Table 1 Socio-demographic data (n = 408)

Variables	n	%
Socio-economic variables		
Age (median: 37 years)		
<37	197	48.3
≥37	211	51.7
Marital status		
Married or living together	243	59.6
Divorced or separated	48	11.8
Widowed	112	27.5
Never married	5	1.2
Health status		
Good	263	64.5
Some concerns	115	28.3
Feel bad	28	6.9
Education		
None	146	36.1
Primary	173	42.8
Secondary or higher	85	21.0
Number of children (mean: 2.2)		
Having a son	277	67.9
Having a daughter	247	60.5
Pregnancy experience after HIV diagnosis		
Yes	159	39.0
No	249	61.0
Awareness of MTCT		
Correct	369	90.4
Incorrect	39	9.6
Time since diagnosis of HIV positivity (median: 48 months)		
<48	202	49.5
≥48	186	45.6
Time on anti-retroviral therapy (median: 32 months)		
<32	195	47.8
≥32	198	48.5
Partner-related variables		
Living with partner		
Yes	237	58.1
No	171	41.9
Disclosed HIV status to partner		
Yes	237	58.2
No	170	41.8
Partner's HIV status*		
Positive	192	74.1
Negative	58	22.4
Unsure	9	3.5

*Total number of women with a partner. MTCT: mother to child transmission of HIV.

Multivariate logistic regression analysis to determine associations of risk of inconsistent condom use

Two multivariate logistic regression models were employed in the analysis of data (Table 3). In model 1, which excluded partner-related variables, obtaining family planning information from health facilities (adjusted odds ratio (AOR): 2.6, 95% CI: 1.1-6.2, $p < 0.05$), awareness of MTCT (AOR: 4.7, 95% CI: 1.9-11.6, $p < 0.01$), and having a son (AOR: 2.0, 95% CI: 1.1-3.9, $p < 0.05$) were identified as significant predictors of the use of modern contraceptive methods at every sexual intercourse. Model 2, which included all variables, identified being able to ask a partner to use of condom as the only significant predictor of the use of modern contraceptive methods at every sexual intercourse (AOR: 23.7, 95% CI: 5.8-97.6, $p < 0.001$). Data of 38 respondents were excluded from the bivariate analysis and logistic regression analysis due to invalid answer about the last sexual intercourse (Figure 1). Women who were widowed were 75.0% despite 27.5% among all respondents. The percentages of education and health status indicated a similar tendency of all respondents (Table 4).

Discussion

Although previous studies reported that HIV-positive women tend to plan to have a baby because of their personalized stigma [15-17], our study that targeted HIV-positive Cambodian women on ART showed that the majority (92.3%) of respondents were not planning to have a child, although some reported the experience of losing a child due to MTCT of HIV and surrounding pressure to have a baby. The difference between this study and the above previous studies may be due to differences in fertility preference, given that the median age of respondents was 37 years, or because more than 80% of women of this study had at least one child. Our results demonstrated that many (61.2-89.2%) of our respondents had knowledge of condoms, the pill, injection and IUD as modern contraceptive methods and that the majority (68.7%) were actually using condoms. The percentage of women using other modern methods ranged from 3.2 to 14.2%. This means that the proportions of women using the pill, IUD or injection were relatively low compared with the level of awareness about these methods. According to the Cambodia Demographic and Health Survey, 2010 [9], 95% of women of the general population of Cambodia have some knowledge about condoms, the pill, injection, or IUD as family planning methods, and the pill is the most commonly used method of family planning (9.5%), with only 1.7% reporting the use of condoms [9]. This was considerably different to the women from our study, all of whom were on ART. Our results indicated that women on ART were much more inclined to use condoms for family planning compared to women in the general population. Interestingly, the proportion of women on ART using

Table 2 Family planning practice (n = 408)

Variables	n	%
Planning pregnancy		
Yes	27	6.7
No	374	92.3
Unsure	4	1.0
Knowledge of family planning methods (multiple answers)		
Any modern method	398	97.8
Sterilization	185	45.5
Pill	341	83.8
Intrauterine device	249	61.2
Injection	299	73.5
Implant	191	46.9
Condom	363	89.2
Any traditional method	0	0.0
None	9	2.2
Source of family planning		
Any health facility	356	87.7
Used contraceptive method during sexual intercourse*		
Every time	194	68.5
Sometimes/Never	62	29.5
Unsure	2	2.0
Being able to ask partner to use condom*		
Always	170	58.6
Sometimes	85	29.3
Never	35	12.1
Being able to refuse sexual intercourse with partner*		
Possible	175	68.1
Impossible	70	27.2
Unsure	12	4.7
Variables related to last sexual intercourse		
Time		
≤4 weeks	154	37.8
≤3 months	37	9.1
≤1 year	22	5.4
>1 year	113	27.8
Never	2	0.5
Unsure	79	19.4
Partner		
Husband	223	87.7
Partner living together	15	5.9
Boyfriend	10	3.9
Other	1	0.4
Unsure	5	2.0
Family planning methods (multiple answers)		
Any modern method	228	81.4
Sterilization	9	3.2
Pill	40	14.2
IUD	17	6.0
Injection	10	3.6
Implant	9	3.2
Condom	193	68.7
Any traditional method	3	1.1
Dual method (condom + modern method)	49	17.5
None	10	15.2

*Total number of women with partners.

condoms in Cambodia seems much higher than that in African countries, where the rates ranged from 30 to 50% [18]. This means that Cambodian HIV female carriers seem to be better educated on condom use as a means of preventing HIV transmission to their partners as well as for avoiding unintended pregnancy. However, since the choice of contraceptive method for family planning among HIV-positive women seems to be limited to condoms, which requires cooperation from the male partner, it might be difficult for such women to achieve their desired fertility choice.

Our study also demonstrated that approximately one quarter of the respondents who were not planning to have a child was exposed to the risk to unintended pregnancy by not using any modern contraceptive method. Unintended pregnancy can lead to unsafe abortion, which is a major cause of maternal death in developing countries, such as Cambodia [4,6]. In addition, prevention of unintended pregnancy among HIV-positive women is stressed as the second prong for PMTCT. However, according to CDHS2010, the unmet need for family planning among the general population in Cambodia was 16.6%, which has recently been declining but is still high in comparison to other Southeast Asian countries, largely due to insufficient opportunities for women to obtain family planning information [9]. There is a need to emphasize that Cambodian women on ART should be better protected against unintended pregnancy, and that it is necessary to consider an effective strategy to reduce the risk by assessing predictors of the risk of unintended pregnancy. On the other hand, taking the male-dominant culture into account, multivariate logistic regression analysis was performed in the present study using two models. The first model focused on women-related predictors, with the expectation that individual support for each woman would be considered in further detail. The second model included all variables and assessed the predictors to the risk of inconsistent condom use.

Table 3 Associations between routine use of modern contraceptive method and related factors: Multivariate logistic regression showing adjusted odds ratio's (AOR) and 95% confidence intervals [95% CI]

Variables	Using modern contraceptives every time			p value	Adjusted odds ratio	
	Total (n=238) [%]	Yes (n=179) [75.2%]	No (n=59) [24.8%]		Model 1: women status	Model 2: all variables
Socioeconomic variables						
Age (median: 37 years)						
<37	138[58.0]	103[74.6]	35[25.4]	0.810	—	—
≥37	100[42.0]	76[76.0]	24[24.0]			
Education						
Less than primary	189[80.1]	140[74.1]	49[25.9]	0.510	—	—
Secondary or Higher	47[19.9]	37[78.7]	10[21.3]			
Duration of ART (median: 32 months)						
<32	48.5	86[75.4]	28[24.6]	0.878	—	—
≥32	51.5	85[74.6]	29[25.4]			
Having a son						
No	70[29.4]	46[65.7]	24[34.3]	0.029	1.0	1.0
Yes	168[70.6]	133[78.7]	35[21.3]		2.0**[1.1-3.9]	2.2[0.9-5.9]
Having a daughter						
No	89[37.4]	63[70.8]	26[29.2]	0.222	—	—
Yes	149[62.6]	116[77.9]	33[22.1]			
Pregnancy experience after HIV diagnosis						
No	124[52.1]	100[80.6]	24[19.4]	0.043	1.0	1.0
Yes	114[47.9]	79[69.3]	35[30.7]		0.6[0.3-1.1]	1.2[0.4-3.8]
Awareness of MTCT						
Correct	215[90.3]	169[78.6]	46[21.4]	<0.001	4.7**[1.9-11.6]	2.1[0.5-9.9]
Incorrect	23[9.7]	10[43.5]	13[56.5]		1.0	1.0
Partner-related variables						
Living with a partner in same house						
Yes	211[88.7]	166[78.7]	45[21.3]	0.001	—	8.1[0.6-113.9]
No	27[11.3]	13[48.1]	14[51.9]			1.0
Disclosed HIV status to a partner						
Yes	207[87.0]	166[80.2]	41[19.8]	<0.001	—	2.0[0.3-13.9]
No	31[13.0]	13[41.9]	18[58.1]			1.0
Partner's HIV status						
Negative	52[21.8]	36[69.2]	16[30.8]	0.032	—	1.0
Positive	159[66.8]	132[83.0]	27[17.0]			0.8[0.3-2.4]
Family planning-related variables						
Obtaining family planning information from health facility						
No	27[11.3]	15[55.6]	12[44.4]	0.012	1.0	1.0
Yes	211[88.7]	164[77.7]	47[22.3]		2.6*[1.1-6.2]	2.1[0.6-7.7]
Being able to ask a partner to use condom at each sexual intercourse						
Possible	151[63.4]	146[96.7]	5[3.3]	<0.001	—	23.7***[5.8-97.6]
Impossible	84[35.3]	33[39.3]	51[60.7]			1.0

Table 3 Associations between routine use of modern contraceptive method and related factors: Multivariate logistic regression showing adjusted odds ratio's (AOR) and 95% confidence intervals [95% CI] *(Continued)*

Being able to refuse a sexual intercourse with a partner						
Possible	160[69.9]	143[89.4]	17[10.6]	<0.001	—	2.1[0.7-6.5]
Impossible	69[30.1]	33[47.8]	36[52.2]			1.0
Person in last sexual intercourse was a husband						
Yes	203[86.8]	162[79.8]	41[20.2]	0.001	—	3.2[0.7-15.1]
No	31[13.2]	16[51.6]	15[48.4]			1.0

***p<0.001, **p<0.01, *p<0.05 MTCT: mother to child transmission of HIV.

Since multivariate regression model 1 identified seeking information on family planning from government health facilities was an independent predictor of routine use of modern contraceptive methods, effective methods should be considered to dissipate information on family planning. Our respondents, as HIV-positive women on ART, must be encouraged to visit health facilities periodically to obtain their medications, and this relation should be utilized to link ART centers and family planning services. To enhance motivation of HIV-positive women to family planning practice, it is likely that family planning services provided by medical personnel, including counselors, could eventually lead to a reduction in the risk of unintended pregnancy [4,19]. Alternatively, the health facilities at ART sites should also provide family planning services as part of the ART service, so that women do not have to disclose their HIV status to family planning services. Moreover, the timing of the provision information on family planning to women after starting ART needs to be taken into account. A study from South Africa reported that unmet family planning needs rose in the year following the beginning of ART [6]. In this regard, the provision of information soon after starting ART would seem unsuitable since HIV-positive patients likely receive a great deal of information at that time, including their health status and explanation regarding ART medications [4].

Another predictor of the use of modern contraceptive methods in Model 1 was awareness of MTCT. While there are no studies that have directly determined the association between awareness of MTCT and family planning practices, a study from Uganda reported that HIV-positive women who were aware of the short life expectancy of HIV-infected children tended to use contraceptive methods [20]. By being aware of MTCT, HIV-positive women might be more concerned about the chance of mothering HIV-infected children, and thus plan to have no more children [15]. Although providing information on MTCT seems to be an effective way to avoid unintended pregnancies, health care providers involved in family planning services, e.g., counselors, should be aware of the sensitivity of MTCT issue for HIV-positive women. Information on MTCT could have negative effects on family planning and fertility desires by promoting the recalling of a trauma, feeling of guilt in relation to the loss of a child due to MTCT, or anxiety regarding possible infection of a child or possibility that the child may become an orphan in the future [7,15,16,20]. Therefore health care providers should be careful while providing education on MTCT to women on ART; they should advise women on the need to reduce the risk of unintended pregnancy but at the same time avoid negative psychological effects.

Having a son was also a predictor for use of modern contraceptive methods. In our study, HIV-positive women who did not have sons were less likely to employ adequate

Table 4 Socio-demographic data (n = 36*)

Variables	n	%
Age (median: 37 years)		
<37	22	61.1
≥37	14	38.9
Marital status		
Married or Living together	4	11.1
Divorced or Separated	5	13.9
Widowed	27	75.0
Never Married	0	0
Education		
None	7	19.4
Primary	19	52.8
Secondary or Higher	10	27.8
Health status		
Good	18	50.0
Some concerns	15	41.7
Feel bad	3	8.3
Time since diagnosis of HIV positivity (median: 48 months)		
<48	23	63.9
≥48	12	33.3
Unsure	1	2.8

*36 women who were excluded due to invalid answers regarding the last sexual intercourse and contraception use at last sexual intercourse.

contraceptive methods regardless of their family planning and fertility desire. Similar findings have also been described in several other studies [21-23]. Reports from India and Uganda have shown a preference among HIV-positive people in those countries for having sons [4,7]. In Cambodia, boys also tend to be preferred culturally and a disparity between boys and girls in education, nutrition, and health aspects has been reported [24]. Thus, the cultural background about the preference for male children should be further investigated.

In Model 2, which included all variables related to both HIV-infected women and their partners, only "Being able to ask a partner to use a condom" was a significant predictor related to the routine use of a modern contraceptive method. The lack of significance of the predictors identified in Model 1 by the logistic regression analysis could be related to possibility that the ability of negotiation for condom use confounded each significant variable. Since condom use was the main contraceptive method among our respondents, the ability to ask the partner to use condom is likely to be a key in preventing unintended pregnancy. Although the condom is an easy and effective tool with little side effects for contraception, this method requires the cooperation of the male partner, who may not always view its use positively based on interruption of sexual pleasure and sexual function or because the partner is the final decision maker and the woman request is refused [18]. Moreover, in the general population, there are some cultural norms or behaviors such as subordination, discrimination, and violence against women, with men tending to have more power to control sexual relationships [25-28]. This is reflected by the low proportion of women using condoms for family planning in Cambodia compared with those using methods that do not require the partner's cooperation such as the pill, injection and IUD. Thus, although the ability to negotiate condom use was identified as a significant determinant in the prevention of inconsistent condom use in our study, similar to the findings of previous studies [12,29], cultural background should be carefully considered so that women in Cambodia who want to enforce the use of condoms for family planning may be empowered through improvements to communication and negotiation skills. A dual contraceptive method, i.e., condom plus a modern contraceptive which does not require the cooperation of the male partner, should be better promoted among HIV-infected women in order to protect them from both pregnancy and disease.

In our analysis, 36 women were excluded due to invalid answers about the last sexual intercourse and contraceptive use then, which might be sensitive questions to answer, and this exclusion could lead to a bias. However, many of the 36 excluded women were old, widowed or divorced, who might not have any stable partner, or they did not feel obligated to answer questions on family planning practice and details of sexual intercourse. Therefore, the exclusion of these 36 women from our analysis was unlikely to have biased our analysis.

Study limitations

The present study had certain limitations. First, since this study was conducted in the capital of Cambodia, where access to health facilities was better than in rural areas, and the sampling of sites was purposive, it cannot generalize the study findings to the overall population. Moreover, since it was a health facility-based study, the respondents did not include women who have a little motivation to control their own health and rarely visit health facilities. These women might be at greater risk with other predictors of unintended pregnancy. Second, the structured questionnaire based on a self report may be subject to recall bias; thus, there is possibility of being imprecise or false answers with the actual family planning practice. However, respondents whose last sexual intercourse was more than one year before the questionnaire were excluded from the analysis to avoid potential bias. Third, the odds ratio was noticeably large because the ability of negotiation for condom use was strongly related to some predictors, potentially creating imbalance in cell size due to the relatively small population sample. Despite these limitations, our selection of five study sites among 11 in Phnom Penh and our quantitative analysis mean that our findings likely represent the reality of family planning practice among HIV-positive women on ART in Cambodia. To our knowledge, this is the first study implying important issues and suggestions in order to prevent unintended pregnancy among women on ART, in Southeast Asia.

Conclusions

The present study showed that nearly one quarter of the investigated women were at risk of unintended pregnancy, suggesting a high unmet need for pregnancy among HIV-positive women on ART in Cambodia. These women on ART mainly use condom in their family planning compared with methods that do not require male cooperation. The results suggest that the ability of women on ART to enforce condom use was a significant predictor and that they could be better empowered through improvements of communication and negotiation skills to help them achieve this end. Furthermore, the results suggested that, in order to prevent unintended pregnancy, male partners should be more involved in family planning. Otherwise, in order to help prevent unintended pregnancies, health professionals providing family planning information to women on ART need to promote a

dual method, including a method that does not require male cooperation.

Abbreviations

ART: Anti-retroviral therapy; IUD: Intrauterine device; MTCT: Mother to child transmission of HIV; PLHIV: People living with HIV; PMTCT: Prevention of mother to child transmission of HIV; VCT: Voluntary counseling and testing.

Competing interests

The authors declare that they have no competing interest.

Authors' contributions

NN, IN, FY, YS and KK carried out data analysis and drafted the manuscript. NN, TS, FY and KK helped collect the data and participated in coordinating the study design to involve trained interviewers. TS, IN, FY, YS and KK helped with the design of the study. All authors read and approved the final manuscript.

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References

1. USAIDS: UNAIDS World Aids Day report. 2011 [http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2011/JC2216_WorldAIDSday_report_2011_en.pdf]
2. WHO/UNAIDS/UNICEF: Global HIV/AIDS response progress report 2011. [http://whqlibdoc.who.int/publications/2011/9789241502986_eng.pdf]
3. Homsy J, Bunnell R, Moore D, King R, Malamba S, Nakityo R, Glidden D, Tappero J, Mermin J: Reproductive intentions and outcomes among women on antiretroviral therapy in rural Uganda: a prospective cohort study. *PLoS One* 2009, 4:e4149.
4. King R, Khana K, Nakayiwa S, Katuntu D, Homsy J, Bunnell R: 'Pregnancy comes accidentally-like it did with me': reproductive decisions among women on ART and their partners in rural Uganda. *BMC Public Health* 2011, 11:530.
5. Myer L, Carter RJ, Katyal M, Toro P, El-Sadr WM, Abrams EJ: Impact of antiretroviral therapy on incidence of pregnancy among HIV-infected women in Sub-Saharan Africa: a cohort study. *PLoS Med* 2010, 7:e1000229.
6. Schwartz SR, Rees H, Mehta S, Venter WD, Taha TE, Black V: High incidence of unplanned pregnancy after antiretroviral therapy initiation: findings from a prospective cohort study in South Africa. *PLoS One* 2012, 7:e36039.
7. Kanniappan S, Jeyapaul MJ, Kalyanwala S: Desire for motherhood: exploring HIV- positive women's desires, intentions and decision-making in attaining motherhood. *AIDS Care* 2008, 20:625–630.
8. HIV AIDS Asia Pacific research statistical data information. [http://www.aidsdatahub.org/dmdocuments/Cambodia_Country_Review_2011_HIV_and_AIDS_Data_Hub_for_Asia-Pacific_(2011).pdf]
9. National Institute of Statistics, Ministry of Planning, Kingdom of Cambodia: Cambodia demographic and health survey. 2010 [http://www.measuredhs.com/pubs/pdf/FR249/FR249.pdf]
10. UNFPA: State of world population. 2012 [http://www.unfpa.org/webdav/site/global/shared/swp/2012/EN_SWP2012_Report.pdf]
11. Sathiarany V, Kanal K, Nakaie N, Kakimoto K: *Scaling Up of the National Programme for the Prevention of Mother-To-Child Transmission (PMTCT) of HIV in Cambodia*. Busan, Korea: The 10th ICAAP; 2011.
12. Areechokchai D, Bowonwatanuwong C, Phonrat B, Pitisuttithum P, Maek-A-Nantawat W: Pregnancy outcomes among HIV-infected women undergoing antiretroviral therapy. *Open Aids J* 2009, 3:8–13.
13. Webb S, Holman D: A survey of contraceptive use and unplanned pregnancy in Perth, Western Australia. *Aust J Public Health* 1992, 16:382–386.
14. WHO/UNICEF/UNAIDS/UNFPA: HIV and infant feeding: guidelines for decision-makers. [http://whqlibdoc.who.int/hq/2003/9241591226.pdf]
15. Cooper D, Harries J, Myer L, Orner P, Bracken H, Zweigenthal V: "Life is still going on": reproductive intentions among HIV-positive women and men in South Africa. *Soc Sci Med* 2007, 65:274–283.
16. Craft SM, Delaney RO, Bautista DT, Serovich JM: Pregnancy decisions among women with HIV. *AIDS Behav* 2007, 11:927–935.
17. Oosterhoff P, Anh NT, Hanh NT, Yen PN, Wright P, Hardon A: Holding the line: family responses to pregnancy and the desire for a child in the context of HIV in Vietnam. *Cult Health Sex* 2008, 10:403–416.
18. Wenjuan W, Soumya A, Shanxiao W: HIV-related knowledge and behaviors among people living with HIV in eight high HIV prevalence countries in Sub-Saharan Africa. [http://www.measuredhs.com/pubs/pdf/AS29/AS29.pdf]
19. Beyeza-Kashesya J, Kaharuza F, Mirembe F, Neema S, Ekstrom AM, Kulane A: The dilemma of safe sex and having children: challenges facing HIV sero-discordant couples in Uganda. *Afr Health Sci* 2009, 9:2–12.
20. Kikuchi K, Wakasugi N, Poudel KC, Sakisaka K, Jimba M: High rate of unintended pregnancies after knowing of HIV infection among HIV positive women under antiretroviral treatment in Kigali, Rwanda. *Biosci Trends* 2011, 5:255–263.
21. Wongboonsin K, Ruffolo VP: Sex preference for children in Thailand and some other South-East Asian countries. *Asia Pac Popul J* 1995, 10:43–62.
22. Jayaraman A, Mishra V, Arnold F: The relationship of family size and composition to fertility desires, contraceptive adoption and method choice in South Asia. *Int Perspect Sex Reprod Health* 2009, 35:29–38.
23. Kamal SM, Islam MA: Interspousal communication on family planning and its effect on contraceptive adoption in Bangladesh. *Asia Pac J Public Health* 2012, 24:506–521.
24. Miller JE, Rodgers YV: Mother's education and children's nutritional status: new evidence from Cambodia. *Asian Dev Rev* 2009, 26:131–165.
25. Ministry of Women's and Veterans' affairs: The national policy for women, the girl child, and HIV/AIDS. 1999 [http://www.racha.org.kh/rc2008/106/HAG-057.pdf]
26. Anupama KM: Gendered epidemic: addressing the specific needs of women fighting HIV/AIDS in Cambodia. *Berkeley Women's Law J* 2003, 18:254–264.
27. Samandari G, Ilene S, O'Connell K: The role of social support and parity on contraceptive use in Cambodia. *Int Perspect Sex Reprod Health* 2010, 36:122–131.
28. Couture MC, Sansothy N, Sapphon V, Phal S, Sichan K, Stein E, Evans J, Maher L, Kaldor J, Vun MC, Page K: Young women engaged in sex work in Phnom Penh, Cambodia, have high incidence of HIV and sexually transmitted infections, and amphetamine type stimulant use: new challenges to HIV prevention and risk. *Sex Transm Dis* 2011, 38:33–39.
29. Beyeza-Kashesya J, Kaharuza F, Ekstrom AM, Neema S, Kulane A, Mirembe F: To use or not to use a condom A prospective cohort study comparing contraceptive practices among HIV-infected and HIV-negative youth in Uganda. *BMC Infect Dis* 2011, 11:144.

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Original article

Can Japan Contribute to the Post Millennium Development Goals? Making Human Security Mainstream through the TICAD Process

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Abstract: In 2013, the fifth Tokyo International Conference on African Development (TICAD V) will be hosted by the Japanese government. TICAD, which has been held every five years, has played a catalytic role in African policy dialogue and a leading role in promoting the human security approach (HSA). We review the development of the HSA in the TICAD dialogue on health agendas and recommend TICAD's role in the integration of the HSA beyond the 2015 agenda. While health was not the main agenda in TICAD I and II, the importance of primary health care, and the development of regional health systems was noted in TICAD III. In 2008, when Japan hosted both the G8 summit and TICAD IV, the Takemi Working Group developed strong momentum for health in Africa. Their policy dialogues on global health in Sub-Saharan Africa incubated several recommendations highlighting HSA and health system strengthening (HSS). HSA is relevant to HSS because it focuses on individuals and communities. It has two mutually reinforcing strategies, a top-down approach by central or local governments (protection) and a bottom-up approach by individuals and communities (empowerment). The "Yokohama Action Plan," which promotes HSA was welcomed by the TICAD IV member countries. Universal health coverage (UHC) is a major candidate for the post-2015 agenda recommended by the World Health Organization. We expect UHC to provide a more balanced approach between specific disease focus and system-based solutions. Japan's global health policy is coherent with HSA because human security can be the basis of UHC-compatible HSS.
Key words: Japan, human security concept, health systems strengthening, primary health care, universal health coverage

INTRODUCTION

The year 2013 can be a landmark year for global health trends because the 5th Tokyo International Conference on African development (TICAD V) will be held in Yokohama, Japan, followed by a high-level panel on the post-2015 Millennium Development Goals (MDG) agenda in the United Nations [1]. This is expected to cast light on global health in the post-MDG agendas.

Since its first launch in 1993, TICAD, which is co-hosted by the government of Japan, the United Nations Development Programme (UNDP), and the World Bank, has aimed primarily at promoting policy dialogue on Africa with action-oriented results as opposed to the pump-priming of pledges [2]. Thus far, TICAD has been held every five years with several additional meetings (Table 1).

TICAD has played a leading role in promoting the human security concept in policy dialogue on Africa. As stated above, TICAD is not a pledge conference, thus it may not be appropriate to evaluate it from the financial aspect. It is, however, necessary to examine the relationship between global health and TICAD to understand its catalytic function.

In this article, we briefly review the development of the human security concept in the TICAD health agenda dialogue, and finally recommend a role for TICAD in the integration of the human security concept in the post-2015 agenda.

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AGENDA ON HEALTH AND INTEGRATION OF HUMAN SECURITY IN THE TICAD DIALOGUE

Looking back on TICAD's dialogue, health in Africa has not been the main agenda. Its momentum in relation to health has grown gradually.

In the Tokyo declaration adopted in TICAD I (1993), health was treated as an ad-hoc topic. The statement mentioned that investment priority should be given to nutrition, health, and education with special reference to the improvement of the situation of woman and children. In addition, the threat posed by the HIV/AIDS pandemic was recognized [3].

In TICAD II (1998), the statement items in "Towards the 21st century," included health through all life stages and an increase of access to primary health care [4].

The term "Human Security" was first adopted in TICAD III [5]. In the Chair's summary of TICAD III, the three pillars of Japanese assistance in Africa were announced including: "human centered development," "poverty reduction through economic growth," and "consolidation of peace." Under the item "human centered development," besides underscoring the seriousness of HIV/AIDS as one of the most serious threats to African development and the serious impact of tuberculosis, malaria, and polio, the importance of primary health care (PHC), and the development of a regional health system as well as health education to deal with infectious diseases was recognized.

The year 2008 was a very special year for global health trends because the G8 Toyako Summit, Japan and the TICAD IV were both co-hosted by the Government of Japan. A strong momentum for global health that focused on Africa was developed and which kept MDGs 4, 5, and 6 high on the agenda. The momentum was developed by the Takemi Working Group (TWG), which was chaired by Prof. Keizo Takemi [6]. The high-level working group, which was comprised of scholars, government officials, and practitioners from a diverse range of sectors in Japan, was managed by the Japan Center for International Exchange (JCIE). The group held several dialogues on global health. The TWG membership included officers from the Japan International Cooperation Agency (JICA), which is in charge of handling Japan's overseas domestic aid activities, alongside officers from the Ministry of Foreign Affairs, and the Ministry of Health, Labour and Welfare, Japan. Over the course of dialogues, focus was set primarily on Sub-Saharan Africa because the *Millennium Development Goals Report, 2007* revealed that Sub-Saharan African countries had fallen far behind in the achievement of MDG 4, 5, and 6 [6]. At that time, since health systems strengthening was considered a key to empowering individuals and communities [7], the focus of the topic gradually evolved to health system strengthening with human security. The TWG proposed several recommendations to the Government of Japan that emphasized these two points of focus [7, 8]. In TICAD IV, their recommendations were also reflected in the "Yokohama Action Plan," which indicated that the TICAD process should focus on the notion of "human security" for the achievement of the MDGs [9].

In the TICAD V Preparatory Senior Officials' Meeting held in Burkina Faso (November, 2012), which was attended by the delegations of African countries and TICAD co-organizers (the Government of Japan, the African Union Commission, the United Nations, the United Nations Development Programme and the World Bank), participants commended African countries for having achieved remarkable economic and social development, but stressed that they are still faced with various development challenges, including growing economic disparity and insufficient progress towards achieving the MDGs [10].

THE RELEVANCE OF HUMAN SECURITY TO HEALTH SYSTEM STRENGTHENING

The human security approach has particular adaptability with regard to the promotion of health system strengthening because of its focus on comprehensive health care services for improving the health and wellbeing of individuals and communities [11]. Human security builds on two kinds of mutually reinforcing strategies: protection and empowerment. Protection shields people from dangers, while empowerment enables people to develop their potential and to participate fully in decision-making [12]. According to the Takemi schema (Fig. 1) of health system strengthening in Japan's post World War II period [13], protection equates to a top-down approach. Empowerment, in contrast, is a bottom-up approach. The top-down approach can be made by central or local governments, while the bottom-up approach can be achieved by individuals and communities. Both are therefore required in a variety of situations and are mutually reinforcing. The Takemi schema is a dual approach in that it is both top-down and bottom-up and as such aims to protect communities as it empowers [13]. Tall and Jimba modified this dual approach into a model that fits the situation of Africa, with a structure that is almost same as the Takemi schema [14].

The government of Japan has made global health a high priority in its foreign policy agenda and it has been among the strongest advocates for human security.

The government of Japan thus welcomed the TWG recommendation. Interestingly, in the Kyushu-Okinawa G8 summit held in 2000, infectious diseases were picked up as

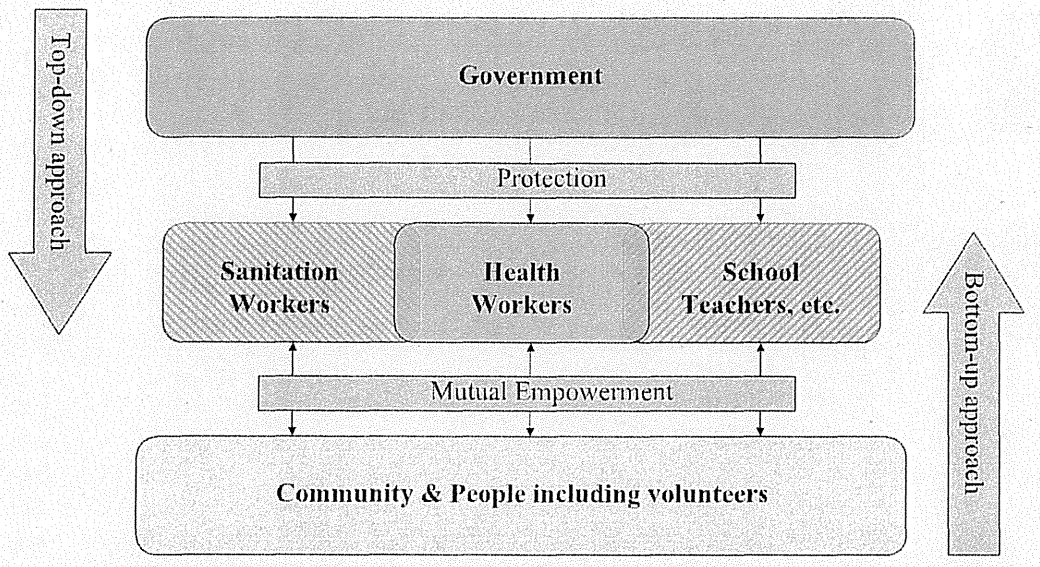

Fig. 1. Takemi's schema on health system strengthening—Two sided strategy—
Source: Modified from Takemi K. Japan's Role in Global Health and Human Security. 2008. http://www.jcie.or.jp/cross/globalhealth/cgh-jc01.pdf

a threat with the potential to reverse decades of development and rob an entire generation of hope for a better future, upholding the importance of human security [15]. The Japanese foreign minister of the day declared Japan's commitment to the support of global health through the human security approach with a mention of the vital importance of not only focusing on the health and protection of individuals, but also striving to empower individuals and communities through the strengthening of health systems [7, 16].

In February 2008, the G8 health experts group (GHEG) meeting was organized among G8 member countries. In its dialogue process, respect for human security was affirmed and its importance for global health was stipulated in the report entitled "Toyako Framework for Action on Global Health," which was welcomed by the chair's summary of G8 Toyako Summit [17, 18].

THE post-2015 AGENDA

Now that the year 2015 is approaching, the post-2015 agenda should be carefully considered. Universal health coverage (UHC) is, thus far, a major candidate for the post-2015 agenda since the WHO emphasizes its importance as a single overarching health agenda that makes sense [19]. We support this recommendation because UHC is deemed to be able to provide a more balanced approach between specific disease focus and system-based solutions including PHC [20], and the human security approach would be more effective for covering vulnerable groups that have been excluded from UHC and for fragile countries with weak health systems. One of the weaknesses of PHC is the legacy that the system failed to integrate HIV/AIDS care, which was a major component of MDG 6. We expect UHC to essentially be PHC with HIV/AIDS countermeasures (MDG 6). If MDG 6 is successfully integrated into PHC by UHC, it would make PHC the winning method for integrating health system strengthening with regard to MDGs 4, 5, and 6.

One of major success stories with regard to UHC is Japan. Its successes have been detailed and analyzed in several articles [21–23]. Many factors are suggested to have contributed to the establishment of UHC and improvement of health of Japanese people including public health policies, high literacy and education levels, traditional diet and exercise, economic growth, and a stable political environment with a social, democratic movement [22–24]. In the period following World War II until the mid-1960s, Japan reduced mortality rates due to infectious diseases in children under the age of five and of adult mortality due to tuberculosis. While improvement of nutrition and environmental conditions are primary contributors to health, we speculate that the "selection and concentration strategy" contributed strongly to this success after 1961, at which time UHC was launched and treatment costs of patients with TB were treated as a public expense [25]. As the Takemi schema shows, while local health workers made a conscious effort to deliver services to community people based on the egalitarian principles of treatment, the central government developed the strategy of nationwide utiliza-

tion of UHC [25]. However, we should keep in mind that, in spite of Japan's success with regard to UHC development, the country still faces its own challenges. With its rapidly aging society and the burden of the Great East Tohoku disasters, UHC in Japan is losing its affordability to all people and has required structural reform [26].

The introduction of UHC to global health needs to be considered a dynamic issue and it would be very difficult to provide a one size fits all solution for impoverished countries in Africa and beyond. Africa has its own unique health problem with the high level of HIV/AIDS [27]. In addition to the burden of HIV/AIDS, recent reports indicate that the number of people with undiagnosed hypertension and diabetes is greater than the number of people living with HIV/AIDS [28, 29]. Japan's healthcare challenge is that it must adapt to the pressures of a rapidly aging population. In this regard, we see some similarity as to the issues that must be tackled. Thus, we recommend the UHC for the post-2015 agenda. The lessons Japan has learned from tackling the dynamic challenges of its aging population would apply well to Africa and provide a good opportunity for mutual learning. As Shibuya et al. pointed out in their four key policy recommendations, reconsidering the meaning of global health in aging populations and identifying areas in which Japan has greater expertise is a key facet of the strategic agenda [26].

In this regard, the series of dialogues in TICAD and subsequent meetings should be respected since we see a clue in the implementation of the human security concept.

It is widely recognized that in order to deliver both preventive and curative healthcare services in an efficient and effective manner, health system strengthening with local ownership, local diagnosis and local capacity building is required. For that purpose, a two-sided strategy is needed to both strengthen the state's capacity to deliver prevention and curative health services and to empower community-based health workers, volunteers and parents [20]. In Sub-Saharan African countries, in particular, donors and partners must coordinate and harmonize their approaches to UHC in order to avoid duplication and fragmentation. Thus, the human security approach should not be an additional effort, it should be integrated into efforts towards UHC.

As Vega pointed out [30], for the achievement of sustainable UHC, two inter-related components are required: access to coverage for necessary health services and access to coverage with financial protection. This challenge can be discussed in the coming TICAD and subsequent meetings with a view to the human security approach (protection and empowerment).

Japan's global health policy has been consistent from the Okinawa G8 summit in 2000, through the Toyako G8 Summit and TICAD IV in 2008 to TICAD V in 2013 because it has been based on the human security concept with a special emphasis on bottom-up, comprehensive, multisectoral, and participatory approaches that allow it to transform legacy PHC into effective UHC.

CHALLENGES TO BE CONSIDERED

For the reasons noted above, there is a great opportunity for Japan's global health policy and its domestic experiences of developing UHC to contribute to Africa. We should, however, consider several challenges with respect to its applicability, sustainability and outcome in the African setting.

First, the applicability of the human security model (Takemi's dual approach) to Africa should be carefully discussed. The promotion of the human security approach may not be well accepted given the promotion of a rights-based approach by several stakeholders including the United Nations Children's Fund (UNICEF), the United Nations Population Fund [31], Sweden [32] and the United Kingdom [34]. Although the applicability of the HS model is recognized with a level of expectation [34], it should be a matter of discussion in TICAD V policy dialogues and subsequent meetings. While we see some similarity between the rights-based approach and HSA, including top-down and bottom-up approach [31], we speculate that the rights-based approach, a kind of legal-based and normative approach, may not be effective when "instant choices need to be made between two fundamentally bad options." In contrast, HSA might assist decision-making by "identifying the least objectionable option" [12]. In addition, we should consider the coherence of UHC with existing social franchising systems and conditional cash transfer [35–37], both of which are considered to be innovative and of great impact to health in Africa. A system of UHC with HSA integrated with social franchising and conditional cash transfer could be recognized as being favorable.

Second, the sustainability of UHC should be considered. Looking back on the history of PHC, the lesson of selective PHC is deemed to be important. Criticisms of PHC included that it was too broad and there were doubts over its feasibility. Selective PHC, which consisted of GOBI (growth monitoring, oral rehydration therapy, breastfeeding, and immunization) approaches, was advocated by UNICEF and supported by several donors. However, the scheme has been criticized for its narrow focus on technocentric approaches [38], which did not encourage community participation and which were unable to take a central position in the global health community. As a result, the PHC concept and its implementation fluctuated and com-

Table 1 Brief overview of the TICAD Process

Year	Title of conferences and meetings	Date	Venue	Summary
1993	**TICAD I** First Tokyo International Conference on African Development	October 5–6	Tokyo, Japan	Co-organizers vowed to resuscitate the decline in development assistance for Africa which had followed the end of the Cold War. "Tokyo Declaration on African Development," guidelines for African development were adopted. The emphasized priorities are: Importance of 'Africa's ownership' of its development as well as of the 'partnership' between Africa and the international community. Harnessing of Asian experience for the benefit of African development.
1998	**TICAD II** Second Tokyo International Conference on African Development	October 19–21	Tokyo, Japan	Primary Theme: Poverty Reduction and Integration into the Global Economy "African Development Towards the 21st Century: the Tokyo Agenda for Action" was adopted. Ownership and partnership were the underlying principles. Expressed commitment to the agreed goals and priority actions in the following areas: Social development: education, health and population, and other measures to assist the poor. Economic development: private sector development, industrial development, agricultural development, external debt. Foundations for development: good governance, conflict prevention and post-conflict development.
2001	TICAD Ministerial Meeting	December 3–4	Tokyo, Japan	Substantive discussions took place on TICAD II review and on NEPAD (the New Partnership for Africa's Development), the development initiative by African people themselves.
2003	**TICAD III** Third Tokyo International Conference on African Development	September 29–October 1	Tokyo, Japan	Succeeded in bringing together international support for African development, NEPAD in particular, and expanding partnership within the international community. In addition, at TICAD III priority challenges were specified in the various development areas, and a new initiative toward future African development was adopted. The three pillars of Japan's assistance for Africa was announced including "human centered development", "poverty reduction through economic growth" and "consolidation of peace". "The TICAD Tenth Anniversary Declaration," which confirmed approaches to development including consolidation of peace and human security was adopted.
2008	**TICAD IV** Fourth Tokyo International Conference on African Development	May 28–30	Yokohama, Japan	"Yokohama Declaration" accompanied by "Yokohama Action Plan" was adopted. Action to be taken by 2012 was described in "Yokohama Action Plan".
2010	Second TICAD Ministerial Follow-up Meeting	May 2–3	Arusha, Tanzania	Discussion focused on progress in the implementation of the Yokohama Action Plan as TICAD IV follow-up, as well as MDGs.
2011	Third TICAD Ministerial Follow-up Meeting	May 1–2	Dakar, Senegal	Political and financial issues in Africa were also discussed.
2012	Fourth TICAD Ministerial Follow-up Meeting	May 5–6	Marrakech, Morocco	The "Kan commitment" was mentioned.
2012	TICAD V Preparatory Senior Officials' Meeting	Nov 15–17	Ouagadougou, Burkina Faso	Remaining development challenges including MDGs were mentioned.

The items were modified from the web http://www.mofa.go.jp/region/africa/ticad/meeting.html (accessed on Apr 15, 2013)

mon interest was lost. The sustainability of UHC may be associated with health finance and management capacity, which is another challenge. Once UHC is prioritized and targeted for the post-MDG agenda, it is less likely to fluctuate than PHC. However, the global health community has been swinging like a pendulum from a vertical approach (selective PHC and the MDGs), to a horizontal approach (health system strengthening and PHC). Even if the UHC concept achieves mainstream acceptance among the global health community, the direction of the stream should be carefully monitored through the TICAD dialogue processes and the World Health Assembly agendas, which cover a variety of items but which do not always reflect international health issues in terms of disease burden [39].

Third, the outcomes achieved through TICAD should be considered. As the TICAD monitoring process reported, the renovation of more than 1,000 health facilities and the training of more than 100,000 health workers have already been achieved. These indicators were set in reflection on the "Yokohama Action Plan" and "Toyako Framework for Action on Global Health". In a sense, Japan may have achieved accountability to the global health community, however these achievements and inputs including an ongoing model project named "EMBRACE" (Ensure Mothers and Babies Regular Access to Care) [40], and education services in poor countries from 2011 to present (continuing to 2015) [41] have been made based on a large amount of donor funds, including Japan's pledge of US$ 8.5 million at the UN MDG Summit in September 2010, named the "Kan commitment," from the name of the prime minister of the day [42]. The Kan commitment was not restricted to TICAD actions. The problem, however, is that this achievement came at the cost of such a large amount of input. As noted above, the main objective of TICAD is to promote output-oriented policy dialogue, not the pump-priming of the pledges, which are necessary to sustain high-input programs.

Japan has gained newer accountability for establishing the means by which this achievement can vitalize communities in the light of the human security concept. In the coming TICAD V and follow-up meetings, the direction of policy dialogue should focus on how to bring about outcome and establish accountability in African countries while best utilizing existing outputs along with evaluating the appropriateness and effectiveness of these inputs; even though evaluating outcomes will be difficult due as it will take longer to confirm the actual outcomes.

CONCLUSION

Japan's health system experiences and the global health policy presented by the Ministry of Foreign Affairs and JICA are consistent with the human security concept. The human security concept can be the basis of health system strengthening, which complements UHC. It is also Japan's challenge to incorporate PHC into health system strengthening and infectious disease control activities, to strengthen newborn and child health activities, and to contribute to UHC development. In the coming TICAD dialogue, the human security approach should be strengthened with a view to the post-2015 agenda.

CONTRIBUTION

Takahashi K and Kobayashi J made a significant contribution to the writing of the manuscript. Nomura M made a significant contribution to the writing of the Table 1. Kakimoto K and Nakamura Y supervised all parts of the manuscript.

CONFLICT OF INTEREST STATEMENT

None declared.

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REFERENCES

1. Webster PC. What next for MDGs? CMAJ 2012; 184: E931–932.
2. The Government of Japan, United Nations (OSCAL U, Global Coalition for Africa). Launching of TICAD II Process. Available from: http://www.mofa.go.jp/region/africa/ticad2/ticad23.html. (Accessed on Feb 8, 2013)
3. The Government of Japan. Tokyo Declaration on African Development "Towards the 21st Century". Available from: http://www.mofa.go.jp/region/africa/ticad2/ticad22.html. (Accessed on Feb 8, 2013)
4. The Government of Japan. Second Tokyo International Conference on African Development (TICAD II). Available from: http://www.mofa.go.jp/region/africa/ticad2/ticad22.html. (Accessed on Feb 8, 2013)
5. The Government of Japan. Summary by the Chair of TICAD III. Available from: http://www.mofa.go.jp/region/africa/ticad3/chair-1.html. (Accessed on Feb 8, 2013)
6. Japan Center for International Exchange. Challenges in Global Health and Japan's Contributions. Available from: http://www.jcie.or.jp/cross/globalhealth/overview.html. (Accessed on Feb 12, 2013)
7. Takemi K, Jimba M, Ishii S, Katsuma Y, Nakamura Y;

Working Group challenges with Global Health and Japan's contribution. Human security approach for global health. Lancet 2008; 372: 13–14.
8. Takemi K, Masamine J, Sumie I, Katsuma Y, Nakamura Y. Task Force on "Challenges in Global Health and Japan's Contribution". Global Health, Human Security, and Japan's Contributions. Tokyo, Japan: Japan Center of International Exchange; 2009.
9. Ministry of Foreign Affairs, Japan. Yokohama Action Plan. Yokohama, Japan: Ministry of Foreign Affairs, Japan; 2008.
10. Ministry of foreign affairs J. The TICAD V Preparatory Senior Officials' Meeting (SOM), Chair's Summary: Ministry of foreign affairs, Japan, 2012. Available from: http://www.mofa.go.jp/mofaj/area/ticad/tc5/pdfs/som_1211_01.pdf. (Accessed on Apr 15, 2013)
11. Takemi K, Reich MR. The G8 and Global Health: Emerging Architecture from the Toyako Summit. In: Hubbard S, Ashizawa K, eds. G8 Hokkaido Toyako Summit Follow-Up Global Action for Health System Strengthening: Policy Recommendations to the G8 Task Force. Tokyo, Japan: Japan Center for International Exchange; 2009.
12. Comission on Human Security. Human Security Now. New York: United Nations, 2003.
13. Takemi K. Japan's Role in Global Health and Human Security. Available from: http://www.jcie.or.jp/cross/globalhealth /cgh-jc01.pdf. (Accessed on Apr 15, 2013)
14. Tall CT, Jimba M. Health and Human Security in Action—Presentation from the Ground. Available from: http://www.jcie.org/japan/j/pdf/csc/ghhs/hhs/ticad/symposium_jimba.pdf. (Accessed on Apr 15, 2013)
15. Kunii O. The Okinawa Infectious Diseases Initiative. Trends Parasitol 2007; 23: 58–62.
16. Koumura M. Global health and Japan's foreign policy. Lancet 2007; 370: 1983–1985.
17. G8 Health Experts Group. Toyako Framework for Action on Global Health. Tokyo, Japan: United Nations, 2008.
18. The Government of Japan. Summary by the Chair of Hokkaido Toyako Summit. Available from: http://www.mofa.go.jp/policy/economy/summit/2008/doc/doc080709_09_en.html. (Accessed on Apr 15, 2013)
19. The World Health Organization. Positioning Health in the Post-2015 Development Agenda, WHO Discusssion Paper. Available from: http://www.who.int/topics/millennium_development_goals/post2015/WHOdiscussionpaper_October2012.pdf. (Accessed on Apr 15, 2013)
20. Reich MR, Takemi K, Roberts MJ, Hsiao WC. Global action on health systems: a proposal for the Toyako G8 summit. Lancet 2008; 371: 865–869.
21. Ikeda N, Saito E, Kondo N, Inoue M, Ikeda S, Satoh T, Wada K, Stickley A, Katanoda K, Mizoue T, Noda M, Iso H, Fujino Y, Sobue T, Tsugane S, Naghavi M, Ezzati M, Shibuya K. What has made the population of Japan healthy? Lancet 2011; 378: 1094–1105.
22. Reich MR, Ikegami N, Shibuya K, Takemi K. 50 years of pursuing a healthy society in Japan. Lancet 2011; 378: 1051–1053.
23. Ikegami N, Yoo BK, Hashimoto H, Matsumoto M, Ogata H, Babazono A, Watanabe R, Shibuya K, Yang BM, Reich MR, Kobayashi Y. Japanese universal health coverage: evolution, achievements, and challenges. Lancet 2011; 378: 1106–1115.
24. McKee M, Balabanova D, Basu S, Ricciardi W, Stuckler D. Universal health coverage: a quest for all countries but under threat in some. Value Health 2013; 16: S39–S45.
25. Japan International Coperation Agency (JICA). Japan's Experiences in Public Health and Medical Systems. Available from: http://jica-ri.jica.go.jp/IFIC_and_JBICI-Studies/english/publications/reports/study/topical/health/index.html. (Accessed on Apr 15, 2013)
26. Shibuya K, Hashimoto H, Ikegami N, Nishi A, Tanimoto T, Miyata H, Takemi K, Reich MR. Future of Japan's system of good health at low cost with equity: beyond universal coverage. Lancet 2011; 378: 1265–1273.
27. World Health Organization. MDG 6: combat HIV/AIDS, malaria and other diseases. Available from: http://www.who.int/topics/millennium_development_goals/diseases/en/. (Accessed on Apr 15, 2013)
28. United Nations News Center. Hypertension and Diabetes on the Rise Worldwide, Says UN Report 2013. Available from: http://www.un.org/apps/news/story.asp?newsid=42012#.UbFHi-eeOEY. (Accessed on May 30, 2013)
29. World Health Organization. World Health Statistics 2012. Geneva, Switzerland: World Health Organization; 2013.
30. Vega J. Universal health coverage: the post-2015 development agenda. Lancet 2012; 381: 179–180.
31. United Nations. The Human Rights Based Approach to Development Cooperation Towards a Common Understanding Among the UN Agencies. The Interagency Workshop on a Human Rights Based Approach. Geneva: United Nations; 2003.
32. Ministry of Foreign Affairs, Sweden. Human Rights in Swedish Foreign Policy. Stockholm, Sweden: Government Offices of Sweden; 2009.
33. Bluck S. DFID's Rights Based Approach. Equity and Rights Team, ed. London: DFID; 2006.
34. Were M. Human Security Approach in the Health Sector in Africa. Available from: http://www.jcie.org/japan/j/pdf/csc/ghhs/hhs/ticad/symposium_were.pdf. (Accessed on Apr 15, 2013)
35. International Poverty Centre. Cash Transfers: Lessons from Africa and Latin America. Brasilia: UNDP; 2008.
36. Schubert B, Slater R Social cash transfers in low-income African countries: conditional or unconditional? Dev Policy Rev 2006; 24: 571–578.
37. Beyeler N, York De La Cruz A, Montagu D. The impact of clinical social franchising on health services in low- and middle-income countries: a systematic review. PLoS One 2013; 8: e60669.
38. Cueto M. The origins of primary health care and selective primary health care. Am J Public Health 2004; 94: 1864–1874.

39. Kitamura T, Obara H, Takashima Y, Takahashi K, Inaoka K, Nagai M, Endo H, Jimba M, Sugiura Y. World Health Assembly Agendas and trends of international health issues for the last 43 years: Analysis of World Health Assembly Agendas between 1970 and 2012. Health Policy 2013; 110: 198–206.
40. The Government of Japan. Japan's Global Health Policy 2011–2015. Ministry of Foreign Affairs, Japan; 2010.
41. The Government of Japan. Japan's Education Cooperation Policy 2011–2015. Ministry of Foreign Affairs, Japan; 2010.
42. Ministry of Foreign Affairs, Japan. The Fourth TICAD Ministerial Follow-up Meeting. Available from: http://www.mofa.go.jp/region/africa/ticad/min1205/. (Accessed on Apr 15, 2013)

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

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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 ≤ 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])[a]	26.7	[6.25]	27.3	[6.47]	26.4	[5.93]	27.0	[6.07]
Marital status[b]								
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[c]								
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[d]								
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[2b] (mean [SD])[a]	4.7	[2.63]	5.2	[2.44]	5.3	[2.57]	5.6	[2.47]
Literacy[b]								
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[b]								
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.
[a]Analysis of variance.
[b]Chi-square test.
[c]Chi-square test between farmer and others.
[d]Chi-square test between farmer, homemaker and others.

Table 2 Effect of intervention on key indicators (DID)

Key indicators	Intervention (%)		Control (%)		Difference	Assumption[a]	Effect
	Pre ($N=320$) a	Post ($N=320$) b	Pre ($N=320$) c	Post ($N=320$) d	b − a	d − c	(b − a) − (d − c)
Frequency of ANC							
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

[a]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[a]	Effect
	Pre ($N=320$) a	Post ($N=320$) b	Pre ($N=320$) c	Post ($N=320$) d	b − a	d − c	(b − a) − (d − c)
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.
[a]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[a]	Effect
	Pre ($N=320$) a	Post ($N=320$) b	Pre ($N=320$) c	Post ($N=320$) d	b − a	d − c	(b − a) − (d − c)
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

[a]Counterfactual assumption.

Table 5 Adjusted effect of the intervention on key indicators

Key indicators	Intervention		P	Control		P
	Adjusted OR[a]	95% CI		Adjusted OR[a]	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.
[a]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