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Alleviating price and information barriers to long-acting contraception uptake in Kenyan pharmacies using patient and provider incentives: a cluster randomized control trial

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Summary

Background Access to modern family planning impacts women's health, education, and economic well-being. Persistent barriers to accessing long-acting methods, such as price and lack of information, limit adoption. This study highlights the potential of a novel payment and incentive structure for pharmacies, a key access point for contraceptives for young women in particular, to improve access to subcutaneous depot medroxyprogesterone acetate (DMPA-SC). By targeting incentives to either patients or providers through a low-cost digital tool, the intervention aims to enhance contraceptive choice cost-effectively with potential for scale.

Methods We randomized 137 pharmacies in Kenya into three intervention arms, varying patient copay, pharmacy profit, or pharmacy cost to stock DMPA-SC, plus a status quo control group that conducted pharmacy operations as usual. All pharmacies used an app-based platform for sales and inventory tracking, and a digital tool to manage family planning sales, through which client discounts for DMPA-SC, pharmacy cost to stock DMPA-SC, or pharmacy profit for DMPA-SC were experimentally varied in the intervention arms. We used double/debiased machine learning for adjusted models, with the primary outcome being uptake of DMPA-SC, and secondary outcomes being couple-years of protection, and an analysis of price and information mechanisms.

Findings We analyzed data from 26,883 family planning visits (C = 7605, T1 = 7774, T2 = 5009, T3 = 6495) between August 2022 and May 2023. Providing consumer discounts and provider incentives through a pharmacy-facing intervention increases adoption of DMPA-SC by 14 percentage points (control mean: 0.03), while decreasing use of short-acting methods by 13 percentage points (control mean: 0.92), compared to a control group. Interventions alleviated both price and information barriers to access through a 100% price pass through in the consumer discount arm and an increase in comprehensive counseling by 68 percentage points in the provider-side arms, all compared to the status quo control group. Targeted incentives increase couple-years of protection (CYP) for $2.56–$12.50 per CYP.

Interpretation Pharmacy-based interventions that reduce price and information barriers of DMPA-SC can expand women's contraceptive options, with implications for choosing longer-acting methods. Pharmacies are crucial access points for family planning in Kenya and globally. Understanding how pharmacy-specific interventions influence access to modern methods can generate evidence on this understudied and important care setting.

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Keywords: Family planning; Pharmacy; Digital tools; Incentives; Provider decision-making; Contraceptives; DMPA-SC

Abbreviations: DMPA-SC, Depot medroxyprogesterone acetate DMPA-SC; DMPA-IM, Depot medroxyprogesterone acetate intramuscular injection; CYP, Couple-years of protection; KES, Kenyan shillings; USD, United States dollars

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Research in context

Evidence before this study

Access to modern family planning methods significantly impacts women's health, education, and economic well-being. Despite the authorization of subcutaneous depot medroxyprogesterone acetate (DMPA-SC) in 33 countries, its uptake remains low due to persistent demand-side barriers such as price and lack of information. Previous studies have shown that targeted subsidies and provider incentives can improve healthcare utilization and outcomes, but there is limited large-scale evidence on their effectiveness in the context of family planning and specifically in pharmacy settings, and the pathways through which they operate.

Added value of this study

This study adds to this literature by evaluating the impact of patient and provider incentives on the uptake of DMPA-SC in Kenyan pharmacies through a large-scale cluster randomized control trial in 137 sites. Pharmacies are crucial but understudied access points for contraceptives for Kenyans, particularly young women, that complement the public health care system. Pharmacies tend to be proximate to where people live and work, making them convenient and practical locations to seek care and health commodities. By experimentally varying patient copay, pharmacy profit, and pharmacy cost to stock DMPA-SC, the study provides robust evidence on how these interventions can alleviate price and information barriers for patients. The findings demonstrate that both consumer discounts and provider incentives significantly increase the adoption of DMPA-SC, reduce the use of short-acting methods, and are highly cost-effective in increasing couple-years of protection. Consumer discounts operate by reducing price barriers to patients, while provider incentives operate by encouraging providers to give more information to patients about their contraceptive options.

Implications of all the available evidence

The results suggest that pharmacy-based interventions can effectively and cost-effectively expand contraceptive options for women by addressing financial and informational barriers. These findings have important implications for policymakers and healthcare providers, highlighting the potential of pharmacies as crucial access points for family planning services. The study underscores the need for further research to explore the long-term impacts and scalability of such interventions in different contexts.

Introduction

Improving access to long-acting contraception has long been a policy priority for countries around the world.[d] Many strategies to achieve this goal focus on increasing the availability of discreet, longer-acting methods through accessible distribution channels, including pharmacies and drug shops. Subcutaneous (SC) depot medroxyprogesterone acetate (DMPA) is a relatively new and appealing option.[3] The lower dose, smaller needle size and subcutaneous administration of product in an all-in-one device facilitates administration by a broader set of providers and even users themselves through self-injection.[3,4,e] Despite being authorized for broad use in 33 countries, uptake remains low, suggesting the existence of persistent barriers.[6,7]

For family planning users, price barriers as well as lack of awareness or misinformation about DMPA-SC may contribute to low demand.[8–10] Targeted subsidies, either through lower prices for patients or cost and performance incentives for providers, are commonly used to encourage adoption in health investments with demand-side barriers.[f] In settings where contraceptive users face liquidity constraints and long-term methods are more expensive up front than short-term options, patient subsidies may make the price of long-term methods such as DMPA-SC more comparable to alternatives. Patients decide on products not just based on price, but also on the information and advice from healthcare professionals. Performance incentives may cause providers to give patients more and better information about their contraceptive choices.[g] In Kenya, where unmet need for contraception persists, particularly among young women, community pharmacies present an opportunity to reach women who are not currently served through other channels.[17–20]

This study bridges the literatures on patient subsidies and provider performance incentives in the context of DMPA-SC adoption and contraceptive choice. Using a large-scale cluster randomized control trial (cRCT) in Kenya, we randomized 137 private pharmacies into three intervention arms, varying patient copay, pharmacy profit, or pharmacy cost to stock DMPA-SC, plus a control group. We tested whether these interventions worked by reducing client prices or

[d]Women's reliable access to family planning methods that meet their needs for managing their fertility has important downstream effects on women's health outcomes, educational attainment, and economic well-being throughout the life course.[1,2]

[e]DMPA-SC contains 104 mg of depot-medroxyprogesteone acetate (as opposed to 150 mg in intramuscular DMPA (DMPA-IM), a 30% reduction in active ingredient for the same efficacy) and is administered every 3 months.[5]

[f]A large literature has focused on studying the effects of patient subsidies on short- and long-term adoption of healthcare. For two reviews of this literature see.[11,12]

[g]Research shows that incentivizing providers can improve healthcare utilization and outcomes, though studies have focused on a limited range of indicators.[13–16]

improving provider counseling, and evaluated their cost-effectiveness compared to the status quo. Patient discounts directly alleviate price barriers to purchasing DMPA-SC, while provider-side interventions may indirectly lower patient prices while nudging providers to provide more and better information to patients about DMPA-SC. Our interventions, then, test these two common barriers to adoption. All pharmacies used an app-based platform for sales and inventory tracking, and a digital tool to manage family planning sales, through which incentives for DMPA-SC were experimentally varied in the intervention arms. Our implementing partner managed the interventions and DMPA-SC supply chain, addressing stock barriers.

Our sample consists of private community pharmacies in Kenya. Community pharmacies play a crucial role in providing last-mile health services, including family planning, in Kenya as well as around the world.[17,h] Despite their recognized potential to extend healthcare reach,[21,22] there is limited large-scale evidence on interventions to improve access to family planning methods and counseling in pharmacies. This study helps to fill this gap by rigorously testing a targeted incentive intervention for pharmacy staff that provides patient discounts and provider incentives to reduce financial and informational barriers for DMPA-SC uptake. By examining how cost-lowering interventions affect pharmacy staff decisions and client contraceptive choices, we can better understand the role of incentives in these settings.

Methods

Study design

This was a multi-arm, parallel cluster-randomized trial carried out in 137 private pharmacies located across 21 counties in Kenya between August 2022 and May 2023. Figure S1 shows the distribution of sites across the country—80% of the sites were in Western Kenya, and 20% were near Nairobi and Mombasa. This study was implemented in pharmacies that use a sales tracking and inventory management app operated by Maisha Meds. Maisha Meds is a social enterprise that serves as a pharmaceutical benefits manager for the independent pharmacies in the study sample. All 288 sites in the Maisha Meds network within the study counties without prior exposure to Maisha Meds' family planning programs were screened for eligibility. Sites were excluded if they were not licensed or registered with Kenya's Pharmacy and Poisons Board, if they did not have any family planning services, or if they were less than 0.5 km away from another study site. This distance eligibility criterion was put in place to minimize the likelihood of spillovers given the clustered design.[i] From the 222 sites that met all eligibility criteria, 137 consented to participating in the study and were randomized into the study arms. Fig. 1 shows the study flow diagram.

Randomization and masking

From the 137 eligible and consenting sites, we used stratified randomization based on urbanicity, past availability of subcutaneous family planning methods, and above/below median monthly average family planning product sales volumes. Sites were randomized into treatment groups with a 1:1:1:1 allocation ratio (three treatment arms and one control arm). Randomization occurred in 5 waves between July and November 2022 due to staggered recruitment and onboarding. The smallest wave included 23 sites, and randomization stopped once each arm had at least 33 sites. All arms had a positive probability of assignment in each wave, and wave indicators were included as controls during analysis. Randomization was done by study investigators using Stata V18.

The interventions were implemented by Maisha Meds team members and pharmacy staff, therefore neither pharmacy staff nor the intervention delivery team were blinded. Pharmacy clients and data collection staff were blinded to study arm.

Intervention

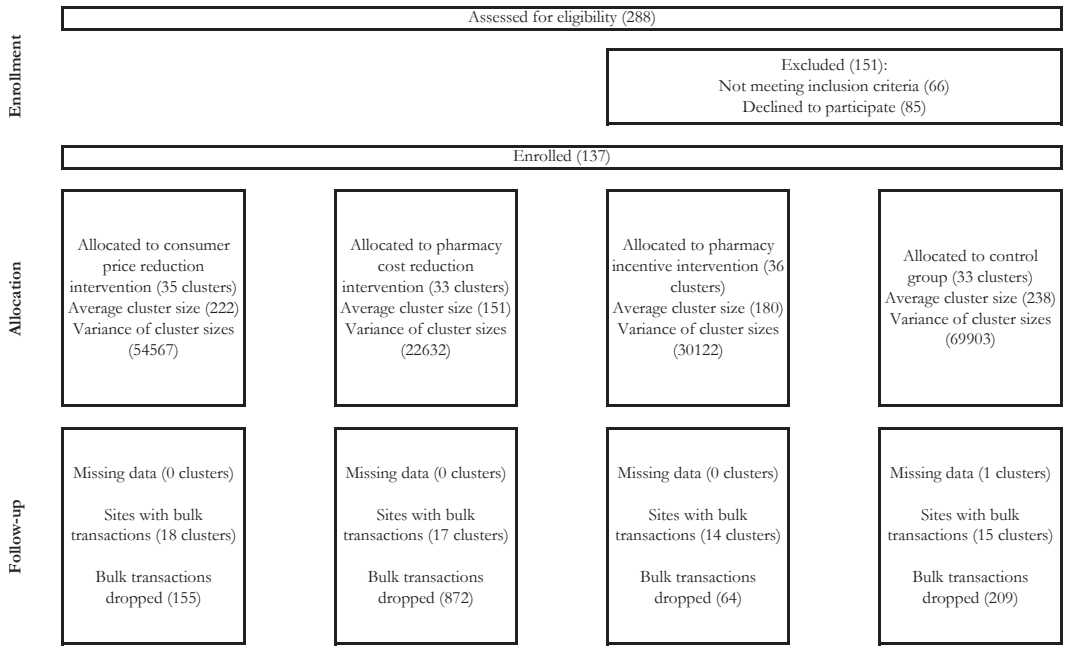
There were four arms: a control group and three intervention arms, with a minimum of 33 sites per arm (N = 137). All study pharmacies used Maisha Meds' digital point-of-sale (POS) system to track sales and were given a fact sheet with information about DMPA-SC to inform counseling on these methods (in Supplementary File). The market price of DMPA-SC in the control group was approximately $1.25USD prior to the study. All intervention arm pharmacies received WHO-prequalified DMPA-SC stock through Maisha Meds, which managed supply chain and distribution on consignment. Fig. 2 provides incentive intervention details (more in Supplementary File).

In the consumer price reduction arm (T1, 35 sites), Maisha Meds supplied free DMPA-SC to pharmacies and the consumer copay for one dose of DMPA-SC (3-month protection) was set at 50 KES, a 60% reduction compared to the market price.[j] Pharmacy staff could only charge clients the fixed price of 50 KES for DMPA-SCs sold through the program. Interested clients were informed of prices via posters and received an automatic price confirmation on their phones at purchase through the POS app. Pharmacies kept the

[h]In Kenya, community pharmacies are authorized to administer DMPA-SC, as well as intramuscular (IM) DMPA, condoms, oral contraceptives, and emergency contraceptives, in addition to providing counseling on alternative options and referrals to health facilities.[18]

[i]The average minimum distance between study sites was 6.5 km, and most study sites were rural or peri-urban.

[j]A 60% subsidy for 3 months of coverage (75 KES) is equivalent to 1 month of coverage using oral contraceptives (73 KES average retail price).



Notes: The size of each cluster refers to the number of unique family planning visits during the study period. Bulk transactions refer to transactions that recorded more than 10 sold products. Missing data refers to clusters that did not record any family planning product sales during the study period.

Fig. 1: Study flow diagram.

50 KES as profit. The 50KES profit was benchmarked against the mean profit in the control group, so this intervention reduces prices to the patient while effectively holding pharmacy incentives constant.

In the pharmacy cost reduction arm (T2, 33 sites), pharmacies were supplied free DMPA-SC but were allowed to set their own consumer prices for DMPA-SC doses sold through the program. Again, pharmacies kept the price charged to consumers as profit.

In the pharmacy incentive arm (T3, 36 sites), pharmacies were supplied free DMPA-SC, were allowed to set their own consumer prices for DMPA-SC doses sold through the program and received an additional 50 KES for each DMPA-SC sale. Pharmacies kept the price charged to consumers plus the additional 50 KES incentive as profit.

The control group (C, 33 sites) did not receive any stock, discounts, or incentives for DMPA-SC. Pharmacies in this arm could purchase DMPA-SC through their standard medication procurement channels and set the prices charged patients. These sites managed their inventory and sales through the Maisha Meds point of sale system.

Participants and procedures

Study sites were selected and randomized according to the procedure described above. All pharmacy clients who sought family planning counseling and purchased contraceptives at study sites were potentially exposed to the interventions. Pharmacy staff could have counseled them on DMPA-SC, and clients may have been eligible for a discounted price depending on the site's assigned intervention arm. Pharmacy staff across all arms were instructed to inform clients that they were free to choose the family planning method that best suited their objectives and lifestyle. Random, unannounced mystery shopper visits were conducted over the course of the study to ensure compliance with study protocols and collect data on client–provider interaction. We collected anonymized transaction data on 26,883 unique family planning client visits and 228 mystery shopper visits across 137 study sites over 8 months.[k]

Ethics approval and consent to participate

This study was reviewed and approved by University of California, Berkeley Committee for the Protection of Human Subjects (CPHS #2021-11-14823), Strathmore University Ethics Review Board (Protocol SU-IERC1233/21) and the Kenyan National Commission for Science, Technology and Innovation (NACOSTI P/22/15858). All participants that were surveyed provided informed consent prior to data collection, and all pharmacy owners and staff provided informed consent to providing anonymized administrative transaction data for this study.

[k]The mystery shopper activity sample includes 82% of study facilities. Coastal Kenyan facilities were excluded due to budget constraints, and a few sites were excluded due to seasonal closures or renovations. There was no differential impact of intervention take-up for this sub-sample, so we treat this subsample as representative of the full study sample.

	C	T1	T2	T3
Cost of DMPA-SC to pharmacy	$0.75	0	0	0
Pharmacy price incentive	0	0	0	$0.50
Patient copay for DMPA-SC	pharmacy sets price	$0.50	pharmacy sets price	pharmacy sets price

Note: $1 USD = 100 KES

Fig. 2: Incentive details by arm.

Trial registration

This study was prospectively registered with the AEA registry for randomized controlled trials (AEARCTR-0009020) and is registered with the Pan-African Clinical Trials Network (PACTR202506634961987).

Data collection

Sites recorded details on all sales through a point-of-sale app, including products sold, quantities, and prices paid by consumers. All transactions were time- and date-stamped. For the intervention arms, when a client purchased DMPA-SC through the program, pharmacy staff registered the client, collected demographic information (age band, gender), and recorded details of the DMPA-SC sold (photograph of the pack, price paid). This information was time- and date-stamped and linked with other products in the same transaction. All data were synced from the pharmacy tablets to the secure Maisha Meds server daily.

Finally, we collected data on client–provider interaction, prices and products purchased, and implementation fidelity through 288 mystery shopper exit surveys between December 2022 and February 2023 (2 mystery shopper visits at each of 114 sites).[l] These data were used to study price and information mechanisms.

Outcomes

Primary and secondary outcomes were assessed among all family planning client visits during the study period. Our primary outcome was purchase of DMPA-SC, with secondary outcomes being purchase of intramuscular DMPA (DMPA-IM), and purchase of short-term family planning methods, including emergency contraception, oral contraception and condoms. We assessed all outcomes at the transaction level. A limitation of the transaction data is its inability to distinguish between first-time and repeat contraceptive users, preventing client-type heterogeneity analysis. Additionally, repeat visits by the same client cannot be tracked, so each transaction is treated as independent. We assessed client price mechanism by generating site-specific average prices of DMPA-SC through transaction data and price reports from mystery shopper exit surveys.[m] We assessed the information mechanism using exit survey data from mystery shoppers, with outcomes being standardized indices of provider counseling on (a) DMPA-SC and (b) general family planning. The DMPA-SC counseling index includes whether provider mentioned DMPA-SC as an option, whether provider discussed DMPA-SC side effects, and whether the DMPA-SC poster was visible at the site. The general family planning counseling index includes the following variables: length of the counseling session, whether the provider gave enough information for client to make an informed decision, whether the provider appeared to be highly knowledgeable about family planning, whether the provider explained things clearly, whether the provider gave any take-home educational materials, whether the provider used illustrations or posters to describe family planning methods, and whether the provider used any physical objects or learning tools to describe family planning methods. Standardized indices were constructed following best practices outlined in Anderson 2008[23]: ordering variables in a consistent direction, demeaning each variable and dividing each by the control group standard deviation, and creating a summary index by setting the weight on each variable equal to the sum of its row entries in the inverted covariance matrix of that variable grouping.

Statistical analysis

Power and sample size calculations

We performed power calculations for pairwise comparisons (Bonferroni-adjusted for 6 comparisons at 80% power, representing pairwise comparisons of each of the three intervention arms to the control group and the other two intervention arms) of 33 intervention and 33 control sites (66 sites) using historical data on our prespecified main outcome: an indicator for whether a transaction includes DMPA-SC (Table 1, column 1). We calculated the minimum detectable effect (MDE) for clustered randomized trials using Stata (V16). Assuming an intra-class correlation of 0.09, a baseline mean of 0.02, and cluster sizes of 120 clients, the experiment was powered to estimate a minimum detectable effect of 5 percentage points on our primary outcome which corresponds to 62% of a 1 SD change (SD = 0.08).

Treatment effects

All analyses are conducted at the transaction level and represent intention-to-treat estimates. For binary outcomes, we report marginal treatment effects from partially linear Double/Debiased machine learning (DML) regression models, with effects interpreted as percentage point changes over the control group mean. We report marginal treatment effects from adjusted models that take the following specification:

$$Y_{ip} = \beta_1 T_{1p} + \beta_2 T_{2p} + \beta_3 T_{3p} + g(\lambda_s, X_p, X_m) + \epsilon_{ip}$$

[l]Number of mystery shoppers by treatment arm: 58 in control group, 58 in T1, 56 in T2, and 56 in T3.

[m]For more details about how site-level average prices were calculated, please refer to the Supplementary File.

	DMPA-SC	DMPA-IM	Short-term methods
T1: Consumer subsidy (β_1)	0.13*	0.01	−0.13**
	(0.06)	(0.03)	(0.05)
T2: Pharmacy cost reduction (β_2)	0.12*	0.02	−0.14**
	(0.06)	(0.03)	(0.06)
T3: Pharmacy incentive (β_3)	0.14*	−0.04	−0.11**
	(0.07)	(0.02)	(0.05)
Treated	0.14***	0	−0.13***
	(0.05)	(0.02)	(0.04)
Control mean	0.03	0.07	0.92
Observations	26,883	26,883	26,883
Clusters	136	136	136
T1 = T2	0.95	0.89	0.86
T1 = T3	0.90	0.16	0.81
T2 = T3	0.86	0.14	0.69

Notes: Stars denote significance adjusted for multiple comparisons using the Holm-Bonferroni method (***p < 0.01; **p < 0.05; *p < 0.1). This table presents double-ML estimates (Chernozhukov et al., 2018), using cross-validated LASSO with randomization strata, ward demographic characteristics, and the characteristics of surrounding census sites. The outcome variable in column 1 is an indicator for whether a family planning transaction includes DMPA-SC. The outcome variable in column 2 is an indicator for whether a family planning transaction includes DMPA-IM. The outcome variable in column 3 is an indicator for whether a family planning transaction includes a short-term method. Treated denotes the average effect across the three treatment arms. Control mean denotes the average value of the outcome variable for the control group. The last three rows present tests of equality for the treatment effects of the study arms.

Table 1: **Uptake of DMPA-SC, DMPA-IM, and short-term methods.**

where Y_{ip} is outcome for transaction i in pharmacy p, T_{jp} are treatment assignment indicators for each intervention j assigned at pharmacy p, with the control group as the reference category, λ_s is a set of strata fixed effects, X_p are pharmacy-level and X_m are ward-level characteristics that enter flexibly through a nonlinear function g (), and ϵ_{ip} is the error term, clustered at the pharmacy level.

To maximize power we use the DML approach described in Chernozhukov et al.[24] We estimate a partially linear regression version of DML that uses cross-validated LASSO as the learner. The potential set of covariates includes indicators for randomization wave, urbanicity, baseline level of sales, baseline availability of DMPA-SCs at site, number of other pharmacies in the surrounding area, fixed features of surrounding sites, ward population density, and the relative wealth index of the ward where the facility is located. In addition to our adjusted DML models, which we present in the main tables, we also report results from unadjusted OLS models which only include treatment assignment and strata fixed effects in the Supplementary File. To account for multiple hypothesis testing, we adjust our p-values using the Bonferroni-Holm stepdown procedure, and all p-values in main tables and in the Supplementary File reflect this adjustment.[25]

Cost-effectiveness

We evaluate the cost-effectiveness of the subsidies in our study by calculating the per-dollar impact of the interventions on couple-years of protection as our primary measure of benefits. We include per-patient costs of the subsidy/incentive program and monitoring costs in T1 as the intervention costs and take an implementer's perspective. Couple-years of protection is defined as the number of years of protection provided by family planning methods due to an intervention and is commonly used to assess the relative impacts of different contraceptive options.[26,27] Couple-years of protection (CYP) for treatment arm T can be estimated by:

$$CYP_T = \sum_m Q_m(T) B_m$$

where $m \in M$ is the set of available family planning methods in the pharmacies, $Q_m(T)$ are the quantities sold for method m in treatment arm T during the study period, and B_m is the conversion factor of a unit of family planning method m into couple-years of protection.[n] For additional details on how couple-years of protection were calculated, see Supplementary File. Cost of the DMPA-SC subsidies/incentives were included in the programmatic costs and were calculated using the per-unit subsidy cost described above (Fig. 2), and the number of sales. Monitoring costs were included for all family planning sales in T1, to account for the fact that when retail prices were set centrally by the program, as is the case in T1, monitoring is needed to ensure that pharmacies charge clients these prices, rather than setting their own.[o]

To estimate the effects on couple-years of protection per dollar spent, for each intervention arm compared to the control group, we estimate the following:

$$ICER = \frac{CYP_T - CYP_C}{subsidy\ cos\ t_T}$$

Patient and public involvement

Our implementing partner piloted the interventions before the study launch to ensure the digital tool was user-friendly and incentives were appropriate for providers and patients. Feedback from pharmacy staff, implementation partners, and clients refined the intervention components and app-based user experience. We pre-tested all data collection tools in a sample of similar pharmacies outside the catchment area.

[n]We use standard conversion factors to calculate couple-years of protection (B_m) as defined in Steiner et al. (2022).
[o]See Supplementary File for additional details on monitoring costs included in T1.

Role of the funding source
The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Results

Sample description
Among the 222 eligible sites in the Maisha Meds network, 137 were randomized and enrolled in the study. On average, each site contributed 5 months of administrative data over the study period, which ended in March 2023. One site did not enter any transaction data over the study period. We removed 1300 transactions from the database because they were wholesale or bulk transactions.[p] This resulted in an analytical sample of 26,883 unique family planning product transactions across 136 sites during the study period. We define family planning product transactions as ones that include any of the following contraception methods: male and female condoms, emergency contraception, oral contraceptives, DMPA-SC, and DMPA-IM.[q]

Table S1 shows that our sample was balanced at baseline across the four arms on stratification attributes. Overall, 37% of sample sites were in urban areas. On average pharmacies had 12.9 other pharmacies located within a 30-min walk. The majority (89%) of study sites were active users of the digital sales and inventory management app prior to the study period. Across all sites prior to study launch, emergency contraceptives, condoms, oral contraceptives, DMPA-SC, and DMPA-IM accounted for 43%, 22%, 19%, 16%, and 8% of family planning commodity sales. There was random imbalance in T1 and T3 for monthly average family planning sales and oral contraceptive sales shares, but a joint orthogonality test across all baseline covariates demonstrated an overall balanced sample across arms.

Effects on contraceptive choices
We find that all three interventions, which reduce financial barriers to accessing DMPA-SCs at pharmacies either directly through consumer discounts or indirectly through supply-side mechanisms, significantly increase the share of pharmacy clients who choose DMPA-SCs as their preferred method of contraception at a given visit (Table 1, Column 1). In the control group, only 3% of family planning client visits result in a purchase DMPA-SC. Both demand- and supply-side interventions significantly increase uptake compared to the control group: family planning clients who receive a discounted price on DMPA-SC are 13 percentage points more likely to choose that option over other methods at a given visit, clients who purchase DMPA-SC from pharmacies that received free commodities are 12 percentage points more likely to choose that option over other methods at a given visit, and clients who purchase DMPA-SC from pharmacies who receive an incentive for counseling on DMPA-SC are 14 percentage points more likely to choose that option over other methods at a given visit. None of the arms are statistically significantly different from one another, suggesting that demand- and supply-side strategies to promote choice around a new contraceptive option work equally well.[r]

In Columns 2 and 3 of Table 1, we investigate substitution patterns across other contraceptive options, to understand how client preferences changed because of the interventions. First, we look at substitution patterns across other long-acting methods available in pharmacies, of which DMPA-IM are the plurality. In the control group, 7% of family-planning client visits resulted in DMPA-IM, and we find no meaningful intervention effects on sales of DMPA-IM (Column 2, Table 1). The fact that clients are not shifting away from DMPA-IM to DMPA-SC suggests that the uptake in DMPA-SC is not being driven by clients who already purchase long-acting methods simply trying an alternative, but close substitute. Column 3 of Table 1 shows substitution patterns for short-term contraceptives. Firstly, the vast majority (92% in the control group) of family planning clients who seek care at pharmacies purchase short-acting methods at a given visit: defined in this context as condoms, oral contraceptives or emergency contraceptives. All three intervention arms reduce the likelihood that a family planning client elects a short-term method, by between 11 and 14 percentage points at a given visit (column 3). The magnitude of this effect directly offsets the increase in DMPA-SC sales, which suggests that women are substituting away from short-acting methods and choosing a longer-acting method when presented with an affordable option and counseled on it.

Assessing price and information channels
We then examine two common access barriers for family planning uptake: price and lack of information (Table 2). First, we look at whether the interventions had any effect on the prices that clients paid for DMPA-SC (Column 1). We find that the consumer subsidy arm has a 70 KES price reduction in DMPA-SC on average relative to the control group mean of 129 KES. This

[p]Wholesale or bulk transactions were defined as transactions that recorded more than 10 sold products in a single transaction.
[q]Long-acting methods, such as intrauterine devices, are out of scope for this analysis. In our sample, they account for <1% of transactions during the study period and are not stocked because sites in our sample do not generally have staff that are trained to administer long-acting methods such as intrauterine devices.

[r]Raw numbers of DMPA-SC sales and family planning sales can be found in the Supplementary File, for the interested reader.

suggests that clients in this arm receive 100% of the discount as intended by the experimental design. On the other hand, in the provider arms we observe that only a small part of the incentive is shared with clients (approximately 33% of the total subsidy size). The lack of difference in client price between T2 and T3 suggests that very little of the provider incentive is passed through to patients. The rest of this table examines whether provider counseling changed because of the interventions. Column 2 of this table presents evidence that providers share more information about DMPA-SC to patients during counseling in the pharmacy arms (T2 and T3) relative to the control group. At the same time, there are no significant effects on the amount of information being shared about alternative methods or general family planning information (Column 3). This suggests that when incentivized directly, as in T2 and T3, providers change their counseling to give more information to patients about new long-term methods.

Cost-effectiveness results

We conduct a cost-effectiveness analysis in terms of dollars spent per couple-years of protection achieved because of the interventions to contextualize the effectiveness results. Table 3 presents the cost-effectiveness of each intervention arm compared to the status quo control group. We find that in the consumer price reduction arm (demand-side), an additional couple-year of protection costs $12.50. In the pharmacy cost-reduction arm, we estimate that an additional couple-year of protection costs $2.56, so by this metric providing the commodities for free to pharmacies is more cost effective. In the pharmacy incentive arm, which has a slightly larger subsidy size per product sold by 50 KES ($0.42 USD using July 2022 exchange rates), we find that an additional couple-year of protection costs $8.33, suggesting that the larger subsidy sizes have diminishing returns.

Table S2 compares cost-effectiveness estimates from this intervention to other estimates from studies measuring cost-effectiveness of family planning interventions (information, vouchers, and provider-facing interventions) in terms of couple-years of protection.[28–31] Comparison interventions reported costs/CYP, and all interventions assessed had an information component. Details of the interventions differed (information alone, information and vouchers, provider-facing intervention, mobile-based support), as did the setting. Broadly, though, we find that the incentive interventions in our study are more cost-effective than other family planning information interventions with similar objectives. The per-person costs of administering the app-based incentive program are quite low, given that the intervention is integrated into providers' existing workflows and providers are nudged to give information to patients when they are making a decision about a family planning method.

Discussion

This paper presents new evidence on how a pharmacy-facing incentive intervention reduces financial and

	Price	DMPA-SC info	General FP info
T1: Consumer subsidy (β_1)	−69.85***	0.34	0.17
	(8.64)	(0.26)	(0.16)
T2: Pharmacy cost reduction (β_2)	−25.42**	0.75**	0.25
	(10.93)	(0.26)	(0.16)
T3: Pharmacy incentive (β_3)	−21.49*	0.8**	0.21
	(11.48)	(0.29)	(0.18)
Treated	−40.04***	0.68***	0.2
	(10.09)	(0.21)	(0.15)
Control mean	129.6	0	0
Observations	131	228	228
Clusters	131	114	114
T1 = T2	0.00	0.28	0.72
T1 = T3	0.00	0.24	0.86
T2 = T3	0.80	0.89	0.87

Notes: Stars denote significance adjusted for multiple comparisons using the Holm-Bonferroni method (***p < 0.01; **p < 0.05; *p < 0.1). This table presents double-ML estimates (Chernozhukov et al., 2018), using cross-validated LASSO with randomization strata, ward demographic characteristics, and the characteristics of surrounding census sites. The outcome variable in column 1 is the mean price in KES in a study site. The outcome variable in column 2 is an DMPA-SC information index including whether the provider mentioned DMPA-SC, discussed DMPA-SC side-effects, and whether the poster for the program was visible in the site. The outcome variable in column 3 is an index of 7 variables summarizing general FP information shared with the patient including length of the counseling session, whether the provider gave enough information to the standardized patient to make an informed decision, whether the provider appeared to be highly knowledgeable about family planning to the enumerator, whether the provider explain things clearly to the standardized patient, whether the provider gave any take-home educational materials, whether the provider used illustrations or posters to describe FP methods, and whether the provider used any physical objects or learning tools to describe family planning methods. Treated denotes the average effect across the three treatment arms. Control mean denotes the average value of the outcome variable for the control group. The last three rows present tests of equality for the treatment effects of the study arms.

Table 2: **Effects on price and provider advice mechanisms.**

	(1) CYP(T)–CYP(C)	(2) Cost (USD)	(3) ICER	(4) Cost/CYP
T1: Consumer price reduction	796	9926	0.08	$12.50
T2: Pharmacy cost reduction	897	2326	0.39	$2.56
T3: Pharmacy incentive	512	4394	0.12	$8.33

Table 3: **Cost-effectiveness of interventions in terms of couple-years of protection.**

information barriers to DMPA-SC and influences short-term family planning decisions for women in Kenya's private pharmacies and clinics. Private sector pharmacies are critical in providing access to contraceptives, reaching segments of the population that are not traditionally served by the public sector, and generally providing access to a wider set of contraceptive options than are available for free in public clinics.[17,18] First, we find that consumer discounts and provider incentives are effective at increasing uptake for DMPA-SC by, respectively, reducing prices (consumer discounts) and increasing information available to patients to make an informed decision (provider incentives). Secondly, this increase in clients choosing DMPA-SC is offset by a decrease in clients choosing short-acting methods. And finally, we find that patient and provider incentive interventions can cost-effectively increase couple-years of protection.

Interventions that reduce the cost of DMPA-SC, either directly through discounts or indirectly through pharmacy-side cost reductions or incentives, lead to more DMPA-SC utilization. This finding reflects that cost and access are meaningful barriers to DMPA-SC adoption for those using private pharmacies and clinics, and that alleviating these constraints allow women to choose from a larger set of contraceptive options. This is consistent with the literature on how price reductions for healthcare impact patient demand.[12,32–34] Price of DMPA-SC and its alternatives does appear to be a key driver of decision-making and can be an important policy tool for expanding access to alternative methods across the healthcare system.

Expanding access to DMPA-SC in pharmacies led to patients switching from short-term options without crowding out existing long-acting method users. This implies that users of shorter-acting contraceptive methods such as pills, emergency contraception, or condoms may have latent demand for longer-acting methods, and that the removal of access barriers can allow them to act on that. Existing literature shows that women's realized contraceptive choices may be different from their true preferences,[35] and that cost is a key factor that limits their ability to act in accordance to their true preference.[36,37] This study adds to this literature by showing that price and information barriers meaningfully restrict choices for contraceptive users in private pharmacies. For policymakers, this study provides evidence on how price and method availability changes in private pharmacies can expand contraceptive choices.

Interventions targeted at family planning clients or providers operated through different channels. Client-targeted discounts reached users, who saw significant price reductions in DMPA-SC. On the other hand, provider-facing interventions that either reduced the cost to stock DMPA-SC or increased the profitability led to changes in provider counseling. Providers in those arms were more likely to counsel patients on DMPA-SC, in addition to other family planning options. By shedding light on two mechanisms of impact, this study provides useful insights on how these types of programs work, which can be adapted and tested in other contexts.

This paper also contributes to the literature on the cost-effectiveness of family planning programs, showing that pharmacy interventions to reduce price and increase access to DMPA-SC can be highly cost-effective. On average, these interventions cost $4.67 USD per additional couple-year of protection and compare favorably in terms of cost-effectiveness to other evaluations of family planning interventions. Given the pharmacy-based digital intervention, and the lower per-person costs of delivery compared to other more traditional programs, this program has the potential to be highly scalable and policy-relevant.

Our study has limitations, and results should be interpreted with these in mind. First, by using administrative transaction data, we only measure short-term family planning choices and cannot assess long-term behavior changes. Second, we cannot determine the impact on different segments of contraceptive users, nor can we remove product purchases by male clients, due to lack of demographic and contraceptive use history data. Future work should examine the sustained effects of these interventions on long-term behavior change and heterogeneous effects by client profile.

We provide novel evidence on the role of patient discount and provider incentive programs that reduce price barriers for DMPA-SC in Kenyan pharmacies. This work spotlights a key population of contraceptive users, those that seek care in private pharmacies, and an underemphasized care setting. We find that pharmacy-based tools are effective at expanding women's available contraceptive options, with implications for contraceptive choice. Women substitute away from short-acting methods and opt for longer-acting options. Targeting subsidies to clients reduces price barriers, while targeting them to providers encourages more comprehensive counseling on an expanded choice set of contraceptive options. Given their low cost and high potential for scalability, these digital interventions can cost-effectively increase couple-years of protection. Taken together, these findings underscore

the potential of digital tools to improve access to care in pharmacy settings and highlight the need for future research in Kenya and other countries where pharmacies are a large and growing part of the private health care sector.

Contributors

All authors contributed to the conception and design of the study, as well as funding acquisition. CP and MD accessed the underlying data and conducted analysis. All authors contributed to the interpretation of the data. MD and CP drafted the paper, and all authors reviewed it critically and approved final version to be published.

Data sharing statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of interests

The authors declare that they have no competing interests.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.eclinm.2026.103789.

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