resources for Health, Ministry of Health, Jakarta, Indonesia

⁶Faculty of Medicine, University of Indonesia, Jakarta, Indonesia

⁷Indonesia Agency for Health Research and Development, Ministry of Health, Jakarta, Indonesia

Address correspondence to Keiko Osaki, E-mail: Osaki.Keiko@jica.go.jp

ABSTRACT

Background Effectiveness of the Maternal and Child Health Handbook (MCHHB), a home-based booklet for pregnancy, delivery and postnatal/child health, was evaluated on care acquisition and home care in rural Java, a low service-coverage area.

Methods We conducted a health centre-based randomized trial, with a 2-year follow-up. Intervention included (i) MCHHB provision at antenatal care visits; (ii) records and guides by health personnel on and with the MCHHB; and (iii) sensitization of care by volunteers using the MCHHB.

Results The follow-up rate was 70.2% (183, intervention area; 271, control area). Respondents in the intervention area received consecutive MCH services including two doses of tetanus toxoid injections and antenatal care four times or more during pregnancy, professional assistance during child delivery and vitamin A supplements administration to their children, after adjustment for confounding variables and cluster effects (OR = 2.03, 95% CI: 1.19–3.47). In the intervention area, home care (continued breastfeeding; introducing complementary feeding; proper feeding order; varied foods feeding; self-feeding training; and care for cough), perceived support by husbands, and lower underweight rates and stunting rates among children were observed.

Conclusion MCHHB use promoted continuous care acquisition and care at home from pregnancy to early child-rearing stages in rural Java.

Keywords children, health promotion, health services

Background

While increased service coverage in maternal, newborn and child health (MNCH) care has been reported, gaps remain in Indonesia, especially when providing a care continuum.^{1,2} To ensure MNCH service provision, the Indonesian Ministry of Health, with the Japan International Cooperation Agency (JICA), designed the Maternal and Child Health Handbook (MCHHB) as an integrated home-based booklet for essential MNCH care, following its validation in various settings.^{3,4} The MCHHB will presumably facilitate care across the lifecycle.⁵ Pregnant women receive the MCHHB at their first antenatal care (ANC) visit, use it for home reference, and share

Keiko Osaki, Senior Advisor on Health, Human Development Department

Tomoko Hattori, Ex-expert, JICA-MOH project for Project for Ensuring MCH services with the MCH Handbook Phase 2

Akemi Toda, Ex-expert, JICA-MOH project for Project for Ensuring MCH services with the MCH Handbook Phase 2

Erna Mulati, Head, Sub-directorate of Inspection on Manufacture and Distributor Facilities, Directorate of Medical Device and Household Product Inspection

Lukas Hermawan, Head, Sub-directorate of Maternal and Neonatal Health, Directorate of Family Health

Kirana Pritasari, Secretary, Agency for Development and Empowerment of Human Resources for Health

Saptawati Bardosono, Lecturer, Department of Nutrition, Faculty of Medicine

Soewarta Kosen, Board member, Scientific Research Commission, Indonesia Agency for Health Research and Development

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information with families during pregnancy and child rearing. For healthcare personnel, the handbook is a critical health record, documenting and monitoring the services provided, a point-of-care information resource enhancing clinical decision-making ability, and helping clients understand takeaway messages.⁶ This study examined the effect of MCHHB use in rural Java, where service coverage was comparatively low.

Methods

Study design and study area

The randomization unit was health centres (HCs). Pregnant women in 2007 were contacted again in 2009. Garut district (located ~75 km southeast of Bandung) has two hospitals and 62 HCs serving 2.3 million people in 3 066.88 km² divided into 424 villages.⁷ The district constitutes geographically access-challenging areas (i.e. mountains) and low socio-economic communities. Professional childbirth care (i.e. community/HC midwives, physicians) was not prevalent in the district, compared to the province (52.4%, 71.4%).⁸ A national household survey's data indicated disparities between rural and urban areas (59.1%, 78.0%), although provincial coverage was similar to the national average (69.4%, 69.1%).⁹ A national initiative to allocate appropriate midwifery care to smaller communities led to more midwives being assigned to the district.¹⁰ The number of pregnancies covered by one midwife at public services decreased both in the intervention and control areas from 2007 (121 and 120 persons, respectively) to 2009 (78 and 70 persons, respectively). Before this study, the MCHHB was insufficiently used in the district because its health office had procured only 10 000 handbooks for the 48 590 expected pregnancies in 2006 with no systematic orientation for health personnel and volunteers.¹¹

Sample

Based on the preliminary administrative data (61.5%),¹² $N = 467$ would have 90% power to detect a 10% increase in professional delivery care at a two-sided significance level of 5%.¹³ Multi-stage cluster sampling was used.^{14, 15} To reduce variation in cluster size and influence of parallel interventions, 13 of 32 HCs with 500–1 500 annual pregnancies, not enrolled in similar interventions, were chosen by lottery (Fig. 1). From systematically selected two villages based on the number of pregnancy in 2005, pregnant women were visited so that 50 pregnant women per HC responded, resulting in $N = 647$. Five HCs with 250 respondents and eight HCs with 397 respondents were assigned to the intervention and control conditions, respectively. Poverty and education levels did not differ significantly between respondents from different areas

in initial sample. The follow-up rate was 70.2% (193 subjects were excluded from the follow-up due to moving or non-response). The analysis included 183 intervention, and 271 control participants. Because respondents from poor households comprised a smaller proportion of excluded participants (26.0%) than the analysed data (38.0%), the wealthier population was possibly underrepresented in the analysis.

Intervention

The intervention was designed to extend the following opportunities to women in the intervention area: (i) reception of the MCHHB; and based on the MCHHB contents, (ii) reception of services, guides, and records by health personnel; and (iii) sensitization by volunteers in service acquisition and home care. The intervention profiles included the following: (i) procurement of 12 228 MCHHBs to facilities (HCs and maternity huts) and distribution to all eligible pregnant women in the area; (ii) competency-based orientation and job-aids for HC staff, to facilitate client care with the MCHHB; (iii) competency-based orientation for health volunteers, to sensitize their roles to support pregnant women and mothers in the community, for appropriate home care and care-seeking, recording child growth trajectory in the MCHHB, and identifying complications requiring referral to health personnel; and (iv) monthly health staff meetings to monitor MCHHB use. Intervention components were designed to be conducted with minimal additional resources through integration into existing activities and mobilizing partial contributions by the village community,^{16–18} before performance-based financial incentives or universal insurance enrolment was introduced.^{19, 20}

Variables

A series of dependent variables were measured along with the care continuum: (i) maternal care during pregnancy and childbirth (tetanus toxoid injections; ANC appointments; professional delivery care); (ii) childcare (vitamin A intake); (iii) feeding practices (exclusive breastfeeding for 6 months, complementary feeding after 6 months); and (iv) anthropometric measurement of child and mother. Based on self-reports, information about care from health service providers for maternal complications (i.e. complications during pregnancy, delivery, postpartum stage), neonatal complications (i.e. small baby/low birth weight, baby not sucking nipples, convulsion, cold/weak extremities, fever, icteric and wet/smelly umbilical cord) and child illness (i.e. pneumonia-like symptoms, long-lasting diarrhoea and fever during the 2 weeks preceding the survey) from health providers, and home care for child illness (i.e. diarrhoea and cough) was gathered.

Respondents' characteristics included age, educational years, number of <5-year-old children in household, child's age and

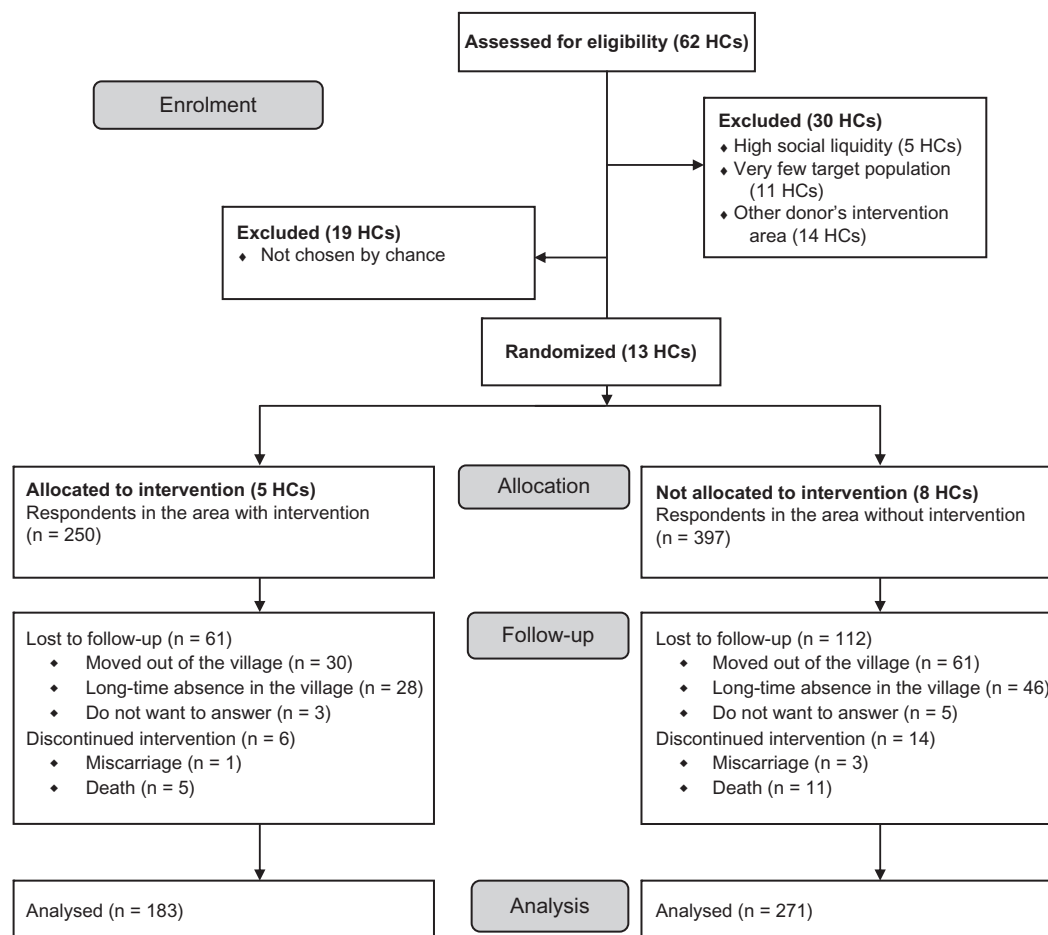


Figure 1 Enrolment of respondents according to the CONSORT 2010 flow diagram.

household economic status.²¹ Regarding financial hardship to access services,²² we assessed pro-poor insurance usage; perceived expense of accessing care at nearest facility; the most frequently visited facility; and *Posyandu* (i.e. integrated health posts within the community, providing free monthly health examinations to pregnant women and <5-year olds).

As part of respondent characteristics, knowledge on MCHHB contents includes danger signs of complications (i.e. pregnancy, delivery, postpartum, and newborn complications, and child sickness), birth preparedness and complications readiness (i.e. recognition of necessities: deciding on the birth assistant and delivery place, saving money for delivery, identifying potential blood donors, acknowledging the expected date of birth and preparing transportation to the delivery location) and child sickness prevention and homecare.

Data collection

Data were collected from January through March 2007 and 2009 using a field-tested, structured questionnaire to interview respondents. The weight and height of the respondents and

children were measured twice at follow-up. To measure the height of respondents and children, a wall-mounted simple height metre was used to the nearest 0.1 cm. Respondents' and children's weight was determined using the standardized scale (SECA) to the nearest 0.01 kg on a scale balance. The subjects wore plain dress without any accessories and footwear.

Statistical analysis

We conducted cross-sectional and longitudinal analyses. Primary analyses followed the intention-to-treat principle, and compared group proportions of mother-child pairs who received care and practiced at home. To adequately adjust correlations of outcomes,²³⁻²⁴ a generalized linear mixed models (GLMM) method was adopted to examine binary data for odds ratio (OR), as a measure of effect, and to calculate 95% confidence intervals (CI). We also adopted the generalized linear model (GLM) method because the sample size was not large enough to use the GLMM in identifying significantly affected sub-groups. Chi-square and *t*-tests were used to compare the socioeconomic variables between areas. McNemar's

and paired *t*-tests were used for comparison within areas and between surveys. To consider the socioeconomic variables in GLMM analysis, a 13-item household poverty index was constructed with the principal component analysis and tabulated into quartiles (Appendix 1).^{21,25} Statistical analyses were performed using SPSS 18.0 (SPSS Japan Inc., Tokyo, Japan). GLMM analysis were conducted to test 21 health service uptakes/practices, 3 child nutrition status and 13 husband practices. Nine GLM tests to identify care-seeking for different sets of complications were performed. Weight and height were calculated against the 2006 WHO Child Growth Standards for <5-year olds.²⁶ Underweight and stunting was defined as below -2 standard deviations from the median weight or height for age, respectively. Wasting was defined as below -2 standard deviations from the median weight for height. Respondents' body mass index (BMI) was calculated as weight (kg) divided by height (m) squared.

Ethical approval

The study was approved by the Ethical Review Committee of the University of Indonesia. All participants provided written informed consent.

Results

Respondent characteristics

Socio-demographic characteristics did not significantly differ between the areas at baseline. Respondents in both areas did not report different perceived expenses to access health facilities, while the mean cost to access the nearest health facility was lower in the intervention area, and the proportion of usage of pro-poor insurance was higher in the control area (Table 1). The analysed samples were not different between areas, in terms of maternal BMI (23.3 ± 0.7 , 22.2 ± 0.2 ; $P = 0.115$; $n = 448$), birth weight of child in grams ($3\,113.4 \pm 40.3$, $3\,171.6 \pm 32.4$; $P = 0.272$; $n = 388$), and child's age in months (19.0 ± 2.1 , 19.0 ± 2.1 ; $P = 0.221$; $n = 454$).

Intervention

MCHHB use increased in the intervention area (Table 2). More mothers owned the MCHHB (82.0%) and could present it to enumerators (70.5%). Although we could not differentiate between 'skimming' from 'reading' word-for-word, respondents (65.0%) and/or their families (67.8%) had read the handbook. Intervention area handbook owners brought it to multiple health service points (i.e. *Posyandu*, maternity huts, HCs, private practices, hospitals) on multiple occasions (i.e. ANC, delivery, postnatal care, well-baby/well-child check-ups, sick-baby/sick-child appointments). Further, more handbooks of owners in the

intervention area contained information recorded by multiple health personnel. Intervention area respondents owned, read and brought the MCHHB to healthcare facilities; healthcare providers and volunteers recorded and guided respondents by using the MCHHB; and family members, particularly husbands, read the contents with their wives.

Respondents in the both areas had increased knowledge about danger signs for maternal and newborn complications, birth preparedness and complication readiness, and signs for child sickness between the baseline and follow-up, while respondents in the intervention area gained more score to fill the gaps of MNCH knowledge between baseline and follow-up (Table 2).

Service uptake

After most of the respondents in the both areas had accessed healthcare during their pregnancy period represented by one shot of tetanus immunization during the pregnancy (95.6 versus 92.3%), respondents in the intervention area were more concerned about consecutive care acquirement. They were more likely to receive two doses of tetanus immunization, antenatal care four times, professional assistance during child delivery and ensure that children took vitamin A supplements (OR = 2.03, 95% CI: 1.19–3.47) after controlling for the area of intervention or control, respondent's education, household poverty and child age in month (Table 3). During pregnancy, respondents in the intervention area went to 6.3 (± 2.5) ANC appointments compared to 5.6 (± 3.1) in the control area. More respondents in the intervention went to more than six ANC appointments (54.6 versus 40.6%) and professional childbirth care (43.2 versus 39.1%) than did those in the control area. Respondents in the intervention area received care in the pregnancy stage, in the child delivery, and in the early child-rearing stage, after adjustment for confounding variables and cluster effects.

Feeding practice

Respondents in the intervention area were concerned about feeding after 6 months, including introducing complementary feeding for 6–9 months (OR = 4.35, 95% CI: 2.85–6.65), and continuing breastfeeding (OR = 2.31, 95% CI: 1.22–4.39). While there was no significant difference in GLMM analysis in exclusive breastfeeding for 6 months, feeding soft-rice thrice a day and some kind of side dishes, respondents in the intervention area were more likely to concisely feed complementary food by providing fruits and/or fruits extract, foods containing protein, vitamins, and oil, and two snack feedings with varied food at home, along with administering vitamin A to their child. Respondents in

Table 1 Baseline comparability of socio-demographic background of respondents in intervention and control areas ($n = 454$)

	Intervention ($n = 183$) Mean (SD)	Control ($n = 271$) Mean (SD)	Comparison P
Age (years)	27.2 (7.7)	26.8 (6.4)	0.633
Education (years)	7.0 (2.6)	6.8 (2.5)	0.482
Number of children in the household under 5 years of age	0.4 (0.6)	0.4 (0.6)	0.367
	% (n)	% (n)	P
Poor household+	38.3 (70)	37.6 (102)	0.922
	Mean (SD)	Mean (SD)	P
Cost to the nearest health facility (in Rupiah)	700 (1 791)	1 140 (1 852)	0.012
Cost to the most frequently visited health facility (in Rupiah)	1 670 (6 814)	1 780 (2 924)	0.810
Cost to <i>Posyandu</i> ++ (in Rupiah)	10 (185)	10 (192)	0.952
	% (n)	% (n)	P
Perceived expenses to access the nearest health facility	15.8 (29)	21.4 (58)	0.147
Perceived expenses to access the most frequently visited health facility	24.0 (44)	26.9 (73)	0.513
Perceived expenses to access <i>Posyandu</i> ++	0 (0)	0 (0)	–
Use of insurance for the poor	12.6 (23)	22.9 (62)	0.007

Bold values indicate statistical significance at 95% confidence level.

+Respondents with nine or more items from 14 items are to be identified as members of poor households: (a) Building area <8 m²; (b) floor made from dirt/bamboo/cheap wood; (c) wall made from bamboo/rumbia/low quality wood/unplestered wall; (d) do not have closet/closet together with other neighbour; (e) water from dweel/fountain, unprotected/river/rain; (f) no electricity; (g) cook with fire wood/charcoal/fuel; (h) buy one clothing item a year; (i) 1–2 meals per day; (j) cannot afford to buy meat, chicken, milk; (k) cannot afford to pay for HC or other healthcare facilities; (l) source of income from a 0.5 acre farmer, paid farmer, fisherman, construction worker, plantation worker or other occupation that has low income < rp 600.000 per month; (m) household head education: no formal school, elementary school ungraduate, graduated from elementary school only; (n) do not have money saving/belongings worth >rp 500.000: non-credit motorcycle, gold, cattle, boat or other capital stuff.²¹

++*Posyandu*: community-based integrated health post.

the intervention care about feeding order with breastfeeding and complementary feeding, and train the child to self-feed.

Anthropometric

Less number of underweight children (5.2%, 14.0%; OR = 0.33, 95% CI: 0.12–0.94) or less number of children with stunted growth (26.3%, 40.3%; OR = 0.53, 95% CI: 0.30–0.92) were observed in the intervention compared to control area, after adjusting for maternal BMI and birth weight of child.

Husband support

Respondents in the intervention area reported that their husbands' support with respect to saving money for delivery (OR = 1.82, 95% CI: 1.20–2.76), keeping their baby warm (OR = 1.58, 95% CI: 1.02–2.46), and giving their child developmental stimulation (OR = 1.62, 95% CI: 1.06–2.48) (Appendix 2).

Care-seeking in need

Respondents reported pregnancy (7.1 versus 19.6%), postpartum (7.7 versus 10.7%) and newborn (3.3 versus 10.3%)

complications, respectively. Respondents in the intervention area were more likely to seek care for complications, although difference was non-significant. Among the reported child illnesses (75.8 versus 71.2%), while care-seeking from health personnel was similarly observed in both areas, home care for cough was observed more in the intervention area (80.0% of 45 cases, 53.3% of 60 cases; Appendix 3). In GLM analysis, those who had cough received home care in the intervention than control area (OR = 3.50, 95% CI: 1.44–8.52).

Discussion

Main findings of this study

Effective MCHHB use promotes multiple services uptakes from pregnancy to early child-rearing stages. The intervention also promoted feeding practices and home care for cough, and encouraged husbands to undertake roles in MNCH care. There were a fewer number of children with stunted growth or underweight in the intervention area.

While under-utilization of home-based records is often reported,²⁷ interventions ensured that health personnel distributed, explained and recorded the MCHHB; health volunteers

Table 2 Use of the Maternal and Child Health Handbook (MCHHB) in the intervention and control areas at baseline and follow-up ($n = 454$)

Variables	Intervention ($n = 183$)			Control ($n = 271$)			Differences in differences %
	Baseline % (n)	Follow-up % (n)	Comparison P*	Baseline % (n)	Follow-up % (n)	Comparison P*	
MCHHB ever given to respondents	6.6 (12)	82.0 (150)	<0.001	16.6 (30)	21.0 (57)	0.001	71.0
MCHHB showed to enumerators by respondents***	6.0 (12)	70.5 (129)	<0.001	14.8 (30)	9.6 (26)	0.644	69.7
MCHHB ever read by respondents	6.0 (11)	65.0 (119)	<0.001	11.1 (24)	15.9 (41)	0.021	54.2
MCHHB ever read by respondents and/or family members	6.0 (11)	67.8 (124)	<0.001	11.4 (24)	16.2 (42)	0.015	57.0
MCHHB brought to more than two facilities	3.3 (6)	54.6 (100)	<0.001	5.5 (15)	11.8 (32)	0.012	45.0
MCHHB brought to more than two occasions	0 (0)	51.9 (95)	–	0 (0)	13.3 (36)	–	38.6
MCHHB filled in by more than two personnel	0.5 (1)	42.1 (77)	<0.001	0 (0)	8.9 (24)	–	33.7
Ever received explanation from a health personnel	2.7 (5)	74.3 (136)	<0.001	6.6 (18)	18.1 (49)	<0.001	60.1
Mothers' class for the child attended	0 (0)	1.6 (3)	–	0 (0)	0 (0)	–	1.6
	<i>Mean (SD)</i>		<i>P**</i>	<i>Mean (SD)</i>		<i>P**</i>	<i>Mean</i>
Respondents' activeness in MCHHB use (score 0–4) ⁺¹	0.39 (1.08)	2.55 (1.75)	<0.001	0.44 (1.16)	0.30 (0.97)	0.080	2.30
Family's activeness in MCHHB use (score 0–3) ⁺²	0.25 (0.74)	1.37 (1.05)	<0.001	0.28 (0.80)	0.33 (0.78)	0.453	1.07
Health Staff's activeness in MCHHB use (score 0–16) ⁺³	0.03 (0.19)	1.58 (1.51)	<0.001	0.07 (0.26)	0.14 (0.60)	0.069	1.48
Health volunteers' activeness in MCHHB use (score 0–4) ⁺⁴	0.00 (0.00)	0.66 (0.81)	<0.001	0.00 (0.06)	0.07 (0.31)	<0.001	0.59
	<i>Mean (SD)</i>		<i>P**</i>	<i>Mean (SD)</i>		<i>P**</i>	<i>Mean</i>
Knowledge about signs of pregnancy complications ^{#1}	0.58 (0.87)	1.63 (1.40)	<0.001	0.90 (1.30)	1.46 (1.48)	<0.001	0.49
Knowledge about signs of delivery complications ^{#2}	0.36 (0.65)	1.42 (1.51)	<0.001	0.91 (1.33)	1.56 (1.56)	<0.001	0.41
Knowledge about signs of postpartum complications ^{#3}	0.27 (0.60)	1.02 (1.09)	<0.001	0.60 (0.93)	1.04 (1.05)	<0.001	0.31
Knowledge about signs of newborn complications ^{#4}	0.73 (1.07)	1.64 (1.46)	<0.001	1.22 (1.27)	1.84 (1.57)	<0.001	0.29
Knowledge about signs of sick child ^{#5}	1.61 (1.55)	1.93 (1.44)	0.036	1.68 (1.58)	2.28 (1.73)	<0.001	–0.28
Knowledge about birth preparedness and complication readiness ^{#6}	0.53 (0.71)	1.30 (1.29)	<0.001	1.01 (1.26)	1.24 (1.27)	0.044	0.54
Knowledge about prevention sick and sick child care at home ^{#7}	3.14 (2.22)	4.01 (2.11)	<0.001	3.37 (2.27)	3.68 (2.36)	0.095	0.56

Bold values indicate statistical significance at 95% confidence level.

*P-values are for McNemar tests within areas and between surveys.

**P-values are for paired t-tests within areas and between surveys.

***Respondents who cannot show the MCHHB to the enumerator includes (i) never have MCHHB: 18.0% (33), (ii) lost/ no answer: 10.9% (20), (iii) kept by others like health staff, health volunteers and relatives: 0.5% (1) in the follow-up in the intervention area, while 79.0% (214), 10.4% (27), 1.5% (4) in the follow-up in the control area, respectively.

⁺¹Respondents' activeness in using the MCHHB includes (i) observable to enumerators, (ii) read by respondents, (iii) respondents felt that it was easy to understand and (iv) respondents brought it to the facility.

⁺²Family's activeness in using the MCHHB includes (i) husbands often/sometimes read the MCHHB, (ii) respondents often/sometime read the MCHHB with their husbands and (iii) other family members often/sometimes read the MCHHB.

⁺³Health staff's activeness in using the MCHHB includes (i) helped respondents read contents, (ii) recorded information on it, (iii) explained how to use it at home and (iv) gave guidance according to its contents; health staff includes (i) midwives, (ii) nurses, (iii) doctors and (iv) nutritionists.

⁺⁴Health volunteers' activeness in MCHHB use includes (i) guiding women in MCHHB practice, (ii) recording results of child's growth monitoring according to the MCHHB and (iii) identifies complications to be referred to health personnel.

- #1 Knowledge about signs of pregnancy complications includes (i) bleeding, (ii) oedema, (iii) convulsion, (iv) fever, (v) early rupture of the amnion sack, (vi) less movement of the foetus and (vii) emesis/nausea/loss of appetite.
- #2 Knowledge about signs of delivery complications includes (i) prolonged delivery, (ii) bleeding, (iii) fever, (iv) umbilical cord or baby's arm exposed from the birth passage, (v) convulsion, (vi) mother cannot push any longer, (vii) muddy and smelly amniotic fluid, (viii) retention of placenta and (ix) mother's experiencing restlessness or considerable pain.
- #3 Knowledge about signs of postpartum complications includes (i) bleeding, (ii) fever, (iii) convulsion, (iv) smelly fluid from birth passage, (v) oedema and (vi) swollen or reddish breasts.
- #4 Knowledge about signs of newborn complications includes (i) small baby or low birth weight, (ii) baby does not want to suck nipples, (iii) convulsion, (iv) cold extremities, (v) fever, (vi) icteric, (vii) wet and smelly umbilical cord and (viii) weak movement of extremities.
- #5 Knowledge about signs of sick child includes (i) long-lasting diarrhoea, (ii) bloody stool, (iii) sunken eyes, (iv) coughing with difficult/rapid breath, (v) worsening sickness, (vi) fever for more than 2 days, (vii) weak baby, (viii) nose bleeding, (ix) red spots and (x) cold arms and legs.
- #6 Knowledge about birth preparedness and complications readiness includes (i) recognition of necessities: deciding on (ii) birth assistant and (iii) delivery place, (iv) saving money for delivery, (v) identifying potential blood donors, (vi) acknowledging the expected date of birth and (vii) preparing transportation to the delivery location.
- #7 Knowledge about child sickness prevention and care at home includes: diarrhoea prevention by (i) boiling drinking water, (ii) washing hands, (iii) separation from stool; diarrhoea care with (iv) BF, (v) oral rehydration solution, (vi) food, (vii) knowledge about how to prepare oral rehydration solution; and providing care fever with/by (viii) BF, (ix) fluid, (x) cooling and (xi) medicine upon health personnel's suggestion.

supported adherence to MCHHB guidance; and information in the MCHHB was shared with family members. Respondents read and brought the MCHHB to multiple health facilities on different occasions. Multiple health personnel recorded in the same handbook, enabling more frequent monitoring of a mother/child by different healthcare providers at different service points. As appropriate guidance for health personnel is needed for linked interventions,²⁸ systematic orientation of health personnel may have addressed this need. The effect of volunteers residing close to clients possibly facilitated seeking out of healthcare services.²⁹ Encouraging husband' roles through the use of the MCHHB would have enabled the respondents to access health services and be confident in daily care. More frequent and diverse complementary feeding practices could partially explain the fewer underweight or stunting children observed.³⁰

What is already known on this topic

McElligott and Darden³¹ summarized the potential roles of home-based records in service utilization as follows: (i) increasing parental knowledge and demand for essential services, (ii) facilitating communication within and between practices and (iii) reducing the number of missed service appointments by prompting parents/providers. Several programmes, such as maternal care,³² child immunization,^{33, 34} and growth monitoring³⁵ have acknowledged the benefit of home-based records. However, the effects of home-based records across programmes have rarely been reported.³⁶

Cross-sectional studies have indicated that MCHHB users are more likely to accept a care continuum before/after childbirth.^{37–40} A positive association between MCHHB ownership and active health personnel/family communication have been implicated in the MCHHB's care facilitation.⁴¹ Studies suggest the importance of proper MCHHB use by mothers, volunteers, and health personnel for maternal knowledge on MNCH care.^{42–45} While a study in Mongolia confirmed MCHHB use leading to frequent ANC appointments and families' healthier behaviour,⁴⁶ more reports are needed, especially from developing countries, and for the child-rearing period.^{47,48}

What this study adds

To our knowledge, this is the first study on the effect of MCHHB considering its effective use in a prospective manner. Our results supplement those of the previous studies, permitting causal inferences in wide range of outcomes. This study demonstrates that benefit of approaches for ensuring proper MCHHB use does not only stay in the pregnancy stage but also in the early child-rearing stage, and a care continuum across MNCH programs. While facility access does

Table 3 Service uptakes for pregnancy, delivery, child care and child nutrition with GLMM analysis ($n = 454$)

	Intervention, n (%)	Control, n (%)	OR (95% CI)
Continuum of care uptake			
TT2, ANC4	104 (56.8)	123 (45.4)	1.49 (1.01–2.22)*
TT2, ANC4, SBA	53 (29.0)	50 (20.8)	1.46 (0.89–2.40)
TT2, ANC4, SBA, VitA	49 (26.8)	40 (14.8)	2.03 (1.19–3.47)*
TT2, ANC4, SBA, VitA, ExBF	31 (16.9)	22 (8.1)	2.38 (1.22–4.64)*
TT2, ANC4, SBA, VitA, ExBF, current BF	29 (15.8)	17 (6.3)	2.97 (1.45–6.10)**
TT2, ANC4, SBA, VitA, ExBF, start CF in 6–9 months	22 (12.0)	5 (1.8)	7.13 (2.43–20.90)***
Single Service uptake			
TT2	139 (76.0)	162 (59.8)	1.98 (1.29–3.04)**
ANC4	133 (72.7)	185 (68.3)	1.25 (0.81–1.95)
ANC6	100 (54.6)	110 (40.6)	1.67 (1.12–2.49)*
SBA	79 (43.2)	106 (39.1)	1.14 (0.75–1.74)
VitA	160 (87.4)	205 (75.6)	2.00 (1.16–3.47)*
Feeding practice			
Exclusive BF for 6 months	79 (43.2)	132 (48.7)	0.76 (0.51–1.14)
Start CF in 6–9 months	113 (61.7)	74 (27.3)	4.35 (2.85–6.65)***
Feeding order with BF first, CF second in 6–9 months	93 (50.8)	73 (26.9)	2.70 (1.79–4.09)***
Current feeding: BF	167 (91.3)	224 (82.7)	2.31 (1.22–4.39)**
Current feeding: soft rice three times per day	103 (56.3)	140 (51.7)	1.29 (0.87–1.93)
Current feeding: side dishes to soft rice	71 (38.8)	84 (31.0)	1.35 (0.90–2.04)
Current feeding: add protein/vitamin/oil rich food to soft rice	89 (48.6)	101 (37.3)	1.54 (1.03–2.30)*
Current feeding: fruits/fruits extract	71 (38.8)	62 (22.9)	2.18 (1.42–3.36)***
Current feeding: various snack food for two times between meals	107 (58.5)	70 (25.8)	4.14 (2.70–6.34)***
Training self-feeding	65 (35.5)	45 (16.6)	2.75 (1.74–4.36)***
Anthropometric (n_1=intervention, n_2=control)			
Wasting ($n_1 = 133, n_2 = 248$) [#]	10 (7.5)	30 (12.1)	0.59 (0.24–1.47)
Underweight ($n_1 = 135, n_2 = 250$) [#]	7 (5.2)	35 (14.0)	0.33 (0.12–0.94)*
Stunting ($n_1 = 133, n_2 = 248$) [#]	35 (26.3)	100 (40.3)	0.53 (0.30–0.92)*

* P value < 0.05; ** P value < 0.01; *** P value < 0.001. GLMM: the generalized linear mixed models, which include area of intervention or control, respondent's education, household poverty and child age in month. OR, odds ratios; CI, confidence intervals; TT2, two doses of tetanus toxoid injections; ANC4, more than six ANC appointments; ANC6, more than four ANC appointments; SBA, professional delivery care; VitA, vitamin A intake; ExBF, exclusive breastfeeding for 6 months; and CF, complementary feeding.

[#]The model includes area of intervention or control, maternal BMI and birthweight under 2500 g or not.

not always promise appropriate practices at home, MCHHB use may have promoted home care and husband participation. Although further exploration of factors on child nutrition is necessary, less observed under-nutrition cases encourages us to use the MCHHB to promise the first 1000 days of life.⁴⁹

Limitations of this study

As far as the public health policy prioritizes strategies to improve the lives of the poor, our analysis still contributes to policy development. However, in the effort to reduce variation in cluster size, our study may have inadvertently excluded the population most unlikely to partake in healthcare services (e.g.

HCs in remote areas, due to few expectant women).² Further, since the unit of randomization is HCs, and the intervention was visible, the intervention and outcomes could not be masked. As respondents were not selected according to the proportion of the number of village population, the results presented do not represent the study area. Limited number of HCs as cluster may have led limits in randomization.

The treatment was insufficiently powerful for certain outcomes of interest for some possible reasons. First, sporadic MCHHB availability in control area may have diluted observed effects more than assumed. Second, potential economic bias due to withdrawal of wealthier samples in follow-up may have resulted in lower care uptake including professional delivery (43.2 versus 39.1%) in the analysed data, although the

proportions increased from the estimated baseline coverage (30.8%, 37.9%; $P = .076$) among 651 infants sampled in the same villages with the same procedure of the baseline of this study.⁵⁰ Third, delay in certain planned intervention activities may have caused moderate outcome increases in the intervention area. For instance, only on the 14th month of intervention were the midwives orientated to conduct group sessions, called mother's class (MC), for mothers of <5-year olds in village settings,⁵¹ and used the MCHHB as standard material, although Syafiq *et al.* observed that MC during pregnancy might result in greater knowledge and more positive attitudes towards care uptake and childrearing.⁵² Not to discount improved communication skills of midwives through MC orientations, the present data indicate limited influence of MC. Finally, the effectiveness of the MCHHB on care-seeking for sick children may not have been well measured, as the data relied on respondents' reports only. As studies suggest that a combined approach of the integrated management of child illness (IMCI) and MCHHB is effective,^{29,53} it would be worth re-focussing on MCHHB use as part of IMCI in addressing child illness.^{54–56}

Conclusion

The MCHHB is an option for countries that are serious about ensuring a continuum of care for MNCH, as a tool to make programmes and health professionals synchronized⁵⁷ and to empower families by letting them be owners of their information and managers of their family health.

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Authors' contributions

KO, TH, SK and SB conceptualized and designed the study. TH, AT, EM, LH and KP monitored intervention activities,

ensuring effective use of the MCHHB in the intervention area. SB monitored data collection. KO, TH and SK analysed and interpreted the data. KO drafted and revised the article. All the authors read and approved the final article. KO is the guarantor of the article.

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Conflicts of interest

The authors declare no competing interests.

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Appendix

Appendix 1 Internal validity of household poverty based on the principal component (n = 454)

	Quartiles of household poverty			
	1 (n = 113)	2 (n = 114)	3 (n = 114)	4 (n = 113)
a) Building area <8 m ²	3.5%	7.0%	36.8%	58.4%
b) Floor made from dirt/bamboo/cheap wood	2.7%	25.4%	73.7%	89.4%
c) Wall made from bamboo/rumbia/low quality wood/unplestered wall	7.1%	36.8%	79.8%	92.9%
d) Do not have closet/closet together with other neighbour	4.4%	41.2%	64.9%	72.6%
e) Water from dweel/fountain, unprotected/river/rain	36.3%	81.6%	85.1%	88.5%
g) Cooking with fire wood/charcoal/fuel	45.1%	75.4%	91.2%	98.2%
h) Buy one clothing item a year	5.3%	29.8%	62.3%	89.4%
i) 1–2 meals per day	0.0%	5.3%	19.3%	72.6%
j) Cannot afford to buy meat, chicken, milk	0.9%	6.1%	14.0%	80.5%
k) Cannot afford to pay for puskesmas or other healthcare facilities	1.8%	4.4%	21.9%	61.9%
l) Source of income from a 0.5 acre farmer, paid farmer, fisherman, construction worker, plantation worker or other occupation that has low income < rp 600.000 per month	15.9%	65.8%	77.2%	98.2%
m) Household head education: no formal school, elementary school undergraduate, graduated from elementary school only	18.6%	57.0%	74.6%	82.3%
n) Do not have money savings/belongings worth > rp 500.000: non credit motorcycle, gold, cattle, boat or other capital stuff	14.2%	60.5%	71.9%	90.3%
Average Wealth (Mean Scores for the principal component)	-1.303	-0.389	0.395	1.297

Among 14 items to identify poor household,¹⁹ those items that had principal component score below 0.4 (i.e. no electricity) were removed and a 13-item household poverty index was constructed and tabulated into quartiles.

Appendix 2 Husband behaviour for birth preparation and infant home care from respondents perception with GLMM analysis (n = 454)

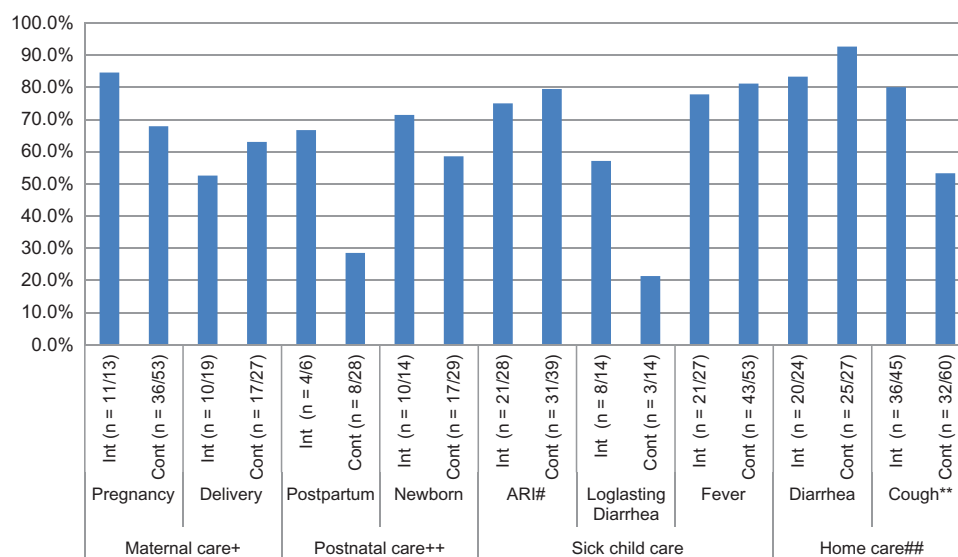
	Intervention, n (%)	Control, n (%)	OR (95% CI)
Saving money for child birth	109 (59.6%)	119 (43.9%)	1.82** (1.20–2.76)
Identifying blood donor#	5 (2.7)	6 (2.2)	1.24 (0.37–4.13)
Acknowledging the expected date of delivery	47 (25.7)	71 (26.2)	0.93 (0.45–1.91)
Preparing transportation to delivery settings	28 (15.3)	39 (14.4)	1.03 (0.55–1.93)
Preparing home setting for delivery child	85 (46.4)	139 (51.3)	0.75 (0.50–1.14)
Contacting health personnel	42 (23.0)	70 (25.8)	0.89 (0.53–1.47)
Supporting mother to breastfeeding	23 (12.6)	49 (18.1)	0.61 (0.35–1.09)
Keeping infant warm	65 (35.5%)	72 (26.6%)	1.58* (1.02–2.46)
Bathing the infant/child	22 (12.0)	37 (13.7)	0.85

Continued

Appendix 2 Continued

	Intervention, n (%)	Control, n (%)	OR (95% CI)
Caring cord of newborn	9 (4.9)	19 (7.0)	0.658 (0.45–1.62)
Giving infant/child developmental stimulation	78 (42.6%)	86 (31.7%)	1.62* (1.06–2.48)
Bringing child to the healthcare facility	28 (15.3)	63 (23.2)	0.669 (0.39–1.15)
Bringing child to <i>Posyandu</i> +	13 (7.1)	24 (8.9)	0.743 (0.33–1.69)

P* value < 0.05; *P* value < 0.01; ****P* value < 0.001. GLMM: the generalized linear mixed models, which include area of intervention or control, respondent's education and household poverty. +*Posyandu*: community-based integrated health post.



Appendix 3 Care sought for maternal and postnatal complications and child illness among reported cases.

+Maternal care includes care sought for pregnancy complications (bleeding, oedema, convulsion, fever, early rupture of amnion sack, less movement of the foetus, emesis and nausea/loss of appetite) and for delivery complications (prolonged delivery, bleeding, fever, umbilical cord or baby's arm exposed from the birth passage, convulsion, mother cannot push any longer, muddy and smelly amniotic fluid, retention of placenta, mother experiences restlessness or considerable pain).

++Postnatal care includes postpartum complications (bleeding, fever, convulsion, smelly fluid from birth passage, oedema, and swollen or reddish breasts) and newborn complications (small baby or low birth weight, baby does not want to suck nipples, convulsion, cold extremities, fever, icteric, wet and smelly umbilical cord, and weak movement of extremities).

#ARI: acute respiratory infection with fever accompanied by rapid breath.

##Homecare for diarrhoea includes more often than usual breastfeeding, administering oral rehydration solutions, and giving normal food portions. Homecare for cough includes more frequent breastfeeding, administering more fluids, keeping distance from smoke, refraining from burning garbage near children.

***P* value < 0.01.