

Original research article

Cost of providing injectable contraceptives through a community-based social marketing program in Tigray, Ethiopia

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Abstract

Objective: To provide a cost analysis of an injectable contraceptive program combining community-based distribution and social marketing in Tigray, Ethiopia.

Methods: We conducted a cost analysis, modeling the costs and programmatic outcomes of the program's initial implementation in 3 districts of Tigray, Ethiopia. Costs were estimated from a review of program expense records, invoices, and interviews with health workers. Programmatic outcomes include number of injections and couple-year of protection (CYP) provided. We performed a sensitivity analysis on the average number of injections provided per month by community health workers (CHWs), the cost of the commodity, and the number of CHWs trained.

Results: The average programmatic CYP was US \$17.91 for all districts with a substantial range from US \$15.48–38.09 per CYP across districts. Direct service cost was estimated at US \$2.96 per CYP. The cost per CYP was slightly sensitive to the commodity cost of the injectable contraceptives and the number of CHWs. The capacity of each CHW, measured by the number of injections sold, was a key input that drove the cost per CYP of this model.

Conclusion: With a direct service cost of US \$2.96 per CYP, this study demonstrates the potential cost of community-based social marketing programs of injectable contraceptives. The findings suggest that the cost of social marketing of contraceptives in rural communities is comparable to other delivery mechanisms with regards to CYP, but further research is needed to determine the full impact and cost-effectiveness for women and communities beyond what is measured in CYP.

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1. Introduction

Injectable contraceptives like depot-medroxyprogesterone acetate (DMPA) are becoming increasingly popular in many countries because of their safety, convenience, privacy, and effectiveness [1,2]. A commonly used method in sub-Saharan Africa [3], injectables are more challenging for women with limited access to health facilities because it requires an injection every 3 months [4]. One way to increase access is to task-shift administration to lower-level pro-

viders, thus alleviating strains on overburdened clinic staff and extending access to modern contraceptives to rural communities. Since the 1970s, safe, effective, and acceptable community-based distribution (CBD) models for delivery of injectable contraceptives have been established in South America, Asia, and more recently, sub-Saharan Africa [2,5–13]. However, the expansion of the health workforce, particularly for contraceptive delivery, is often an ambitious and expensive undertaking.

Given limitations in overall funding, program planners have to determine which service delivery approaches to prioritize within family planning programs, yet little is known about the cost of various models of contraceptive delivery. In the family planning literature, the most common

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measure of output has been couple-year of protection (CYP) [14]. Across studies, there is considerable variability in costing methods, scale and setting of the program, level of demand, supply and service infrastructure, and content and quality of the services. The average commodity cost of contraception, as procured by governments of developing countries and adjusted for inflation in 2011, is US \$2.35. While commodity costs are relatively constant across programs, there is significant variation in program costs based on mode of delivery [14]. There is also considerable variation among regions; costs per CYP in Africa were greater than the global average, costing between US \$8.02–\$20.32 per CYP [14]. Adjusting these 2001 estimates for inflation, the range would be US \$10.19–\$25.82 in 2011 USD [15]. Meanwhile, the methods of contraceptive provision and the outcomes measured are variable across studies [16].

Governments need cost-reducing strategies to offset the financial burden of meeting the growing demand for contraceptives. CBD, which brings family planning information and services to women in their homes, has been shown to effectively meet the growing demand for contraceptives, but still remains one of the more expensive modes of service delivery in Africa [14]. CBD is more effective when combined with strategies to improve community perceptions of family planning [17]. Social marketing links affordable, branded products with mass media campaigns, which, depending on the country, may include radio, television, billboards and other media outlets to raise awareness and change behavior. Social marketing programs have improved access to contraceptives for the urban poor by using existing private outlets to sell affordable contraceptive methods while partially or fully recovering costs, but have had limited application in rural settings [18]. At the same time, the provision of public health services with user fees, or costs of services and commodities imparted on the client, has been a key strategy employed in developing countries to address inadequate financing for health [19].

Consequently, our research team set out to test a model which combined CBD with social marketing in Tigray, Ethiopia where over 80% of the population is considered rural and 44% of married women report a demand for family planning, half of which is currently unmet [20]. Prata et al. (2011) had already demonstrated the safety, acceptability, and effectiveness of CBD of DMPA with community health workers (CHWs) in Ethiopia [9].

1.1. Program Model

Building upon the pilot study, CHWs were trained to become social marketers of DMPA in their rural communities as a way to sustainably scale CBD [21]. Mekelle University, the Women's Association of Tigray, and the Tigray Regional Health Bureau partnered with the Bixby Center for Population, Health and Sustainability at the University of California, Berkeley to implement this intervention over three years. Each

CHW was trained to meet competencies in the clinical provision of injectable contraceptives and social marketing practices. CHWs were provided with microloans of 25 injections from a drug revolving fund (DRF) at the end of the training and returned to their villages to market their services through print media and community outreach. The DMPA product used in this intervention was distributed by DKT-Ethiopia (a private not-for-profit social marketing organization registered in Ethiopia to procure, market and distribute branded products to promote family planning) and is marketed under the brand name *Confidence*. The CHWs sold each injection for 5 birr (US \$0.29), returned 3 birr (US \$0.17) to the DRF, and kept 2 birr (US \$0.12) as their commission, but they did not receive a base salary [22]. The CHWs were able to provide some injections for free, in cases where women were not able to pay or reach facilities for free services. In these cases, the CHW was not responsible for the cost of the drug and did not receive a commission from the transaction. The 5 birr charged per injection was determined from willingness-to-pay data collected during the pilot study and from the baseline data for the current program [21,23].

Using program funding from Joffe Charitable Trust, an initial sum of \$10,500 was provided as a capital investment to purchase DMPA for the DRF, which was managed by the Women's Association of Tigray, a civil society organization. DMPA injections were purchased for 3 birr (US \$0.17) per unit, a price that is subsidized by DKT-Ethiopia. A 2012 United Nations Population Fund analysis found the average cost of one injection globally to be US \$0.86, thus the price differential should be considered when thinking about the findings from this analysis [24].

Although there has been contextual evidence of the health and social benefits of CBD of contraceptives [13], no analysis has explored the cost per CYP of a model incorporating social marketing of injectable contraceptives in a rural setting. The purpose of this particular study is to present results from a cost analysis of the contraceptive delivery program, which combines social marketing and community-based distribution. The analysis covers the initial three rural woredas (districts) in the first year and explores key variables driving the cost per CYP. In the analyses below, we estimate the following: (1) cost of delivery of injectable contraceptives from the provider perspective; (2) impact of the program in terms of CYP; and (3) the sensitivity of the cost per CYP to changes in input variables.

2. Methods

Data on the number of injections provided by the program from the first year of the program (November 2011 through October 2012) in three districts were collected and translated into CYP. Analyses were performed in Microsoft Excel 2010 and CYP was estimated for the overall program and for each district.

2.1. Outcomes

Contraceptive protection was measured by CYP, a commonly adopted measure used to assess the relative effectiveness of a contraceptive program in the private sector. CYP is the estimated protection provided by contraceptive methods during a one-year period, based upon the volume of all contraceptives distributed to clients during that period. CYP was calculated by multiplying the number of injections provided to clients by a conversion factor of 0.25, to yield an estimate of the duration of contraceptive protection provided per unit of that method [25].

2.2. Costs

Costs were estimated based on 2011 costs in Ethiopian birr and converted to USD using a conversion of 17.15 birr per USD. This analysis omits costs to the client and costs associated with unplanned pregnancies (antenatal care, complications at birth, death). Cost data were collected by first reviewing financial statements to identify consumable, reusable, and human resource inputs.¹ Three categories of cost were identified: direct costs, indirect costs, and operating costs.

A. *Direct costs* are those associated specifically with the set of services provided, in this case, contraceptive delivery. The clinical and social marketing time spent by the CHWs² was multiplied by the opportunity cost of the CHWs' time, or the cost of their time that could have been spent on other activities if they were not involved in this program. In the absence of collecting primary data on actual time spent in a time-motion study, we used a conservative estimate of 15 min per injection provided to take into account the time spent providing family planning counseling and delivering the injection. We excluded CHW time traveled to reach clients because many of the CHWs reported delivering services within their own homes. The amount of time CHWs spent on activities other than delivering family planning services was estimated from speaking with CHWs during in-depth interviews. We estimated that each CHW spends a minimum of one hour per week on social marketing activities. There is likely wide variability in this estimate depending on the proximity of CHWs' villages to health facilities and the level of unmet need in the surrounding area. We do not assume that direct input (time spent on

social marketing) is related to outcomes (number of injections provided) in this analysis. The opportunity cost of the CHWs' clinical and social marketing time was determined using 2012 Gross National Income (GNI) per capita, which was the best available approximation of the value of their time³ [26]. The cost of DMPA is included in the direct costs, which was converted from birr into 2011 USD, the year when the DMPA was purchased [22]. To reflect the below-market unit cost paid by the program, we explore a wider range of unit costs in the sensitivity analysis.

- B. *Indirect costs* are those associated with training CHWs⁴ and collecting data on number of injections provided by CHWs per month. The cost for training CHWs was estimated at US \$120 and, for purposes of this analysis, we assumed the training covers five years, and the year one cost for training was one-fifth of the total training cost. One hundred thirty-seven CHWs were recruited from the three districts to participate in the training. There was one Maternal and Child Health (MCH) expert located in each of the three districts who was responsible for keeping track of the program records and compensated with 500 birr per month stipend.
- C. *Operating costs* include those associated with managing the DRF and resupplying CHWs with DMPA. The Women's Association of Tigray resupplied DMPA injections, collected and recorded resupply data and money received from CHWs, managed the DRF, and provided data to the Program Coordinator. The annual operating costs included time, overhead, and supplies, which totaled US \$5000 in year one.

The following equations were used to calculate costs:

- (1) The *programmatic cost* of the program in year one is represented by the equation,

$$Y_1 = \text{direct costs} + \text{indirect costs} + \text{operating costs}$$

- (2) The *direct service cost* of the program in year one is represented by the equation,

$$Y_2 = \text{direct costs}$$

2.3. Cost per CYP

CYP was estimated by dividing the number of injections provided (taken from the client logs) by four. This conversion

¹ Financial records were reviewed periodically for accuracy. We believe they were reliable, as cost for human resources and other inputs were compared with those paid and expenditure reports. Three institutions were involved in keeping financial records that were consolidated to report to the donor: University of California, Berkeley; Mekelle University College of Health Sciences; and Women's Association of Tigray.

² Estimated from qualitative data and supportive supervision in which program staff accompanied CHWs during program activities.

³ GNI per capita is a common approach when estimating wages in developing countries for those who work outside the formal sector of the economy.

⁴ CHW training of 4 days includes the cost of space, participant stipends, office supplies, injection training supplies, CHW supply bags, and per diems for supervisors and trainers.

Table 1
Programmatic inputs and outcomes in Year 1

	All	District A	District B	District C
Number of community health workers (CHWs)	137	48	48	41
Average injections per month per CHW	1.52	2.06	0.81	1.70
Number of injections provided per year ¹	2497	1184	464	834
Percentage doses free per year	31	32	28	31
Estimated clinical time per injection (h)	0.25	0.25	0.25	0.25
Social marketing time per week (h)	1	1	1	1

¹ The number of injections in each district was calculated by taking the total injections provided in each district and adjusting for CHW person-months. Most CHWs were enrolled in the project for 12 months.

factor was used because DMPA is active at full protection for approximately three months, thus four doses are needed for one year of protection [10]. The cost per CYP for each district was compared against one another and with program averages. We calculated the full programmatic cost per CYP (includes direct, indirect and operations costs) and the total service costs per CYP (includes only direct cost) for each district and the total program for year one.

2.4. Sensitivity analysis

Sensitivity analyses were performed on several input variables in order to assess relative change in CYP given changes in the input variables. The input variables that could potentially be intervened upon through management strategies were selected. For each scenario, a new cost per CYP was estimated. We considered the CYP cost of the program to be the baseline and estimated new CYPs for each input variable by decreasing or increasing its value. We present the results in graphs along with the associated cost per CYP:

- The average number of injections per CHW per month, ranging from 0.5 (baseline) to 4.
- The cost per dose of DMPA, ranging from US \$0.17 (baseline) to US \$2.00.
- The number of CHWs trained, ranging from +/-50% of the baseline value of 137.

3. Results

Table 1 presents the inputs and programmatic outcomes for each of the three districts. We refer to each district by a randomly assigned letter. The inputs used in estimates are averages from the three initial implementing districts. The greatest differences across districts were related to injection provision, both monthly average among CHWs and total number per year. We calculated the number of injections in each district by taking the total injections provided in each district and adjusting for CHWs person-time. The first training of CHWs took place at the start of the program and the second 3 months later. CHW person-time was a function of the number of months each CHW spent on the program and the

Table 2
Unit costs (2011 USD)¹

Unit of injectable contraceptive	\$0.17
Opportunity cost of community health worker's time (per hour) ²	\$0.19
Maternal and child health district experts	\$1044.00
Women's Association of Tigray district supervisors	\$5000.00
Training per community health worker	\$120.00
Community Health Worker commission per dose	\$0.12

¹ 1 USD=17.2 birr (Mobile Soft Jungle. Online Currency Converter. Ethiopian birr (ETB) and United States dollar (USD) Year 2012 Exchange Rate History. Sunnyvale: Yahoo Finance; 2014.)

² Calculated using 2012 GNI per capita (World Bank, 2012).

number of CHWs in each district. On average, each CHW provided 1.5 injections per month during the program period, with an estimated 31% given free of charge. Table 2 presents the unit costs in 2011 USD, which were used in the analysis. The one exception to this is the CHW time, which was calculated using 2012 GNI per capita given that most of their opportunity costs were accrued in 2012.

The average programmatic cost per CYP for all districts is US \$17.91 (Table 3). Cost per CYP ranged from US \$15.48 in District A to US \$38.09 in District B. Average direct cost per CYP for all districts was US \$2.96. The programmatic cost for all districts combined was US \$11,179. Forty-five percent of programmatic costs were operating costs, 39% were indirect costs, and 16% were direct costs.

We explored the impact on cost per CYP of varying several key inputs in one-way sensitivity analyses. The cost per CYP is very sensitive to the average number of injections given by each CHW per month (Fig. 1). When 0.5 injections are given per CHW per month, the programmatic cost per CYP would be US \$53.01. Whereas, when 4 injections are given per CHW per month, the programmatic cost per CYP would drop to US \$7.22. The effect of the commodity cost per injection was explored by entering the values corresponding to the private sector costs in Ethiopia ranging from US \$0.58 to US \$2.00 (Fig. 2). The program level commodity cost per injection is US \$0.17, which is subsidized. The programmatic cost per CYP would be US \$25.23 if we set the commodity cost at US \$2.00, compared to the current cost per CYP of US \$17.91. The number of CHWs trained was varied +/-50% from the baseline level. The programmatic cost per CYP ranged from US \$27.78 with 69 CHWs to US \$14.62 with 206 CHWs (Fig. 3).

4. Discussion

Our findings are from a unique program that combines CBD with social marketing in rural areas. It provides insights for organizations and governments trying to provide affordable family planning services in rural areas. While difficult to compare results, as we did not find cost analyses of similar programs, results are consistent with other family planning cost per CYP estimates from sub-Saharan Africa. In 2010, the United States Agency for International Development (USAID)

Table 3
Cost estimates by scenario in Year 1

	Total programmatic costs	Total service costs	District A	District B	District C
Direct costs					
Cost of injections (per year)	\$424.48	\$424.48	\$201.23	\$78.91	\$141.82
CHW ¹ — Clinical time on injection provision (per year)	\$120.70	\$120.70	\$60.33	\$22.28	\$38.10
CHW — Social marketing time (per year)	\$1301.50	\$1301.50	\$456.00	\$456.00	\$389.50
Total	\$1846.68	\$1846.68	\$717.56	\$557.19	\$569.42
Indirect costs					
CHW training cost per year (5 years)	\$3288.00	-	\$1152.00	\$1152.00	\$984.00
Maternal and Child Health District Experts (per year)	\$1044.00	-	\$1044.00	\$1044.00	\$1044.00
Total	\$4332.00	-	\$2196.00	\$2196.00	\$2028.00
Operating costs	\$5000.00	-	\$1666.67	\$1666.67	\$1666.67
Total costs	\$11,178.68	\$1846.68	\$4580.22	\$4419.85	\$4264.08
CYP	624	624	296	116	209
Cost per CYP	\$17.91	\$2.96	\$15.48	\$38.09	\$20.45

¹ Community health worker.

estimated the public sector cost per CYP for Ethiopia to be US \$3.93 for commodities plus supplies with an additional \$0.40 for personnel costs [27]. Private clinics were estimated to have a relatively similar commodity cost but a slightly lower (US \$0.36) personnel cost. The personnel cost was estimated at US \$0.02 per minute for Health Extension Workers (HEWs) at 5 min per visit for an injection. If we set the commodity cost at US \$3.93 in our analyses, the direct cost per CYP would be US \$18.00, which is higher than the USAID estimate, but within the range of earlier estimates for African costs per CYP using social marketing (US \$15.95) and CBD (US \$20.32) [14]. Adjusting these 2001 estimates to 2011 USD, the costs per CYP would be US \$20.27 and US \$25.82, respectively [15].

We compared the USAID estimate to our direct cost of US \$2.96, which includes similar inputs but with a heavily subsidized commodity cost. The personnel costs in our analysis reflect a more conservative understanding of the opportunity cost of CHWs, who are non-salaried and less skilled than the HEWs included in the USAID estimate. We allow for 15 min per injection and 1 h per week for activities related to promoting community understanding of injectable contraceptives and recruiting clients. Our results are exclusively for rural populations, for whom it is typically more expensive to provide services because of inadequate or nonexistent health infrastructure [28], while the USAID figure was mainly for urban populations.

Our sensitivity analyses demonstrate how the cost per CYP could be reduced by striving to make adjustments to aspects of our program. We examined the impact of varying the number of CHWs enrolled in each district, which had an increasing benefit from economies of scale. The number of injections per CHW is a critical determinant of cost-effectiveness: by doubling the average number of injections per CHW from 1.5 per month to 3, the cost per CYP would be halved. The heterogeneity in cost per CYP across districts was largely driven by the distribution of number of injections per month for each CHW. Factors such as the unmet need in the area served and the time and effort inputs by each CHW are likely to influence the number of injections provided.

Two program components may contribute significantly to the cost of CYP with implications for programming and market shaping: commodity cost and the number of injections given by a CHW. Commodity cost has a minor role in total CYP cost, while the number of injections given has a major role. The cost of commodities absorbed by clients will continue to be subsidized, but the level and duration are currently unclear. Contraceptive prices should be set according to ability to pay in rural areas. The number of injections given, the most important factor contributing to cost per CYP, can be a function of unmet need for injectables and will vary according to the stages of fertility decline, as well as changes in method preference among rural women.

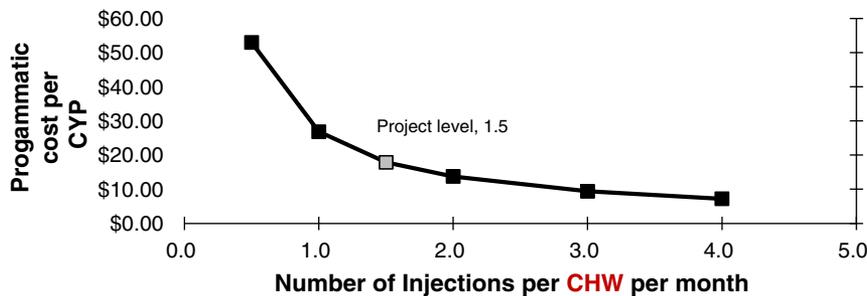


Fig. 1. One-way sensitivity analysis on number of injections per CHW.

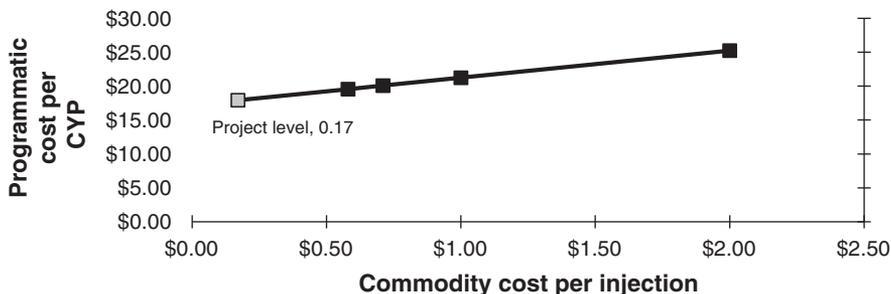


Fig. 2. One-way sensitivity analysis on the cost of one injection.

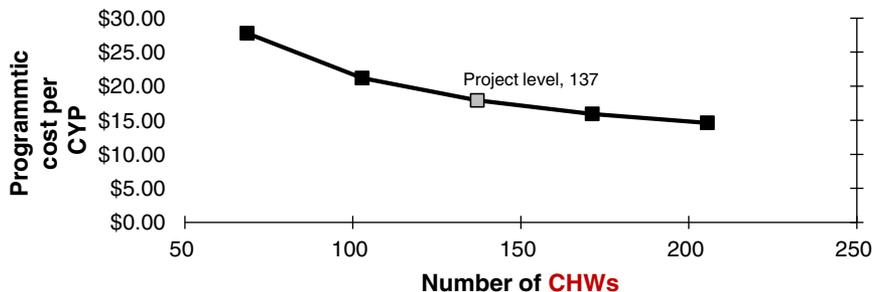


Fig. 3. One-way sensitivity analysis on number of trained CHWs.

The implications for this analysis in family planning and programing have limitations. The cost per CYP is a measure of intermediate program outcomes and not the impact on health. Analysis of the cost-effectiveness of the program would be necessary for future planning, as it would illustrate the impact of the program by comparing reproductive health outcomes in program districts to reproductive health outcomes in reference districts. For example, pregnancies-averted is an indicator of fertility impact and can be estimated by dividing the CYP distributed in a population by the mean birth interval [29]. Unfortunately, current available data prevent us from calculating these estimates. In the rural areas of Tigray, many women may have had limited access to modern methods of their choice without this program. However, we were unable to capture the potential changes in health outcomes associated with the increased access to DMPA provided by this program, and thus, we were not able to do a true cost-effectiveness analysis. Nonetheless, DMPA is the fastest growing contraceptive method in rural Africa and WHO has recommended that countries increase access to community distribution of DMPA [10]. Our analysis provides insights on cost per CYP for an approach combining CBD and social marketing, a model that can be replicated and easily adapted in other rural settings with high demand for DMPA.

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