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Original research article

Providing free pregnancy test kits to community health workers increases distribution of contraceptives: results from an impact evaluation in Madagascar☆

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Abstract

Objectives: To improve access to contraceptives in remote and rural areas, sub-Saharan African countries are allowing community health workers (CHWs) to distribute hormonal contraceptives. Before offering hormonal contraceptives, CHWs must determine pregnancy status but often lack a reliable way to do so. No studies have evaluated the impact of providing CHWs with urine pregnancy test kits. We assessed the impact of giving CHWs free pregnancy test kits on the number of new clients purchasing hormonal contraceptives from CHWs.
Study design: We implemented a randomized experiment in Eastern Madagascar among CHWs who sell injectable and oral hormonal contraceptives. A total of 622 CHWs were stratified by region and randomly assigned at the individual level. Treatment-group CHWs were given free pregnancy tests to distribute (*n* analyzed=272) and control-group CHWs did not receive the tests (*n* analyzed=263). We estimated an ordinary least-squares regression model, with the monthly number of new hormonal contraceptive clients per CHW as our primary outcome.
Results: We find that providing CHWs with free pregnancy test kits increases the number of new hormonal contraceptive clients. Treatment-group CHWs provide hormonal contraceptives to 3.1 new clients per month, compared to 2.5 in the control group. This difference of 0.7 clients per month (95% confidence interval 0.13–1.18; p=.014) represents a 26% increase.
Conclusions: Giving CHWs free pregnancy tests is an effective way to increase distribution of hormonal contraceptives. As pregnancy tests become increasingly affordable for health-care systems in developing countries, community-based distribution programs should consider including the tests as a low-cost addition to CHWs' services.
Implications: No study has evaluated the impact of giving CHWs free urine pregnancy test kits for distribution to improve provision of hormonal contraceptives. Giving CHWs free pregnancy test kits significantly increases the number of clients to whom they sell hormonal contraceptives. Community-based distribution programs should consider including these tests among CHWs' services.

Keywords: Pregnancy tests; Community health workers; Hormonal contraceptives; Sub-Saharan Africa; Family planning

1. Introduction

One out of every 39 women of reproductive age in sub-Saharan Africa will die during pregnancy or delivery [1]. Use of modern contraceptive methods can substantially reduce maternal mortality and morbidity by preventing unintended pregnancies and ensuring birth spacing [2,3]. However, only 21% of married women in the region use modern contraceptives, most commonly oral or injectable hormonal contraceptives [4]. In addition, 25% of married women report wanting to avoid pregnancy but not currently using modern contraceptives [4].

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To improve access to contraceptives in rural areas and reduce unmet need, several African countries have shifted some of the provision of injectable and oral contraceptives from health facilities to community health workers (CHWs), i.e. lay health workers who have not received formal professional training [5,6] and whose responsibilities vary by country depending on programmatic needs and the country context. The World Health Organization recommends that health workers confirm that a woman is not pregnant before offering her hormonal contraceptives [7]. This need to verify that pregnancy status presents a barrier to increasing contraceptive use because CHWs lack a reliable method of determining pregnancy status.

This study assesses whether providing CHWs in rural Madagascar with free urine pregnancy tests increases the number of women to whom they sell hormonal contraceptives. The tests can complement or substitute for the simple six-question checklist currently used by health workers in more than a dozen African countries, including Madagascar, to rule out pregnancy. The checklist is an improvement on earlier methods, such as checking menstruation [7–12]. However, the checklist has a false-positive rate ranging between 11% and 61% [13]. As a result, a substantial proportion of women who are not pregnant may be denied contraceptives. In addition, there is evidence that some CHWs do not view the checklist as reliable and continue to rely on the menstruation requirement [14]. Women who are denied contraceptives until their menses begin may become pregnant in the interim [15].

In contrast, pregnancy tests are easy to administer and false-positive results are extremely unlikely [16]. Because uring pregnancy tests are ineffective between fertilization and menses, these tests should be used in combination with the checklist, shown to have a false-negative rate of 22% during this period [17]. The tests have long been unaffordable in low-resource settings, but their cost has fallen significantly in recent years. Nonetheless, these tests are not typically available through health-care providers [16]. To date, only one published study, conducted in Ghana and Zambia, has assessed the effect of introducing free pregnancy tests for use by health workers in family planning (FP) clinics. This study found mixed evidence on whether the availability of pregnancy tests reduced the proportion of nonmenstruating women who were denied contraceptive methods [16]. In our study, we assess the extent to which providing free pregnancy tests to CHWs in rural areas of Madagascar increases the number of clients to whom they provide hormonal contraceptives.

1.1. Background — community-based distribution of contraceptives in Madagascar

The Ministry of Health, Family Planning and Social Protection in Madagascar has task-shifted some of the provision of contraceptives to CHWs as a way to expand access to FP among women in remote, rural areas [7,8]. Approximately 64% of women in Madagascar live 5 km or more from the nearest health center; 40% live 10 km or further [18]. While 32% of married women in rural Madagascar currently use contraceptives, researchers estimate that 18% have an unmet need. Injectable contraceptives are the most popular form of modern FP, used by 20% of married women in rural areas, followed by oral contraceptives (6%) [19]. Madagascar was the first country in sub-Saharan Africa to allow CHWs to administer injectable contraceptives [8,14].

The community-based distribution programs in Madagascar, supported by the United States Agency for International Development (USAID), allow CHWs to sell contraceptives at a small profit to women in rural areas who otherwise have limited access to FP providers. These CHWs are recruited in rural areas at least 5 km from the nearest health center. They live within the communities where they work, and each village typically has one or two CHWs. In addition to conducting other public health promotion activities, they provide FP counseling, pregnancy and method eligibility screening, and they sell short-acting methods (fertility-awareness method using cycle beads, condoms and hormonal contraceptives).

The study was implemented in three regions of Eastern Madagascar — Aloatra Mangoro, Atsinanana and Analanjirofo — among CHWs who had been trained to administer injectables. These CHWs were supported by USAID's Santénet2 project, which was implemented from 2008 to 2013 to scale up training of CHWs, expand public demand for health services and link CHWs to reliable supply chains for health commodities. CHWs visit new and existing FP clients at their homes but can also provide services from their own residence. CHWs maintain individual client records and submit monthly aggregate data to the local health center on the number and type of contraceptive clients.

Until 2006, CHWs in Madagascar were allowed to provide hormonal contraceptives to women only at the time of their menses. The policy was then revised to allow CHWs to use an eligibility checklist, which combines the questions from the pregnancy checklist with other medical eligibility questions related to hormonal contraceptives. In 2008, all CHWs were trained on the eligibility checklist [7]. Despite the training, a survey among an initial cohort of 62 CHWs trained in 2007 found that only 15% said that they could provide injectables to nonmenstruating women [14].

2. Methods

2.1. Experimental design

This study uses a randomized-controlled trial design in which CHWs either (i) were given free pregnancy tests to distribute and trained on how to use them (the treatment group) or (ii) did not receive the tests or training on their use (the control group). We estimate the impact of the intervention by comparing outcomes between the treatment and the control groups. The main outcome of interest is the

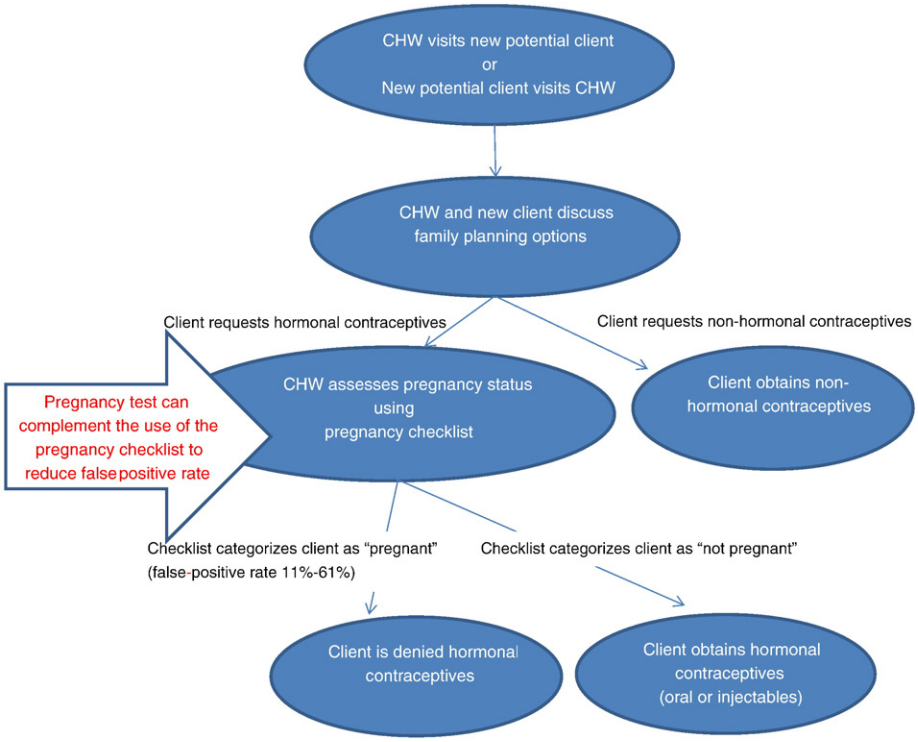

Fig. 1. CHW decision-making for providing contraceptives.

monthly number of new oral and injectable hormonal contraceptive clients per CHW.

Treatment- and control-group CHWs were invited to participate in a training session, but they were not told what the training was about (such invitations to trainings are common). Random assignment occurred prior to CHWs being invited to the training. All CHWs received training on how to complete a monthly reporting form to collect data on the FP services they provide. In addition, each CHW in the treatment group was given a free supply of 50 tests. The CHWs received training on how to use the tests, but they were not specifically told to use them for prescribing hormonal contraceptives, allowing us to explore different pathways for affecting demand for hormonal contraceptives. These CHWs were told that the tests have a low false-positive rate and that pregnancy tests could detect pregnancies starting 10 days after fertilization. They were not specifically instructed to use the pregnancy tests to either complement or substitute the checklist (see Fig. 1 for a potential pathway where pregnancy tests are used along with the checklist among all women interested in using hormonal contraceptives).

This study evaluates the effect of the intervention on CHWs who attended the treatment- or control-group training sessions, held between April and July 2013. Invitees were not told, and there is no evidence that they could have inferred their treatment assignment prior to attending the training. Likewise, there is no reason to expect bias from differential attrition at this stage[3]. Treatment and control CHWs within each district attended training sessions in the same location but staggered by 1 day.

2.2. Data

Monitoring data were collected monthly from each CHW during the 4 months following the training. CHWs reported our main outcome of interest, the number of new hormonal contraceptive clients by contraceptive type and secondary outcomes including the number of individual FP counseling sessions and frequency of checklist use.

Other data sources include (1) the Santénet2 project electronic database listing the number of contraceptive clients by CHW at time of randomization in January 2013 and (2) a self-administered baseline survey on background characteristics filled out by all CHWs at the beginning of their training.

The study received approval from Abt Associates' Institutional Review Board, the National Ethics Committee

[3] A large number of trainings were held throughout the three regions in which the study was conducted, on varying days of the week and with no systematic pattern to the timing of the trainings. Therefore, we do not expect systematic differences in the types of CHWs who attended.

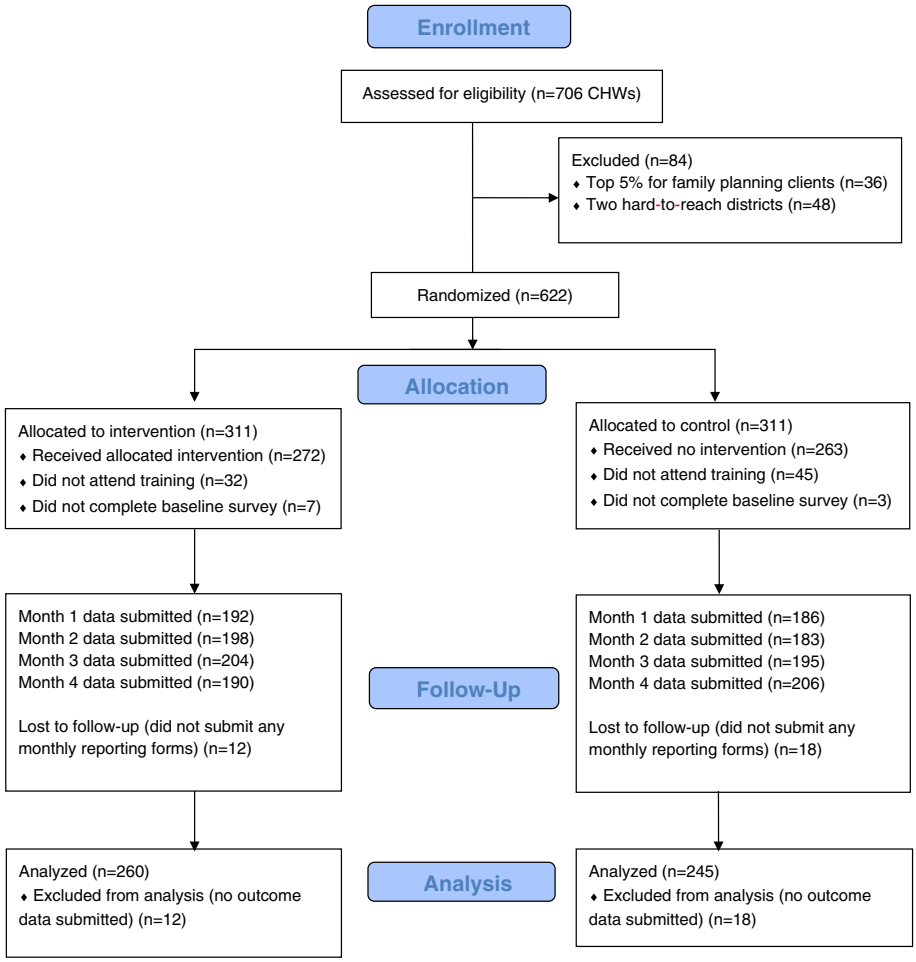

Fig. 2. Consort diagram for sample selection.

in Madagascar and the Ministry of Health in Madagascar. We obtained consent from CHWs at the training[4].

2.3. Sample selection and randomization

All practicing CHWs supported by the Santénet2 project in the three study regions were considered eligible for the study. Before treatment assignment, we excluded CHWs who had client caseloads in the top 5% of the sample distribution to reduce outcome variance attributable to outliers and increase statistical power. We also excluded two hard-to-reach districts. The remaining experimental sample consists of 622 CHWs. Within each region, we randomly assigned half of the CHWs to the treatment group and half to the control group using a random number generator in Stata.

This study estimates the effect of the intervention (i.e., providing CHWs with free pregnancy test kits) among CHWs who were randomly assigned and subsequently attended a training session. Fig. 2 summarizes the sample allocation and attrition. Among the eligible CHWs, 13% of CHWs in the treatment group and 15% of CHWs in the control group did not attend a training session. Each CHW who attended the training could subsequently provide up to four monthly observations for the outcome through the monitoring forms. Among CHWs who attended the training, those in the treatment group submitted 74% of all monitoring forms, compared with 72% in the control group; this difference in response rates is not statistically significant.

2.4. Statistical analysis

We estimate impact using an ordinary least-squares regression model with month-fixed effects. The outcome variable is regressed on a dummy variable indicating treatment status, a month-fixed effect to control for differences in the timing of the intervention start date, a district-fixed effect and the CHW baseline characteristics described in Table 1. Dummy variable adjustment is used to account for missing explanatory data [20,21]. Since some CHWs failed to submit monthly monitoring forms, we also estimate results using

[4] The CHWs who attended the training were reimbursed for their transportation costs and per diem. All CHWs were also provided a nominal compensation each month when they submitted their monitoring data, to incentivize its submission. For the first 3 months, they were given 3.12 USD per month and, for the last month, 4.90 USD.

Table 1
CHW baseline characteristics.

	Treatment group		Control group		Mean difference [95% confidence interval]	Obs.
	Mean	SD	Mean	SD		
Contraceptive clients at baseline[a]						
Injectables	23.9	28.0	27.1	31.4	−3.27 [−8.31 to 1.78]	535
Oral contraceptives	14.6	16.4	13.5	14.3	1.06 [−1.55 to 3.67]	535
Condoms/spermicides	0.6	2.8	0.6	2.9	0.04 [−0.44 to 0.52]	535
Standard days methods/cycle beads	0.9	2.1	1.0	2.3	−0.15 [−0.52 to 0.23]	535
All of these contraceptives	39.1	35.2	41.2	36.9	−2.16 [−8.29 to 3.96]	535
Demographic characteristics						
Age (years)	43.0	8.13	43.4	8.02	−0.35 [−1.72 to 1.03]	531
Female	0.65	0.48	0.72	0.45	−0.07 [−0.15 to 0.01]	535
Married	0.86	0.35	0.83	0.37	0.02 [−0.04 to 0.09]	535
Number of children	4.3	2.39	4.5	2.31	−0.14 [−0.54 to 0.26]	530
Highest class attained[b]	7.3	2.17	7.5	2.1	−0.07 [−0.43 to 0.30]	535
Farmers	0.90	0.30	0.91	0.28	−0.02 [−0.07 to 0.03]	534
CHWs' own contraceptive use						
Ever used FP[c]	0.78	0.42	0.81	0.40	−0.03 [−0.10 to 0.04]	526
Used oral contraceptives	0.10	0.29	0.11	0.31	−0.01 [−0.07 to 0.05]	418
Used injectables	0.63	0.48	0.59	0.49	0.05 [−0.04 to 0.15]	418
Currently uses FP	0.70	0.46	0.70	0.46	−0.01 [−0.09 to 0.08]	420
Uses oral contraceptives	0.10	0.30	0.10	0.31	−0.01 [−0.07 to 0.06]	320
Uses injectables	0.63	0.48	0.65	0.48	−0.01 [−0.12 to 0.09]	320
Experience working as CHW						
Distance to nearest health center (minutes walking)	118.8	80.1	129.5	77.7	−10.75 [−24.17 to 2.68]	534
Number of months working as CHW	65.4	41.5	70.3	40.8	−4.83 [−11.83 to 2.16]	535
Number of hours per week working as CHW	17.1	9.6	19.6	10.4	−2.48 [−4.20 to −0.77]	526
Profit per week as CHW (USD) [d]	0.7	1.0	0.8	1.3	−0.10 [−0.30 to 0.10]	534
Household spending per week on food (USD)	14.0	12.8	12.6	12.0	1.43 [−0.68 to 3.55]	535
Number of months since training on injectables	36.7	21.9	38.3	24.4	−1.59 [−5.67 to 2.48]	498
Distance traveled to refill basket (km)	17.3	32.4	19.1	56.7	−1.76 [−9.58 to 6.05]	535
Experienced shortage with any products in the basket	0.86	0.34	0.84	0.37	0.02 [−0.04 to 0.09]	535
Experienced shortage with oral contraceptives	0.36	0.48	0.33	0.47	0.03 [−0.05 to 0.11]	535
Experienced shortage with injectables	0.22	0.41	0.35	0.48	−0.13 [−0.21 to −0.06]	535
Beliefs and attitudes related to FP provision						
Believes s/he can provide oral contraceptives/injectables to nonmenstruating women	0.05	0.22	0.07	0.25	−0.02 [−0.06 to 0.02]	526
Instructed not to provide oral contraceptives/injectables to nonmenstruating women	0.93	0.26	0.89	0.31	0.04 [−0.01 to 0.09]	486
Has used the pregnancy checklist	0.95	0.22	0.94	0.24	0.01 [−0.03 to 0.05]	511
Believes the pregnancy checklist is very reliable (on a scale 1 to 5 where 5=very reliable)	0.46	0.5	0.46	0.5	−0.002 [−0.09 to 0.09]	504
Feel more comfortable using an actual pregnancy test	0.99	0.09	0.97	0.15	0.02 [−0.01 to 0.04]	506

[a] These data come from January 2013 based on Santénet2 project database.
[b] Malagasy classes begin with 12th grade (equivalent to Kindergarten in the United States). The 7th class is equivalent to 5th grade in the United States.
[c] Includes FP use by the CHWs or the spouse (if CHW is male).
[d] Based on the average exchange rate for April–July 2013, 1 United States Dollar (USD) equals 2,246 Malagasy Ariary.

inverse probability weights to adjust for missing outcome data as a robustness check (see Appendix A). Because we expect outcomes to be correlated across time for each CHW, we calculate robust standard errors clustered at the CHW level.

3. Results

At baseline, there are no statistically significant differences between the treatment and the control groups in the average number of clients to whom CHWs sell contraceptives each month. Considered variable by variable, the only differences in CHWs' background characteristics were that treatment-group CHWs work fewer hours per week as a CHW and control-group CHWs report a higher frequency of shortages in injectables at distribution points (Table 1). An omnibus test across all baseline covariates in Table 1 found evidence of imbalance on these characteristics even when controlling for the large number of statistical tests. We include these baseline characteristics as covariates in the main analysis.

The CHWs who participated in this study live, on average, about a 2-h walking distance from the nearest health center and travel 18 km to replenish their health products for resale. We find no significant differences at

Table 2
Estimated effect of free pregnancy tests on key intermediate and final outcomes.

Outcome of interest	Treatment group	Control group	Difference (T−C)	Percent impact	p-Value	*N*
Confirmatory outcomes						
Number of new hormonal contraceptive clients	3.14	2.48	0.65**	26.4%	.014	1554
Number of new injectable clients	1.94	1.51	0.44**	28.9%	.029	1554
Number of new oral contraceptive clients	1.19	0.97	0.22	22.5%	.13	1554
Intermediate outcomes						
Number of individual FP sessions	17.72	16.49	1.23	7.4%	.262	1493
Frequency of pregnancy checklist use	2.61	2.59	0.01	0.4%	.980	1493

These results represent regression-adjusted means for the treatment and control groups. The percent impact is calculated as the difference between the mean outcomes in the treatment and control groups, expressed as a percentage of the control-group regression-adjusted mean. Each regression controls for a month-fixed effect for differences in the timing of the intervention start date, a district-fixed effect, individual-level CHW characteristics (age, sex, marital status, education, number of children, farmer, distance to health center, hours worked per week as CHW, baseline number of contraceptive clients, own use of FP, source of contraceptive supplies, profits per week as CHW, household spending on food, shortages of contraceptive supplies, use and beliefs about checklist and preference for using a pregnancy test) and dummy variables for missing baseline data. Standard errors are clustered at the CHW level. Any errors for differences are due to rounding.

** $p<.05$.

baseline between treatment- and control-group CHWs' beliefs about the pregnancy checklist. A total of 94% of all CHWs report using the pregnancy checklist, but only 46% say that it is "very reliable." More than 90% of CHWs reported that they were instructed not to provide hormonal contraceptives to nonmenstruating women. Only 6% of CHWs believe that they can provide hormonal contraceptives to nonmenstruating women.

We estimate that providing free pregnancy tests to CHWs for distribution to clients along with training on how to use the tests significantly increases the number of new hormonal contraceptive clients per CHW (Table 2). CHWs in the treatment group provide hormonal contraceptives to an average of 3.14 new clients per month. This is 0.65 more clients than the control-group average of 2.48 new clients per month (p=.014), and it represents a 26% increase from the control-group mean[5]. There are significantly more new clients obtaining injectables among treatment-group CHWs, who have 0.44 more new injectable clients per month compared to control group CHWs and that represents a 29% increase (p=.029). The estimated impact on new oral contraceptive clients is smaller and not statistically significant (p=.133), but the relative effect size is similar in magnitude to injectable clients[6]. There are no significant differences in the number of individual FP sessions held by CHWs in the treatment group compared to the control group nor in the frequency of checklist use (Table 2).

4. Discussion

This study demonstrates that giving free pregnancy tests to CHWs increases the number of women who obtain hormonal contraceptives from those CHWs. Because CHWs are the only easily accessible source of hormonal contraceptives for women in the remote, rural areas of Madagascar included in this study, the increase in new clients likely translates into an increased rate of contraceptive use by women in these areas.

Our findings are consistent with previous research showing that CHWs have difficulty ascertaining a potential client's pregnancy status [13,14]. All CHWs in our study had been trained to use the checklist, yet 54% do not think that it is "very reliable" and only 6% believe that they can provide hormonal contraceptives to nonmenstruating women. In contrast, at baseline, almost all CHWs (treatment and control) reported feeling more comfortable using a pregnancy test to assess pregnancy status than using the checklist. This suggests that CHWs who have access to pregnancy tests would be able to sell more hormonal contraceptives to new clients. Aside from one other study conducted at FP clinics [15], we know of no previous research assessing the impact of providing pregnancy test kits to CHWs to increase contraceptive distribution.

There are two complementary pathways that could explain why providing CHWs with the tests increases the number of hormonal contraceptive clients. First, the pregnancy test could serve as a confirmation or a substitute for the checklist, which CHWs do not view as reliable. Alternatively, the availability of free pregnancy tests could induce women to approach CHWs to determine pregnancy status. This would present an opportunity for the CHW to provide FP counseling and potentially sell contraceptives. We were unable to distinguish

[5] These estimates are regression adjusted. The unadjusted treatment-group mean is 3.10 new clients per month and the unadjusted control-group mean is 2.52 new clients per month. The unadjusted impact estimate is thus 0.57 new clients per month, which is a 23% increase from the control-group mean. The unadjusted impact estimate has a p-value of .057.

[6] The results of the analysis using a weighted least-squares regression model are similar. When the weights are applied, the intervention increases the number of new hormonal contraceptive clients per month by 0.6 compared to the control group (p=.021), which represents a 24% increase. The intervention increases the number of injectable clients by 0.4 per month (p=.035), representing a 27% increase. The estimated impact on new oral contraceptive clients is smaller and not statistically significant (p=.190).

between these two pathways since there was no significant difference in the number of FP counseling sessions between the treatment and control groups.

One important consideration for follow-up training relates to the potential for false-negative results, depending on the pregnancy test's sensitivity and when it is administered. If CHWs only rely on pregnancy tests for pregnancy detection, they may inadvertently prescribe hormonal contraceptives to recently pregnant women. According to the Centers for Disease Control and Prevention, the benefit of initiating contraceptive use (other than for intrauterine devices) will likely exceed the risks even if a health-care provider is unable to rule out pregnancy [22]. However, it is preferable not to provide pregnant women with hormonal contraceptives both medically and from a program view because of wasted resources. While we do not know whether the CHWs complemented the use of the checklist with the tests, we recommend that follow-up training promotes their complementary use particularly given this issue. Another reason for promoting their complementary use is because the Malagasy pregnancy checklist also includes hormonal eligibility questions. Training on the pregnancy checklist itself should also be improved since more than 90% of CHWs reported being instructed not to provide hormonal contraceptives to nonmenstruating women despite having been trained to use the checklist.

Our study has certain potential limitations. First, outcome data were collected using voluntarily submitted monthly monitoring forms for which compliance was imperfect: 17% of CHWs did not submit any monitoring forms and 68% submitted three or fewer of the four required forms. Since our results are robust to nonresponse weighting, this reduces the likelihood that our results are biased due to differential response.

Second, there are several factors that limit the generalizability of our findings. The study regions may be different than other regions in Madagascar. The study also took place during the harvest season for rice, the main crop in Madagascar. Because 90% of the CHWs in our study are farmers, this may reduce the amount of time they devote to their work as CHWs and thus attenuate the impact of the intervention. Other seasonal factors, such as the cyclone season and the traditional exhumation period, may have similarly unpredictable effects. Isolated reports of contraceptive stockouts in some districts during the intervention would also attenuate the impact estimate. This study did not assess the impact of selling pregnancy test kits on pregnancies or births. Finally, the results could be different if the CHW and the consumer were required to bear part of the cost.

Our findings show that giving CHWs free pregnancy tests is an effective way to increase distribution of hormonal contraceptives in countries like Madagascar, particularly where health workers are not trained or hesitant to use the pregnancy checklist. As pregnancy tests — which cost less than 10 cents each — become an increasingly affordable alternative for health-care systems in developing countries, community-based distribution programs should consider using the tests as a low-cost addition to CHWs' services.

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Appendix A. Discussion of probability weights to adjust for potential nonresponse bias

We included probability weights in the regression analysis to adjust for potential nonresponse bias resulting from differential nonresponse rates over the 4-month study period between treatment- and control-group CHWs. CHWs who attended a training session subsequently submitted 74% of all monitoring forms in the treatment group, compared with 72% in the control group. The rate of nonresponse in the treatment group compared to the control group was not statistically significant (p-value is .336). However, there may be differences between treatment and control in the types of CHWs who tend to submit their monitoring forms. To correct for this potential source of bias, we modeled the probability of submitting a reporting form, estimated separately for the treatment and control groups, as a function of region, district and the baseline characteristics for which data were complete for the sample of CHWs who attended the study launch sessions[7]. Since the data were combined across the 4 months

[7] The set of baseline characteristics that were complete for the entire sample of CHWs attending the trainings includes sex, marital status, educational attainment and whether had ever experienced a shortage of injectables from the supplier, as well as the number of monthly contraceptive clients at the time of randomization (January 2013).

in the analysis, we normalized the probabilities by month so that each month of data is given equal weight in the main analysis. Because this method resulted in some probability weights representing extreme outliers (due to low response propensities), we performed a typical adjustment to the weights, whereby we sorted them into deciles and calculated an average weight within each decile. The inverse of the predicted probability of submitting a reporting form is used as the probability weight for the main analyses.

References

[1] World Health Organization, World Bank, UNICEF, United Nations Population Fund. Trends in Maternal Mortality: 1990 to 2008. Geneva, Switzerland: World Health Organization; 2010.

[2] Cleland J, Bernstein S, Ezeh A, Faundes A, Glasier A, Innis J. Family planning: the unfinished agenda. Lancet 2006;368:1810–27.

[3] Marston C, Cleland J. The Effects of Contraception on Obstetric Outcomes. Geneva, Switzerland: Department of Reproductive Health and Research, World Health Organization; 2004.

[4] Clifton D, Kaneda T. Family Planning Worldwide. Washington, DC: Population Reference Bureau; 2013.

[5] World Health Organization, United States Agency for International Development, Family Health International. Community-Based Health Workers Can Safely and Effectively Administer Injectable Contraceptives: Conclusions for a Technical Consultation. Research Triangle Park, NC: Family Health International; 2009.

[6] World Health Organization. WHO Recommendations: Optimizing Health Worker Roles to Improve Access to Key Maternal and Newborn Interventions through Task Shifting. Geneva, Switzerland: World Health Organization; 2012.

[7] World Health Organization. Selected Practice Recommendations for Contraceptive Use. Geneva, Switzerland: World Health Organization; 2004.

[8] Family Health International, Ministère de la Santé, du Planning Familial et de la Protéction Sociale, United States Agency for International Development. Safety, Feasibility, and Acceptability of Community-based Distribution (CBD) of Depot Medroxy Progesterone Acetate (DMPA) in Madagascar. Antananarivo, Madagascar: USAID; 2008.

[9] Shelton JD, Angle MA, Jacobstein RA. Medical barriers to access to family planning. Lancet 1992;340:1334–5.

[10] Stanback J, Thompson A, Hardee K, Janowitz B. Menstruation requirements: a significant barrier to contraceptive access in developing countries. Stud Fam Plan 1997;28:245–50.

[11] Stanback J, Qureshi Z, Sekadde-Kigondu C, Gonzalez B, Nutley T. Checklist for ruling out pregnancy among family-planning clients in primary care. Lancet 1999;354:566.

[12] Stanback J, Diabate F, Dieng T, Duarte de Morales T, Cummings S, Traore M. Ruling out pregnancy among family planning clients: the impact of a checklist in three countries. Stud Fam Plan 2005;36:311–5.

[13] Tepper N, Marchbanks P, Curtis K. Use of a checklist to rule out pregnancy: a systematic review. Contraception 2013;87:661–5.

[14] Hoke TH, Wheeler SB, Lynd K, et al. Community-based provision of injectable contraceptives in Madagascar: "task shifting" to expand access to injectable contraceptives. Health Policy Plan 2012;27:52–9.

[15] Stanback J, Vance G, Asare G, Kasonde P, Kafulubiti B, Chen M, et al. Does free pregnancy testing reduce service denial? Glob Health Sci Pract 2013;1:382–8.

[16] Chard T. Pregnancy tests: a review. Hum Reprod 1992;7:701–10.

[17] Min J, Buckel C, Secura G, Peipert J, Madden T. Performance of a checklist to exclude pregnancy at the time of contraception initiation among women with a negative urine pregnancy test. Contraception 2015;91:80–4.

[18] Kashima S, Suzuki E, Okayasu T, Jean Louis R, Eboshida A, Subramanian SV. Association between proximity to a health center and early childhood mortality in Madagascar. PLoS One 2012;7:e38370.

[19] INSTAT. Enquete Nationale Sur le Suivi des Objectifs du Millenaire pour le Developpement a Madagascar. Etude Nationale Objectif 05. Antananarivo, Madagascar: INSTAT; 2012–2013.

[20] Jones M. Indicator and stratification methods for missing explanatory variables in multiple linear regressions. J Am Stat Assoc 1996;91:222–30.

[21] Puma M, Olsen R, Bell S, Price C. What to Do When Data Are Missing in Group Randomized Controlled Trials (NCEE 2009–0049). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education; 2009.

[22] Centers for Disease Control and Prevention. U.S. Selected Practice Recommendations for Contraceptive Use, 2013: Adapted from the World Health Organization Selected Practice Recommendations for Contraceptive Use, 62 (RR05); 20131–6 [Accessed on August 28, 2015 at http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6205a1.htm?s_cid=rr6205a1_w].