



Increasing the take-up of long-acting reversible contraceptives among adolescents and young women in Cameroon

Berk Özler (*on behalf of a large multi-disciplinary study team**),

Development Research Group, The World Bank

* Susan Athey, Sarah Baird, Vitor Hadad, Julian Jamison, Craig McIntosh, Berk Özler, Luca Parisotto, and Dohbit Sama.



Outline



1. Background, formative qualitative work, and the development of a contraceptive counseling “app.”
2. Adaptive experiments (and our adaptive experiment)
3. Findings from the pilot phase of our study on the effect of price discounts and counseling approaches on the take-up of modern contraceptives.



Part I: Background, formative
qualitative work, and a
contraceptive counseling app



“How is this still a thing?”

- ▶ Startling fact #1:

- ▶ “Currently, almost half of the 6.7 million pregnancies in the United States each year are unintended.” (*MDRC's ICON project*)

- ▶ Even more startling fact #2:

- ▶ 48% of unintended pregnancies in the US occur in the same month when contraception is used (*Finer and Henshaw 2006*)



Unintended pregnancies are a major factor in persistently high maternal mortality...

- Maternal mortality ratio (Cameroon) \cong 600 (*per 100K live births*)
- Lifetime risk of maternal death (Cameroon) \cong 1 in 35
- In addition to the immediate loss of welfare to the mother, unintended pregnancies are associated with:
 - Low age at first birth \rightarrow negative impacts on the spacing of births & timing of future pregnancies.
 - Reduced accumulation of human capital for both the mother & the child.



It's not like the technology does not exist to prevent them...

- ▶ Long-acting reversible contraceptives (LARCs) are close to 100% effective in preventing unintended pregnancies.
- ▶ But, take-up rates are very low (*at least until very recently*)
 - ▶ Especially in developing countries
 - ▶ Even more true for:
 - ▶ Adolescent females
 - ▶ Unmarried women, and
 - ▶ Nulliparous women



It's a complicated problem...

- ▶ An intervention to increase the uptake of LARCs could be very cost-effective...
 - ▶ **But, what would such an intervention look like?**
- ▶ **Big picture:** There exists no contraceptive method that is highly effective, convenient to use, and has, on average, minimal side effects.
 - ▶ Worse, the side effects are highly idiosyncratic.
 - ▶ So are individual preferences...
- ▶ **Smaller picture:** Supply- and demand-side problems galore...
 - ▶ Lack of training and provider bias
 - ▶ Misinformation, fear, culture, religion
 - ▶ Cost



Formative qualitative work in Cameroon (2016)

- ▶ Focus group discussions & individual interviews with adolescent females, their mothers, partners, health care providers, & community health workers:
- ▶ Providers lack adequate training and have bias

Formative qualitative work in Cameroon (2016)

- ▶ Focus group discussions & individual interviews with adolescent females, their mothers, partners, health care providers, & community health workers:
- ▶ Providers lack adequate training and have bias

- *“Family planning is not good for those of us that are young that have not yet put to birth”* (19yo, single, no children, does not use FP)



Formative qualitative work in Cameroon (2016)

- ▶ Focus group discussions & individual interviews with adolescent females, their mothers, partners, health care providers, & community health workers:
- ▶ Providers lack adequate training and have bias
- ▶ Side effects are neither well-communicated nor well-managed.

Formative qualitative work in Cameroon (2016)

- Focus group discussions & individual interviews with adolescent females, their mothers, partners, health care providers, & community health workers:
- Providers lack adequate training and have bias
- Side effects are neither well-communicated nor well-managed.

“I am not still clear with that idea that women are still talking about weight, so I don’t know to go about that particular aspect. Most of them complain of bleeding, their spouse complain that each time the go into their wives they come out with blood. For me I told them that it depends on individuals the way their body reacts to the drugs. Because some don’t complain, some say all is fine; some support the drugs for some time and after some time it goes off. I don’t know”



Formative qualitative work in Cameroon (2016)

- ▶ Focus group discussions & individual interviews with adolescent females, their mothers, partners, health care providers, & community health workers:
- ▶ Providers lack adequate training and have bias
- ▶ Side effects are neither well-communicated nor well-managed.
- ▶ Mothers generally supportive of contraceptives, but reluctant to advise...

Formative qualitative work in Cameroon (2016)

- ▶ Focus group discussions & individual interviews with adolescent females, their mothers, partners, health care providers, & community health workers:
- ▶ Providers lack adequate training and have bias
- ▶ Side effects are neither well-communicated nor well-managed.
- ▶ Mothers generally supportive of contraceptives, but reluctant to advise...

• *“If I advice her to go and take an injection in case she becomes sterile she will be accusing me that my mother took me to be injected... it is difficult for one to advise them.”*



Takeaways from qualitative work and discussions with stakeholders

1. Better counseling, to ...

- Provide information effectively (convenience, effectiveness, reversibility...)
- Undo provider bias



Takeaways from qualitative work and discussions with stakeholders

1. Better counseling, to ...
 - Provide information effectively (convenience, effectiveness, reversibility...)
 - Undo provider bias
2. Improved training for providers



Takeaways from qualitative work and discussions with stakeholders

1. Better counseling, to ...
 - Provide information effectively (convenience, effectiveness, reversibility...)
 - Undo provider bias
2. Improved training for providers
3. Better management of side effects



Takeaways from qualitative work and discussions with stakeholders

1. Better counseling, to ...
 - Provide information effectively (convenience, effectiveness, reversibility...)
 - Undo provider bias
2. Improved training for providers
3. Better management of side effects
4. Reduced prices for FP services, especially for adolescents...



Takeaways from qualitative work and discussions with stakeholders

1. Better counseling, to ...
 - Provide information effectively (convenience, effectiveness, reversibility...)
 - Undo provider bias
2. Improved training for providers
3. Better management of side effects
4. Prices of contraceptives, especially for adolescents...

We decided to tackle many of these questions by developing an “app!”

Redefining the “counseling approach”

➤ **Old/current paradigm for FP counseling:**

- “An informed choice model in which individuals are given extensive information to make their own independent choices.”
 - **“Tell the client about *ALL* the methods and let her make a decision.”**

➤ **New paradigm/destination :**

- Shared decision-making based on the client’s goals, needs, and preferences
- Still patient-centered (respectful, empathetic, and confidential), while hopefully more efficient and realistic (Hoyt et al. 2017)
 - **“Elicit client’s preferences, goals, needs, as well as her birth and medical history, and make a recommendation.”**



FP3.0 - A Counseling “App”

- ▶ We developed a **tablet-based decision-support tool** for nurses to counsel female clients on modern contraceptive methods.
- ▶ We are definitely not the first ones to think about this or develop a tool.
- ▶ Our “app”:
 - ▶ is for **use by providers**,
 - ▶ **recommends a suitable method** based on elicited client preferences,
 - ▶ generates **rich data on family planning preferences**, and
 - ▶ is **usable, functional, and liked by clients** (also adaptable & open-source)
 - ▶ *More testing to come over the main study period...*



Video describing the “app” deleted for size

(some screenshots follow)...

FP3.0 - A Tablet-based Counseling “App

 Press here to begin

I, the health provider, confirm each of the following:

INSTRUCTION
You (the health provider) must complete each task below and confirm by checking the box next to it. You can only continue with the session after you have checked all three boxes.

- I welcomed the client, took steps to ensure a private setting for the counseling session, and commended her for coming in today
- I explained the purpose of the session, which is to talk about her life and goals, healthy families, pregnancy spacing, safe sex, and contraceptive methods
- I explained to the client that she can always ask questions and should speak freely, as this meeting is completely confidential. I also explained to her that she can stop this session at any time for any reason.

Are you ready to go on with counselling?

yes 

No

 Press here to begin

INSTRUCTION
If the patient is currently pregnant, please count it in these pregnancies.

4 

How many abortions have you had?

1 

How many biological living children do you have?

3 

What was the date of your most recent delivery (live or still)?

INSTRUCTION
If the client gives a range rather than an exact date, enter the most recent date of that interval

2018-12-10 

FP3.0 - A Tablet-based Counseling “App”

 Consultation

What issues are you having with IUD?

- Inconvenient (forgot to take pill, facility far to refill)
- Side effects (headache, bleeding, acne, weight gain.)**
- Cost of method
- Other (not discrete, ineffective..)

What are the side effects?

- headaches (migraines)**
- bleeding**
- acne
- weight gain
- discomfort**
- others (not specified)

 Consultation

Some women experience changes in their menstrual period after they start using a method of family planning. Other than rare occasions, these changes are normal, and are not a sign that the method is harmful to your health. Some women who use contraceptive implants and injectables stop having a menstrual period and this is not harmful either. None of the methods we will discuss affect your ability to conceive in the future: you can always stop using the method and try to get pregnant right away. Let's talk about some of the more common things you may experience.

Some methods can cause increased menstrual bleeding and cramping, though this effect subsides for most women after the first three months. How important is it to you to minimize the chances of increased cramping or bleeding in the early stages of adopting a method?

INSTRUCTION
Please read out the answer choices to the patient

- NOT important
- Somewhat important
- Very important** 

Some methods cause decreased menstrual bleeding over time with some women eventually not having a period at all. As we mentioned before, absence of bleeding is definitely not harmful to your health. In fact, some women like you consider this to be convenient and it is an added health benefit. How important is it to you to maximize the likelihood of maintaining your period?

FP3.0 - A Tablet-based Counseling “App”

Consultation

Are you taking any of the following drugs?

INSTRUCTION
Please answer this question to continue

Anti retroviral (ARV)

TB drugs (such as rifampicin)

Barbiturates (such as phenytoin)

none

Do you experience unexplained vaginal bleeding?

INSTRUCTION
Record if client has unexplained vaginal bleeding

Yes

No ✕

Allow us to take your blood pressure

INSTRUCTION
Enter SYSTOLIC BP reading

Method choice

WARNING: the PILL - POP is contraindicated for this patient at this time
- Patient is taking TB drugs or barbiturates

WARNING: the PILL - COC is contraindicated for this patient at this time
[...]
[...]
- Patient has a history of hypertension OR systolic bp>=140 or diastolic bp >=90
- Patient is taking TB drugs or barbiturates

WARNING: the INJECTABLE is contraindicated for this patient at this time
[...]
[...]
- Patient has systolic bp>=160 OR diastolic bp>=100
[...]

Method: IMPLANT

Section not started

COMPLETE INTERVIEW

FP3.0 - A Tablet-based Counseling “App”

METHOD CHOICE /

< Method: IMPLANT

OK, based on our conversation, there are two equally great methods that might fit your goals, needs, and preferences. However, is it ok if we start by discussing the IMPLANT, so that you can understand how it works, its advantages and disadvantages? If you don't like the IMPLANT, then we can always talk about the other method. I am sure that we can find something suitable for you.

Yes No

Pull the cue card for **IMPLANT** from the stack, and put it in front of you and the client, leaving the others on the table.

Go over the information on the front side of the cue card for the IMPLANT, discussing what it is, how it works, and emphasizing its effectiveness and advantages. Pause to see if the client is content with what she has heard about the IMPLANT so far and answer any questions she may have.

If the client is happy to continue, please turn over the cue card and go over the information on the back of it, emphasizing how it is used and administered, possible side effects, and reasons to return to the provider. Again, pause to see if the client is content with what she has heard about the IMPLANT so far and answer any questions she may have.

If at any point, the client no longer wants to hear about this method and rules out adopting it, please move to the next question, select "No, the client does not wish to adopt this method", and record the main reason(s) why.

< Method choice

Would the client like to adopt the IMPLANT?

Yes, the client would like to adopt the method Peut etre, mais la cliente veut discuter d'autres methodes No, the client does NOT want to adopt the method

Please proceed to administration of IMPLANT or (in case of a circumstance that prevents administration immediately) please make an appointment for a future date of administration of method.

Please confirm whether the client received the IMPLANT before leaving the facility?

Yes No

Why did the client not leave with this method?

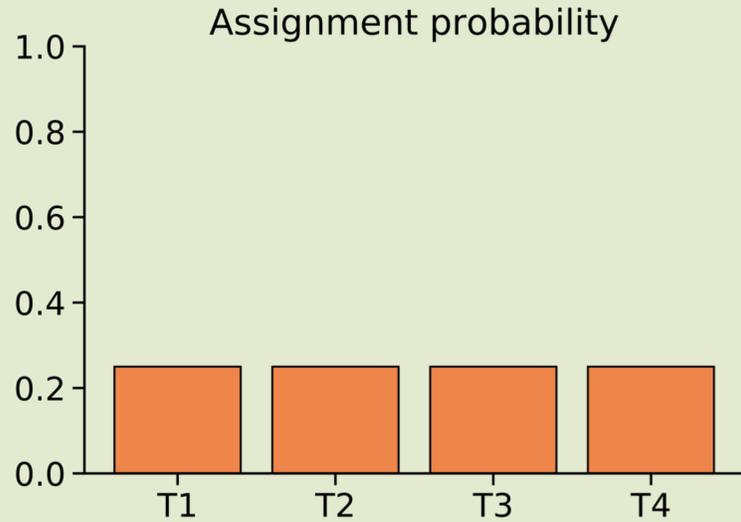
INSTRUCTION



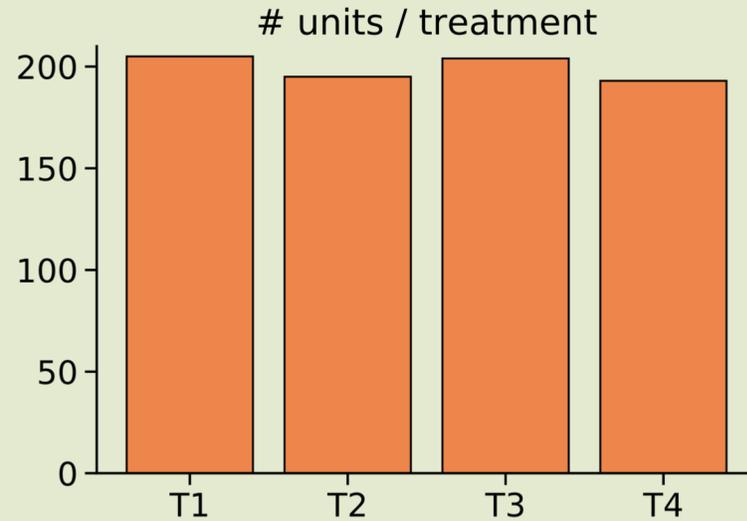
Part II: Adaptive experiments

An overview and an application at a Women's and Children's Hospital in Yaoundé (HGOPY), Cameroon

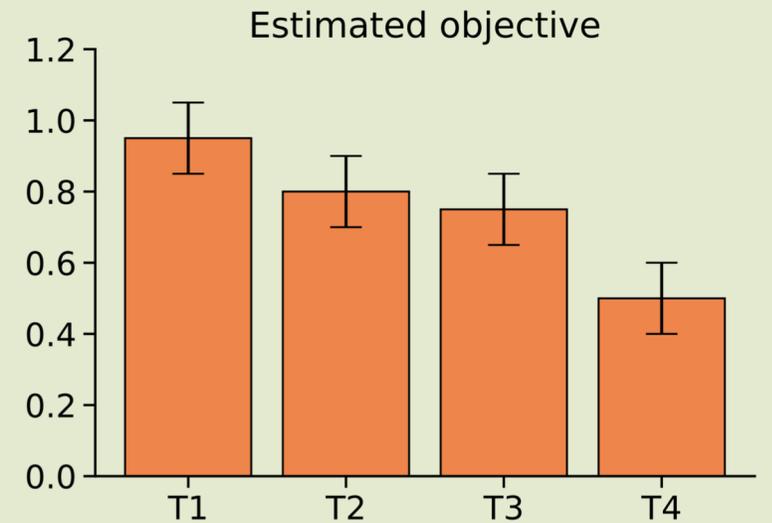
Randomized control trials



Fixed probability of assignment to each treatment*.



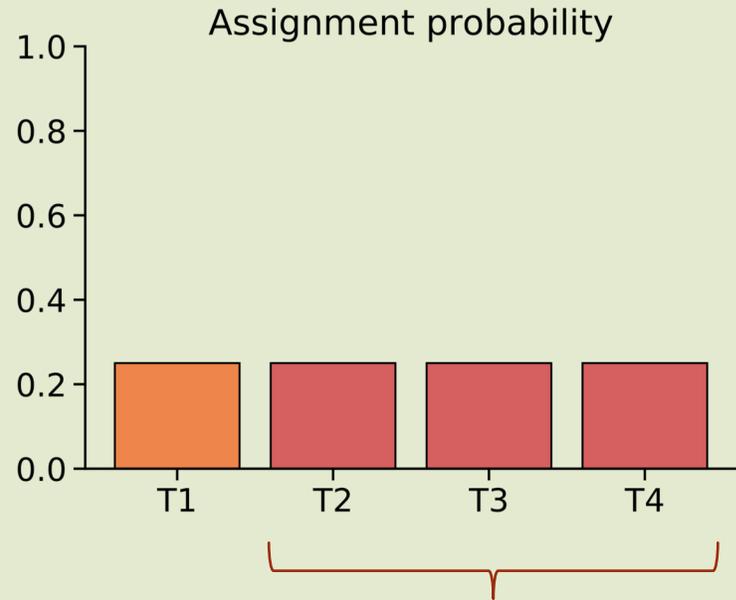
Roughly equal number of units assigned to each treatment.



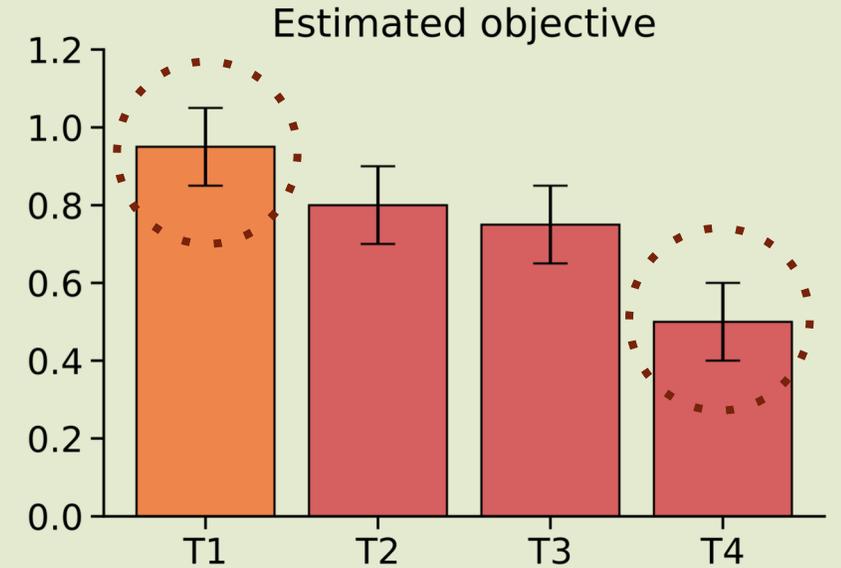
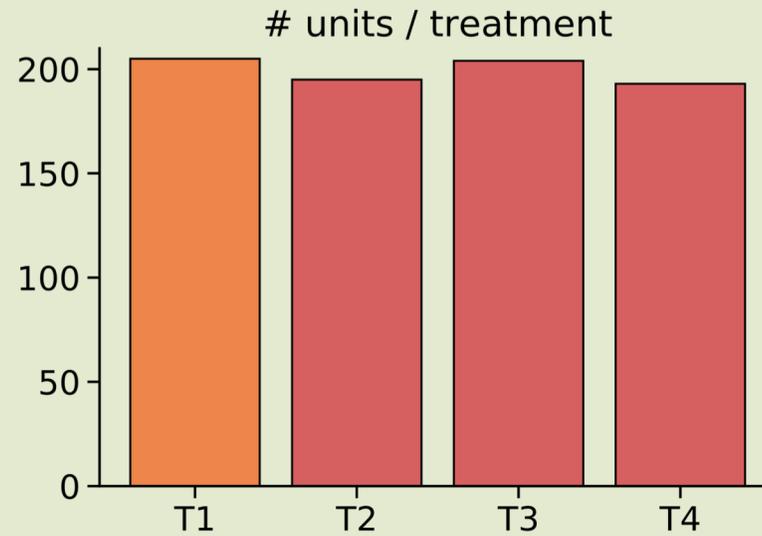
Treatment value estimate

*Note: for illustration only.

Randomized control trials



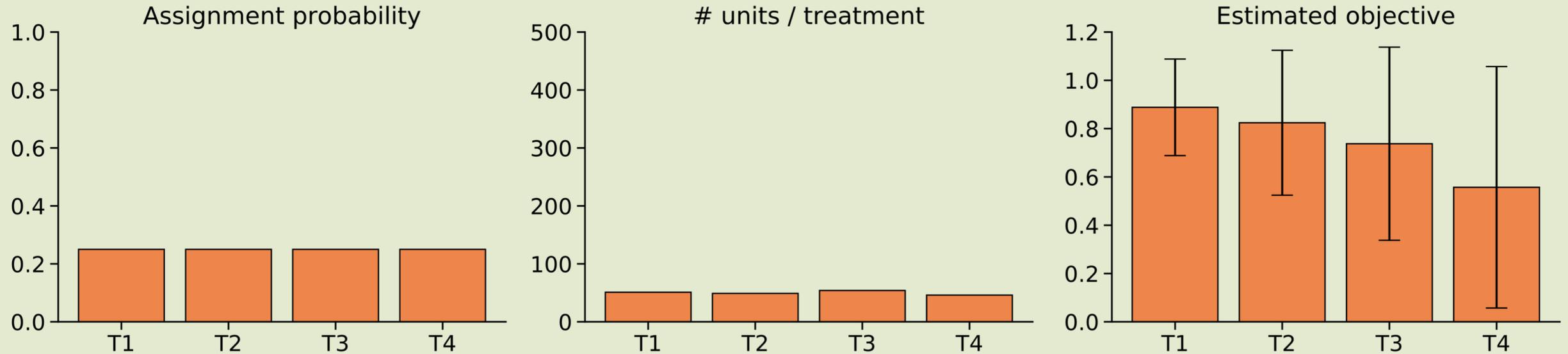
Many individuals assigned to suboptimal treatments (**regret**).



Good treatments not necessarily estimated more accurately than bad ones.

Adaptive experiments

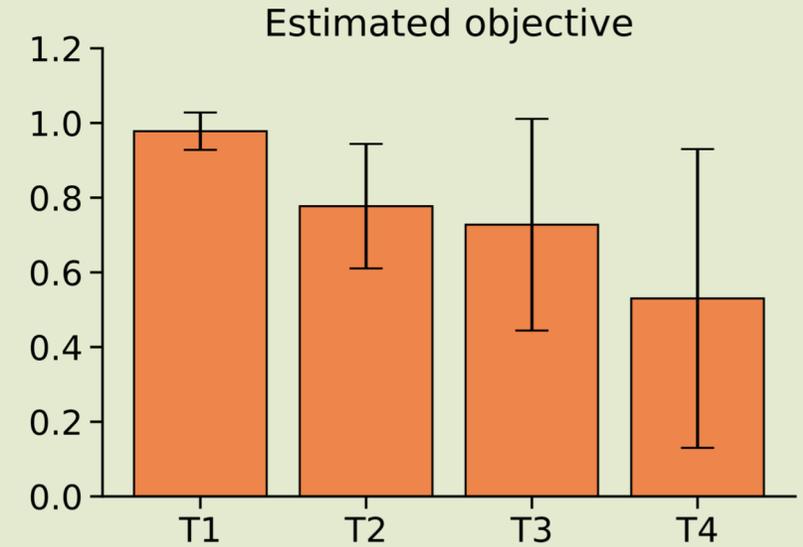
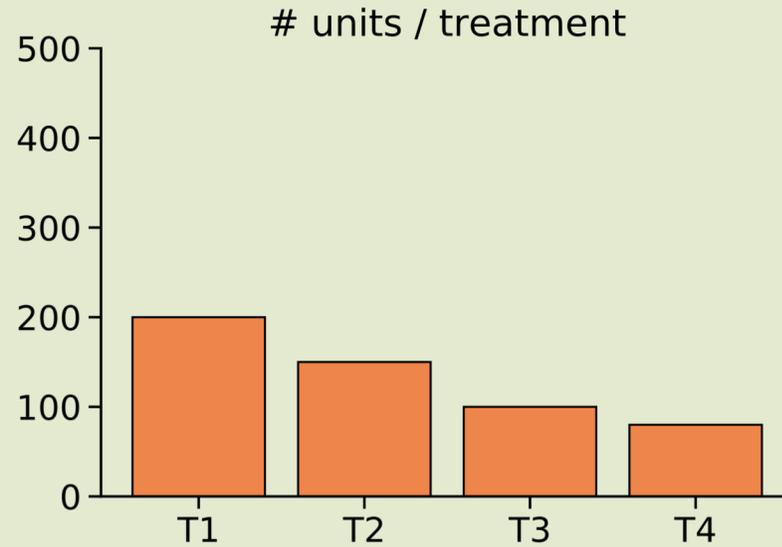
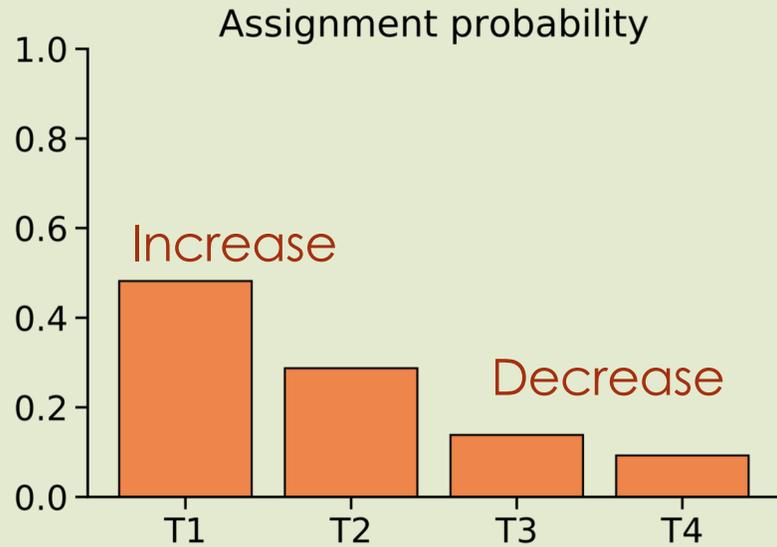
(example: multi-armed bandits)



Step 1: At the *beginning* of the experiment, assign treatments uniformly at random

Adaptive experiments

(example: multi-armed bandits)

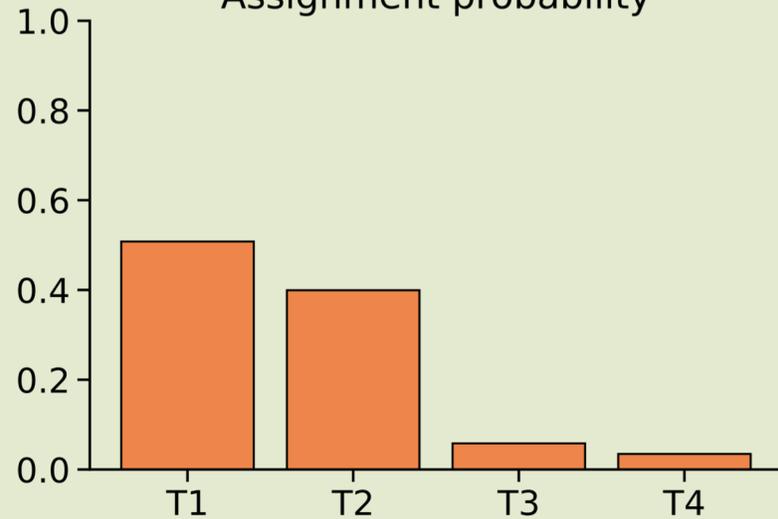


Step 2: Once some data has been collected, **increase** the probability of assignment to more **promising arms**.

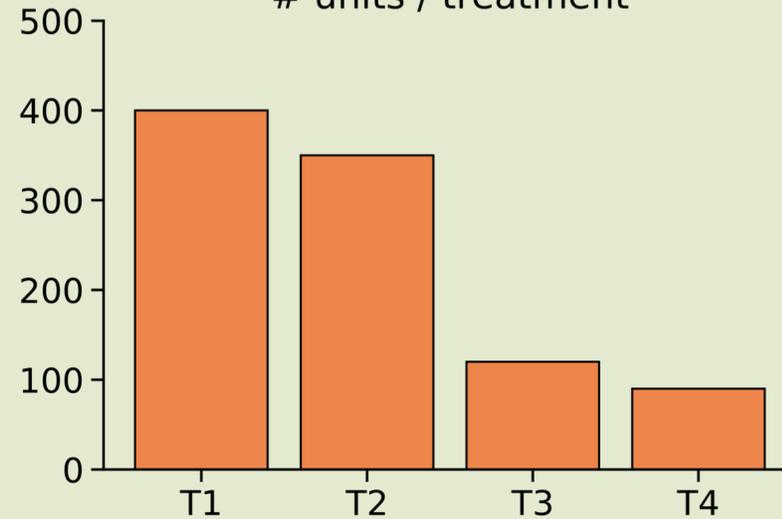
Adaptive experiments

(example: multi-armed bandits)

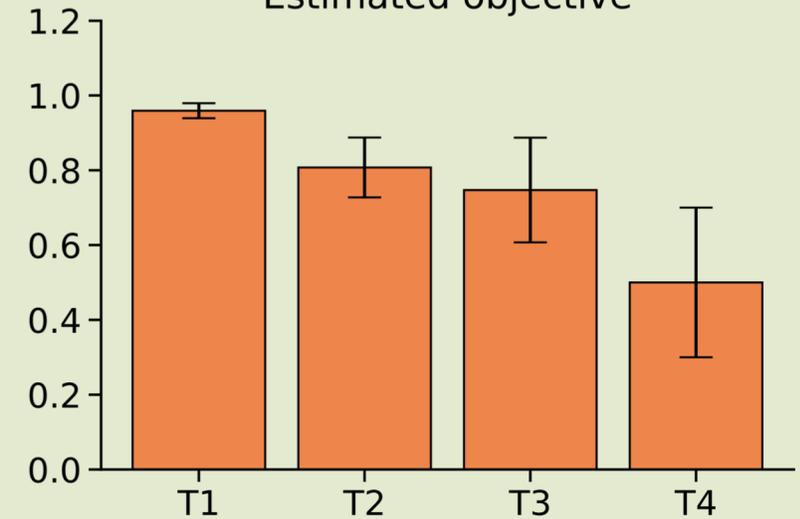
Assignment probability



units / treatment



Estimated objective

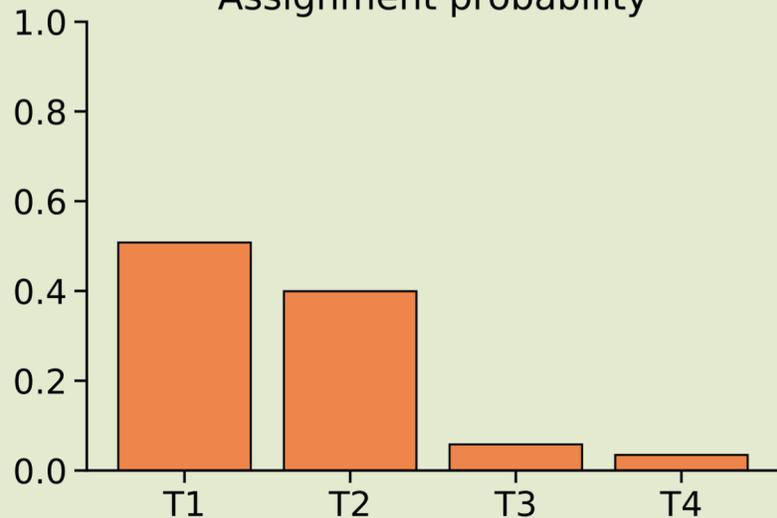


Step k: Repeat this procedure in batches, increasing probabilities of assignment as we become more certain about which treatments are good.

Adaptive experiments

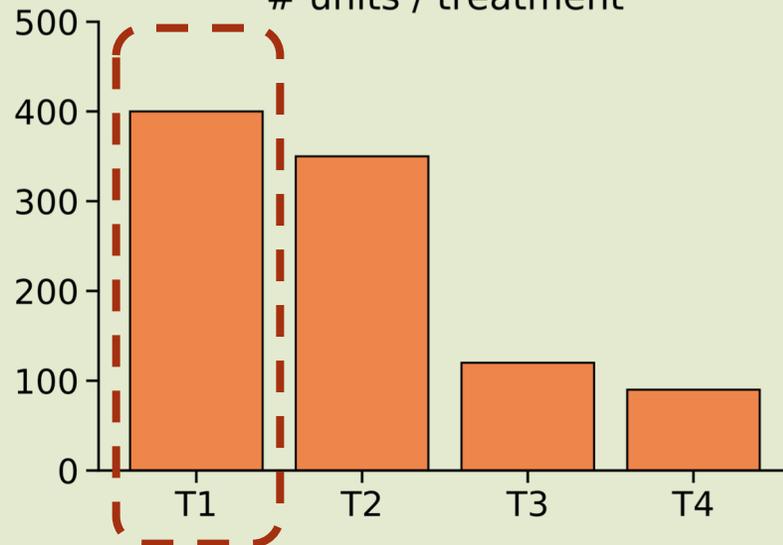
(example: multi-armed bandits)

Assignment probability



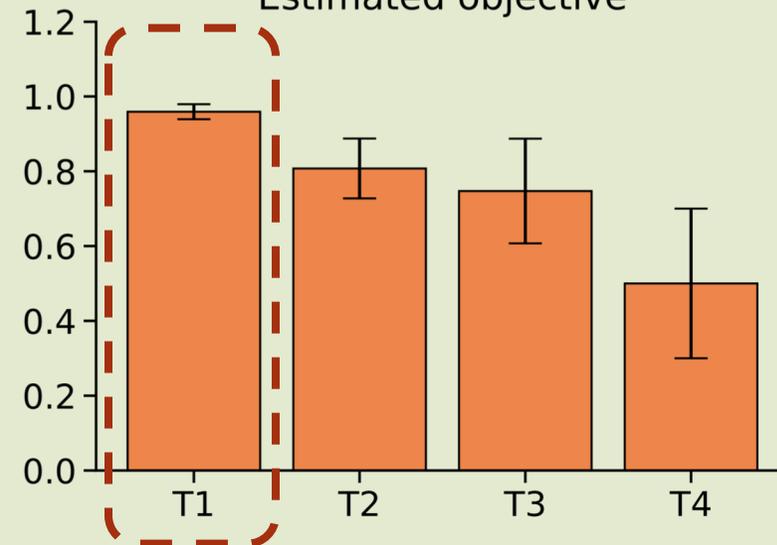
As experiment progresses, suboptimal treatments are assigned less frequently...

units / treatment



...in the end, more observations assigned to optimal treatments (lower **regret**).

Estimated objective

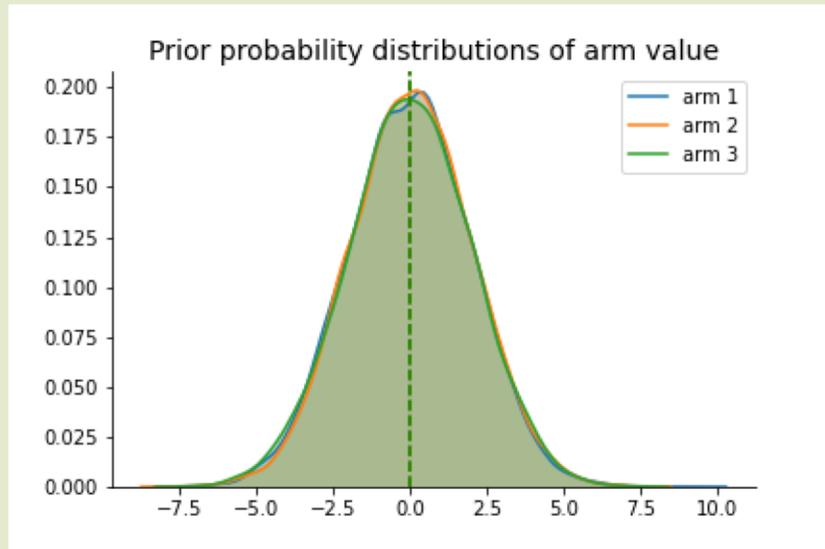


Tighter confidence intervals around optimal treatment value estimates.

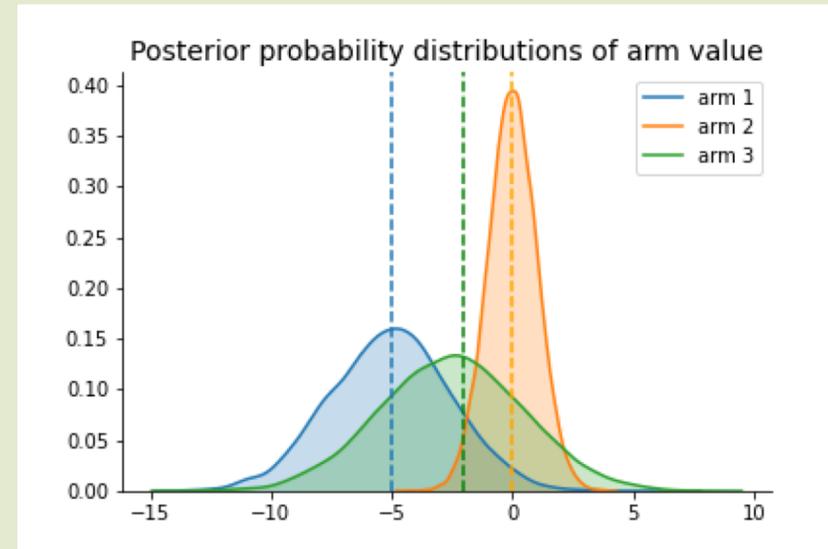
Computing assignment probabilities

Useful heuristic: **Thompson Sampling**

1. Start with a **prior** distribution on arm values.
2. Collect first batch of data by assigning treatments uniformly at random.
3. Observe outcomes and **update the posterior** distribution of arm values.
4. Next batch, assign treatments according to their **posterior probability of being optimal**.



$$\begin{aligned}P(\text{arm 1 is optimal}) &= \frac{1}{3} \\P(\text{arm 2 is optimal}) &= \frac{1}{3} \\P(\text{arm 3 is optimal}) &= \frac{1}{3}\end{aligned}$$

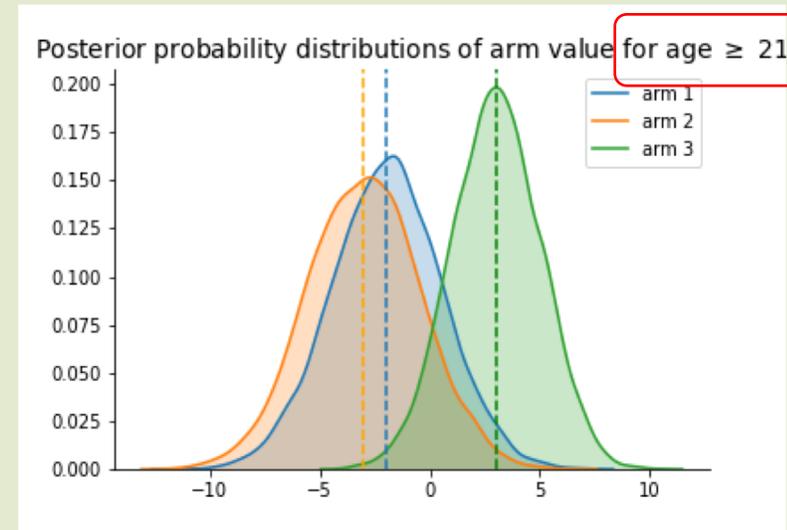
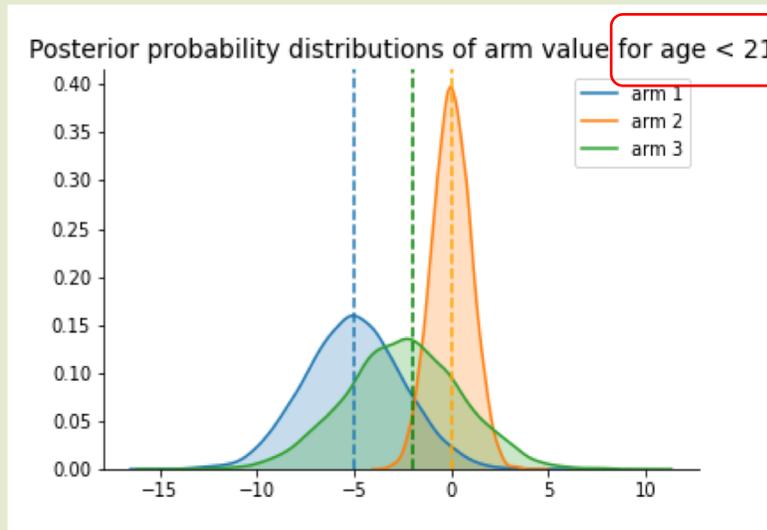


$$\begin{aligned}P(\text{arm 1 is optimal} \mid \text{Data}) &= 0.05 \\P(\text{arm 2 is optimal} \mid \text{Data}) &= 0.70 \\P(\text{arm 3 is optimal} \mid \text{Data}) &= 0.25\end{aligned}$$

The **Thompson Sampling** heuristic dictates that these should be the assignment probabilities.

Adaptive experiments (**contextual** bandits)

When personal characteristics (*contexts*) are observed, the assignment probabilities can be conditional on them.



As we gather more data, we are better able to **personalize** treatments.

Because bandit algorithms maximize the welfare of individuals in the experiment, they can be desirable from an ethical standpoint.

Caveats

In an adaptive experiment, collected data are **not independent**.

Usual methods for inference will often give the wrong answer. More sophisticated methods are needed.

This is an area of active research*

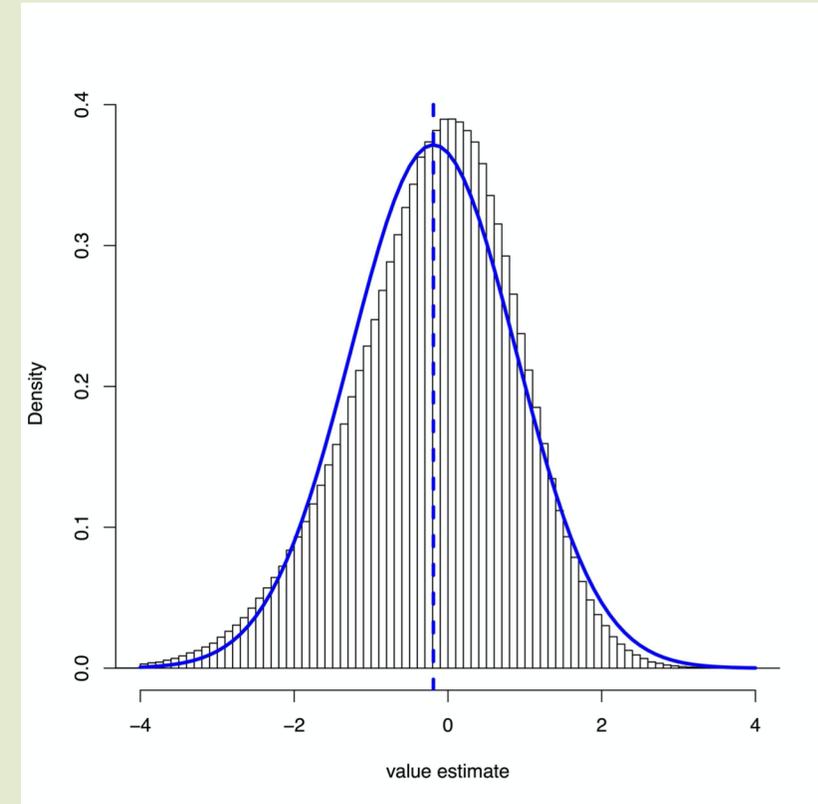
Luedtke and van der Laan (2016)

Deshpande, Mackey, Syrgkanis, Taddy (2017)

Hadad, Hirshberg, Zhan, Wager, **Athey** (2019)

Howard, **Ramdas**, **McAuliffe**, **Sekhon** (2019ab)

Zhang, Janson, Murphy (2020)

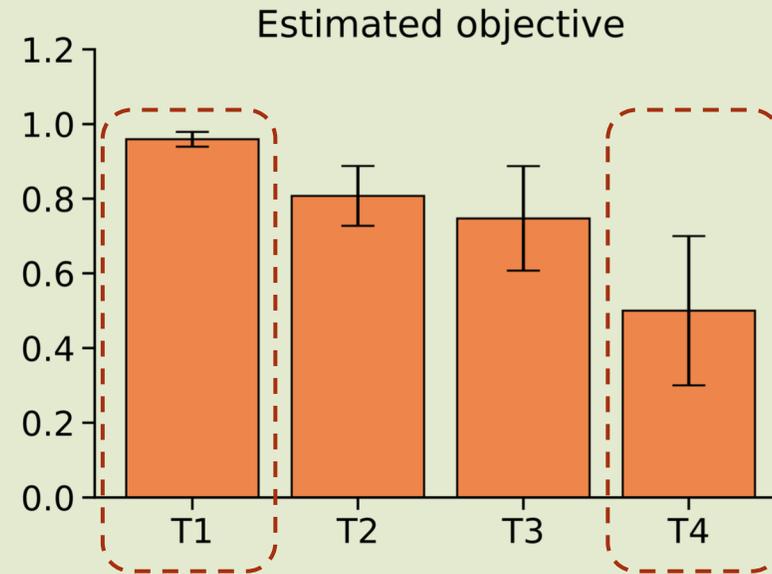


Example: distribution of the sample mean after an adaptive experiment. Estimates are biased and do not have a normal distribution.

Caveats

Need to make sure that the experimental design aligns with research objectives.

For example, if one goal is to be able to test the performance of the best treatment arm against a control, need to ensure that enough observations are collected from control.



Example: if one is expecting to test, e.g., whether T1 (the “best” arm) and T4 (the control arm) have the same mean, need to ensure enough observations in both T1 and T4.

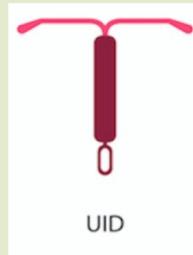
HGOPY Experiment Overview

Step 1: Gathering information (contexts)



Demographics
Contraceptive usage
Family planning

Step 2: Treatment assignment (contextual bandit)



LARC discounts
(5 tiers)

SARC discounts
(2 tiers)

Recommendation*
(2 methods)

*Only randomized
for some clients



sequential



side-by-
side

Step 3: Observe client's choice

Sequentially update the
treatment assignment
model according to
observed data.

Follow up interviews collect
data after counseling
session.

Step 1: Contexts

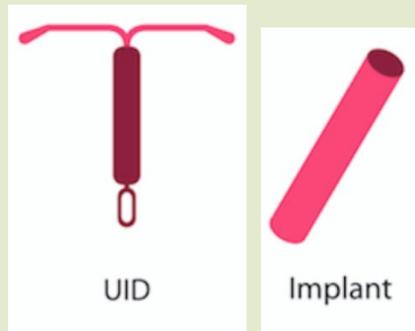


Counseling takes place and the data from the session are uploaded to the cloud...

- Demographics
 - Age, occupation, marital status, birth history, fertility plans, etc.
- Contraceptive use
 - Past experience with contraceptive methods, etc.
- Contraceptive preferences
 - Considerations (convenience, discretion, etc.), preferences for minimizing side effects, method in mind...
- Medical history

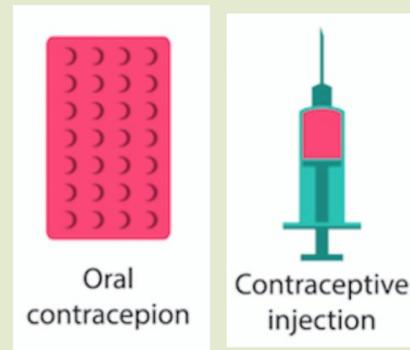
Step 2: Treatment assignment

Treatment arms represent **contraceptive prices** and **alternative counseling approaches**.



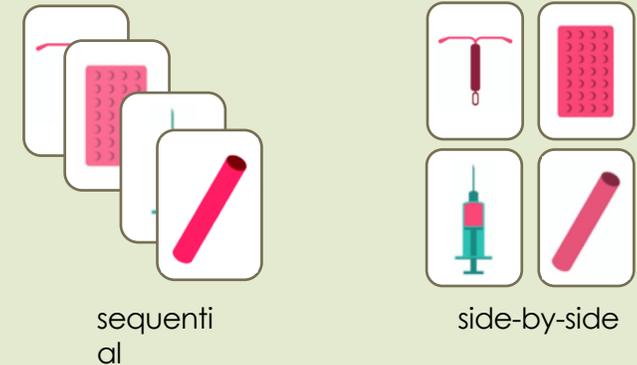
LARC prices (CFA)

0 (free)
150
1,000
2,000
4,000



SARC prices (CFA)

0 (free)
1,500/1,250



Counseling approach / Recommendation*:

Sequential: One contraceptive is suggested to the client first (often a LARC). If she declines, go to next suitable contraceptive. Repeat.

Side-by-side: Nurse counselors briefly describe four modern methods and ask the client which one they'd like to discuss first. Client makes a decision on her own. If she declines, she chooses another method. Repeat.

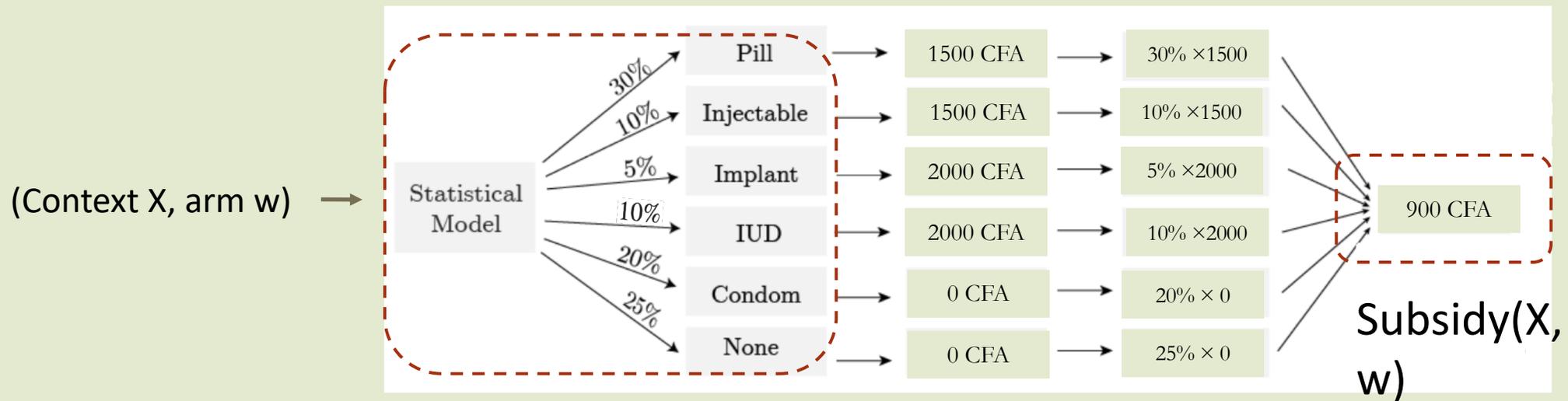
*Only randomized for clients seeking a recommendation.

Step 2: Treatment assignment

During the pilot experiment, treatments are assigned uniformly at random.

During the adaptive main experiment, a **contextual bandit algorithm** is used to decide treatments.

The contextual bandit algorithm selects treatments that are predicted to **minimize the probability of an unwanted pregnancy** within 12 months while still respecting a **budget**. In detail:



For each arm, we compute the posterior probabilities that the client will choose a contraceptive method...

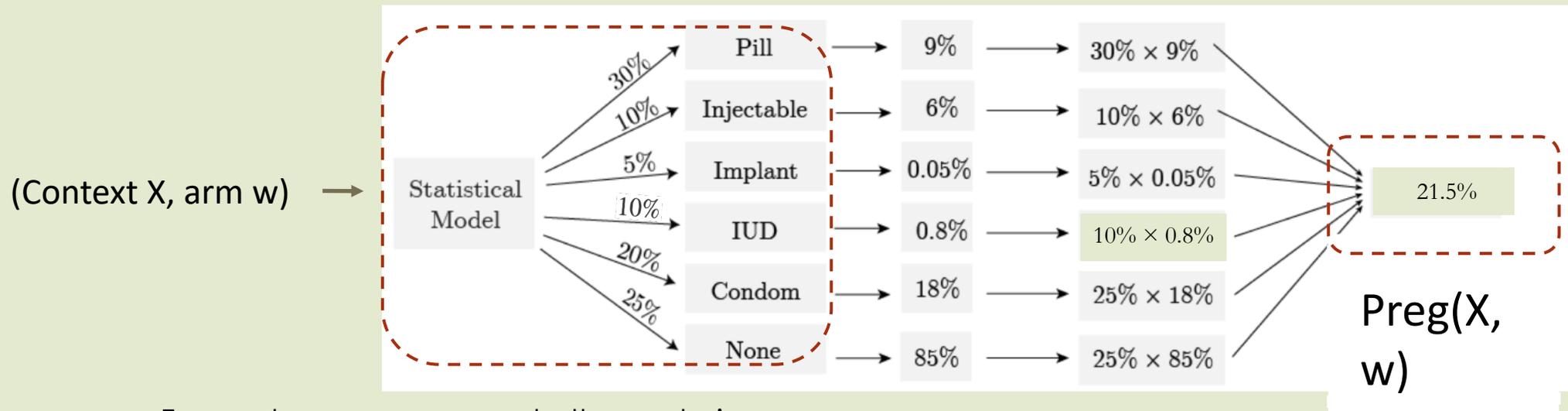
...and the posterior probability of the **average subsidy** we will disburse.

Step 2: Treatment assignment

During the pilot experiment, treatments are assigned uniformly at random.

During the adaptive main experiment, a **contextual bandit algorithm** is used to decide treatments.

The contextual bandit algorithm selects treatments that are predicted to **minimize the probability of an unwanted pregnancy** within 12 months while still respecting a **budget**. In detail:



For each arm, we compute the posterior probabilities that the client will choose a contraceptive method...

...and the posterior probability her **probability of an unwanted pregnancy**.

Step 2: Treatment assignment

During the pilot experiment, treatments are assigned uniformly at random.

During the adaptive main experiment, a **contextual bandit algorithm** is used to decide treatment assignment probabilities.

The contextual bandit algorithm selects treatments that are predicted to **minimize the probability of an unwanted pregnancy** within 12 months while still respecting a **budget**. In detail:

Using these quantities, compute the posterior probability of the **cost**:

$$\text{Cost} := \text{Preg}(X, w) + \lambda \text{Subsidy}(X, w)$$

Parameter λ governs how much the algorithm cares about monetary costs vs pregnancy prevention.

Posterior probability of the cost

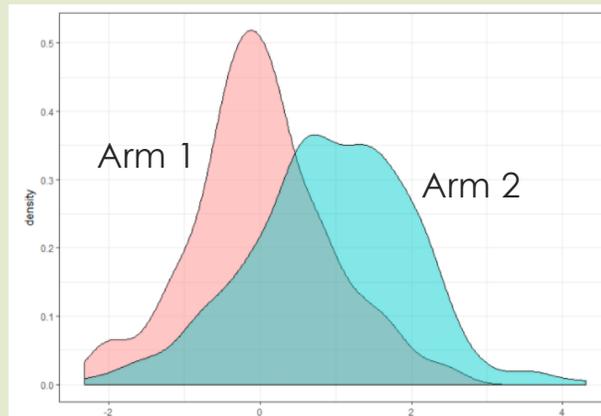


Illustration with 2 arms

Contextual bandit algorithm applies a modified **Thompson sampling** heuristic to these posterior probabilities.

That is -- arms are selected according to their **probability of being the arm that minimizes cost**.

Steps 3: Updating the models

At the end of each month (100-250 obs), treatment assignment **models are updated** using the new data.

Follow-up surveys, conducted at 2 and 16 weeks inform about outcomes after the counseling session. These are also used to revise and refit the models.

Statistical benefits of adaptivity:

Adaptive experimentation concentrates data in cells with higher heterogeneity.

Under certain conditions, we can expect the models to be more accurate than if we had run a random experiment (this is to be verified via simulations in a pre-analysis plan, coming soon).

HGOPY Experiment Overview

Pilot Experiment

Timeline

Fall 2019 - Summer 2020

Treatment assignment:

Random.

Goals:

Inform priors.

Train nurses.

Preliminary findings (later in this talk).

Main Experiment

Timeline

Begins Fall 2020

Treatment assignment:

Adaptive. Contextual bandit algorithm minimizes the probability of unintended pregnancies within 12 months for a given budget.

Goals:

Estimate demand curve for contraceptives for different subgroups.

Learn about effective counseling techniques and interaction effects with prices, tailored to context.

Follow-up surveys inform client satisfaction, $\Pr(\text{discontinuation})$, and unwanted pregnancies.



Part III: Findings from the pilot phase



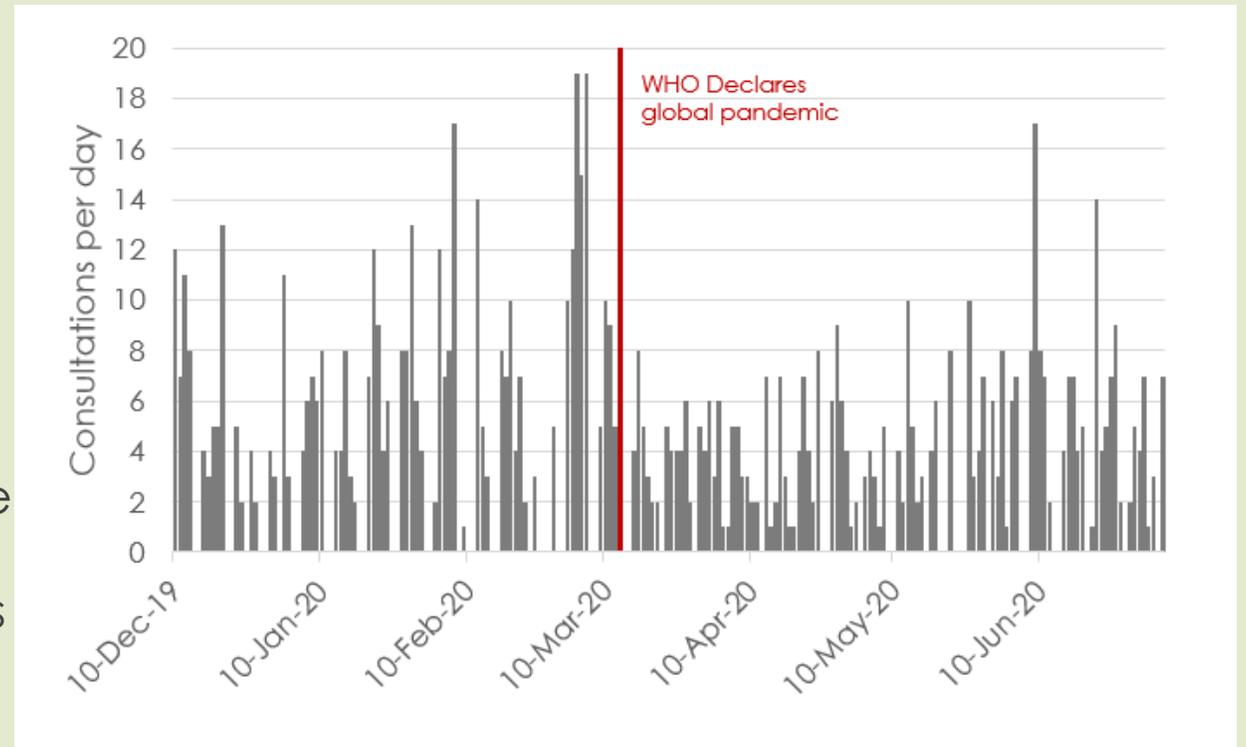
Study sample



- ▶ **803 clients consulted** between December 9th, 2019 and July 6th, 2020, the last data update before the results for this presentation were compiled
- ▶ Out of these clients **669 are eligible for the pilot study**, based on the following criteria:
 - ▶ They want to wait longer than 12 months until their next pregnancy
 - ▶ They were not pregnant at the time of the consultation, or if they were pregnant at the time of the consultation they have returned to the hospital for a consultation
 - ▶ They were not consulted during the post-training campaign, when the providers were still getting used to the application and prices weren't randomized
 - ▶ They were 'treated', i.e. offered a set of prices (and consulted in one of the two consultation styles SBS/SEQ)

Impact of covid-19

- The first case of covid-19 in Cameroon was confirmed on March 6th
- Cameroon closed its borders on March 18th
- HGOPY put in place enhanced safety protocols and limited the number of people allowed on the hospital's premises, but clients could still receive FP consultations

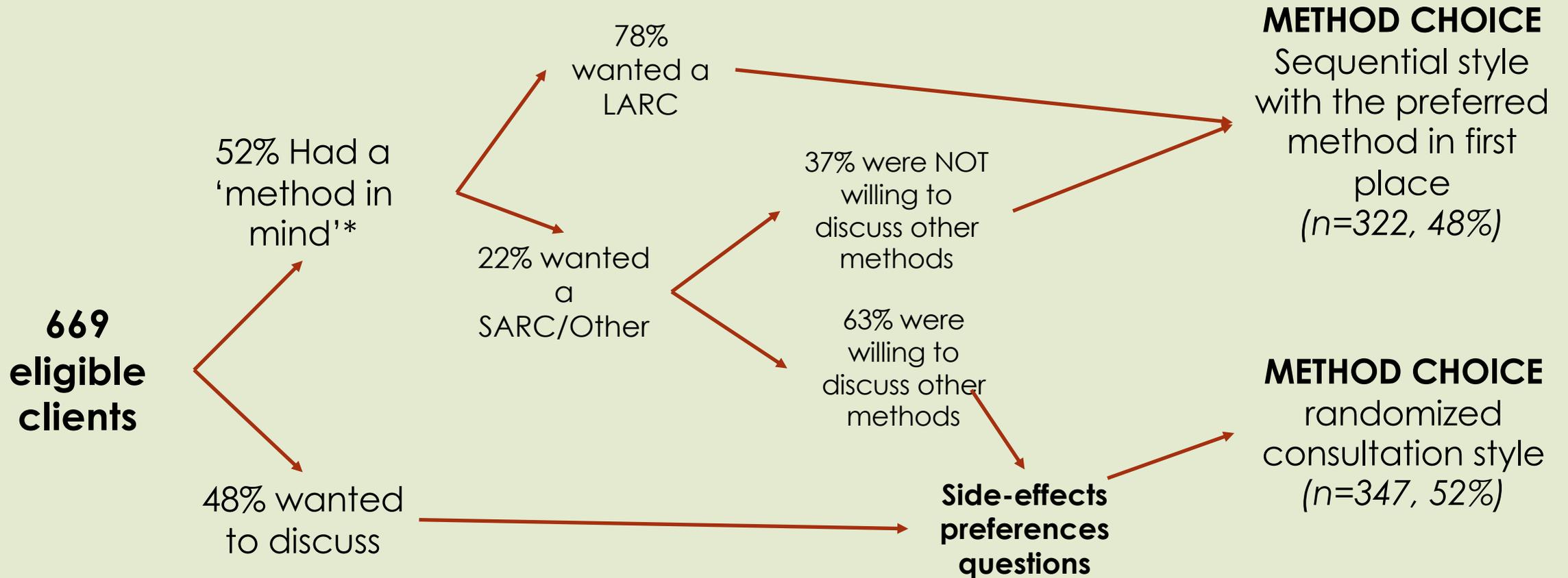


Descriptives and Balance

Variable	CFA 4,000		CFA 1,000/2,000		CFA 150/Free	
	(1) Mean	(2) Mean	Difference (1)-(2) p-value*	(3) Mean	Difference (1)-(3) p-value*	
Department: Gynecology/Maternity	0.38	0.42	0.39	0.36	0.77	
Age	27.79/(7.38)	28.99/(6.93)	0.13	28.79/(7.56)	0.23	
Adolescent	0.39	0.28	0.02	0.33	0.2	
BMI	27.02/(5.30)	27.24/(4.94)	0.69	27.22/(5.07)	0.73	
Single	0.36	0.31	0.32	0.37	0.86	
Unmarried couple cohabiting	0.32	0.36	0.48	0.3	0.7	
Married	0.32	0.33	0.79	0.33	0.84	
Education completed: Tertiary	0.43	0.39	0.49	0.38	0.32	
Education completed: Secondary	0.44	0.48	0.5	0.49	0.36	
Education completed: Primary	0.09	0.11	0.58	0.12	0.35	
Tertiary or secondary	0.04	0.03	0.35	0.01	0.07	
Client is working (salaried or self-employed)	0.51	0.54	0.59	0.56	0.32	
Student, apprenticeship	0.27	0.26	0.81	0.2	0.11	
Domestic activities	0.22	0.2	0.69	0.24	0.7	
Children, alive today	2.54/(1.82)	2.75/(1.75)	0.3	2.62/(1.84)	0.72	
Ever gave birth (live or still)	0.92	0.94	0.46	0.91	0.67	
Currently using a LARC	0.04	0.07	0.4	0.07	0.32	
Currently using a SARC	0.04	0.04	0.94	0.04	0.85	
Currently using another method	0.09	0.05	0.18	0.05	0.15	
F-test of joint-orthogonality (F-stat)**			0.82		0.71	
(p-value)			0.66		0.79	
N	114		273		282	

Note: *the 'Difference' columns show the p-value from a t-test of the difference in means between the two indicated groups; **the F-test of joint-orthogonality (F-stat/p-value) tests that all the coefficients are jointly equivalent to zero when regressing the set of variables shown in this table on a group indicator; Standard deviation in parentheses for non-binary variables.

Consultation Flowchart



Notes: * Or wanted to renew their current method without discussing other methods (10% of clients with a method in mind).
Akin to Hubacher et al. (2017), which is a randomized patient preference trial on LARC acceptability and unintended pregnancies...

The method mix

- The vast majority of clients are not using any method
 - The implant and condoms (primarily male condoms) are the most commonly used methods
- Clients who have a method in mind that they want to adopt mostly seek LARCs, especially the implant

Which method are you currently using?

None	84.2%
IUD	0.3%
Implant	6.1%
Pill	0.4%
Injectable	3.3%
Male/Female condoms	4.9%
Lactational amenorrhea method (LAM)	0.6%
Traditional method or other	0.1%
Total	100%

Which method do you have in mind?

None	47.5%
IUD	9.1%
Implant	31.8%
Pill	2.5%
Injectable	5.2%
Male/Female condoms	1.8%
Lactational amenorrhea method (LAM)	0.7%
Traditional method or other	1.2%
Total	100%

Side effects questions

“Before we find you a suitable method, I will describe some of the possible side effects you may experience, and I will ask you how much each of these will bother you. This will help us find a method which better suits you and your preferences.

Some women experience changes in their menstrual period after adopting a contraceptive method.

Other than in rare occasions, these changes are normal and are not a sign that the method is harmful to your health.

None of the methods we will discuss affect your ability to conceive in the future. You can always stop using the method and start trying to get pregnant right away.”

How much would it bother you if you experience:

Increased bleeding	
NOT at all	27.0%
A little bit	36.2%
A lot	36.8%
decreased/irregular bleeding	
NOT at all	40.7%
A little bit	32.0%
A lot	27.3%
Significant weight gain	
NOT at all	25.8%
A little bit	27.0%
A lot	47.2%

Side effects questions

“Some methods can cause increased menstrual bleeding and cramping, though this effect subsides for most women after the first three months.

How much will it bother you if you experience increased cramping or bleeding during the first three months?

Some methods cause decreased menstrual bleeding over time with some women eventually not having a period at all. Some methods can cause spotting.

Absence of bleeding is definitely NOT harmful to your health. Nor is spotting. In fact, some women consider absence of bleeding to be convenient and it is an added health benefit.

How much will it bother you if you experience spotting or amenorrhea?

A majority of women do not experience any weight gain using the methods we will discuss. However, a minority of women can experience significant weight gain with some of the methods. If this happens to you, we can help you manage this issue.

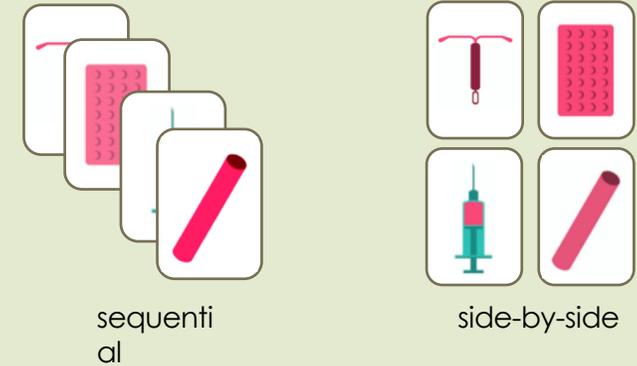
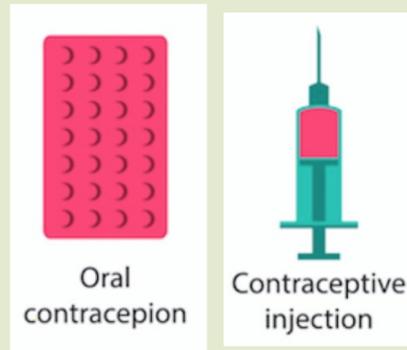
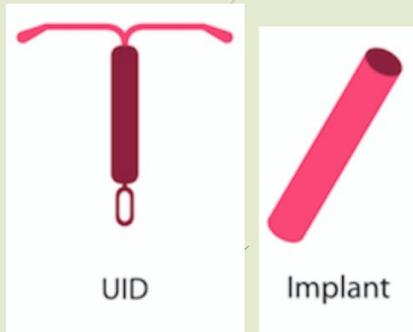
How much will it bother you if you experience significant weight gain?”

How much would it bother you if you experience:

Increased bleeding	
NOT at all	27.0%
A little bit	36.2%
A lot	36.8%
decreased/irregular bleeding	
NOT at all	40.7%
A little bit	32.0%
A lot	27.3%
Significant weight gain	
NOT at all	25.8%
A little bit	27.0%
A lot	47.2%

Study design

Treatment arms represent **contraceptive prices** and how the nurse **recommends** methods.



LARC prices (CFA)

0 (free) } **Low**
150 }
1000 } **Mid**
2000 }
4000 } **Control**

SARC prices (CFA)

0 (free)
1500

Counseling approach / Recommendation*:

Sequential: One contraceptive is suggested to the client first (often a LARC). If she declines, go to next suitable contraceptive. Repeat.

Side-by-side: Nurse counselors briefly describe four modern methods and ask the client which one they'd like to discuss first. Client makes a decision on her own. If she declines, she chooses another method. Repeat.

*Only randomized for clients seeking a recommendation.

Benefits of having a Pilot phase: Case deletions

- ▶ A few months into the pilot we suspected that some of the nurse counselors might be ‘re-randomizing’ prices for clients (*imbalance in the distribution of price discounts...*)
 - ▶ The nurses were deleting the initial consultation for some clients who were randomly assigned to the CFA 4,000 group and restart a new consultation to obtain a lower LARC price.
- ▶ We know, because the nurses told us that they were doing this in a small share of cases 😞
 - ▶ Therefore, they fully cooperated in our efforts to (a) identify these cases, and (b) cease this practice going forward.
- ▶ Using server logs and metadata we identified suspicious cases (n=24) and worked with the nurses to confirm whether the client’s original consultations had been deleted (n=17)
 - ▶ Using various criteria including (i) whether the consultation was started after a deleted case,* (ii) the length of time it took to answer each question, (iii) and the time from the start of the consultation to the prices being revealed
- ▶ New protocols were put in place to eliminate case deletions and we are confident that the practice has stopped and the data are ‘clean’ since the end of April, 2020.

Notes: * Most deletions were legitimate because nurse trainees (stagiaires) would use the tablet to practice counselling during downtime, unfortunately metadata was not available for deleted cases



Benefits of having a Pilot phase: Robustness checks for Case deletions

- ▶ To estimate the **intent-to-treat effect** of price discounts, we reassign the suspicious cases from the ‘actual price’ the client received to the control group (*price = CFA 4,000*)
- ▶ **Lower-bound estimates** assume that *all* of these clients would have adopted a LARC at the highest price (i.e. had they not received a re-randomized price).
- ▶ **Upper-bound estimates** assume that *none* of these clients would have adopted a LARC at the highest price.
 - ▶ We use increasingly conservative rules to increase the number of suspicious cases that are reassigned to the control group.

Post-deletion period estimates provide us with a cleaner look at the ITT effects...

Throughout this section, **we present lower-bound estimates**, unless explicitly stated otherwise...

Impact estimates

	(1) Adopted a LARC	(2) Adopted nothing
LARC price: Free/Low	0.137*** (0.0503)	-0.156*** (0.0486)
LARC price: Mid	0.0809 (0.0503)	-0.105** (0.0486)
Control group mean	0.447	0.491
F-test Low prices=Mid prices, F-stat	1.804	1.684
p-value	0.180	0.195
N	669	669

Notes: Robust standard error in parentheses * $p < .10$ ** $p < .05$ *** $p < .01$; All regressions include age and FP department dummy centered and fully interacted with LARC and SARC prices; Free/low price group were offered LARCs at CFA 0 or 150, Mid group at CFA 1,000 or 2,000, and the control group at CFA 4,000.

Impact estimates - robustness

	Full-sample		Post-case deletions	
	(1) Adopted a LARC	(2) Adopted nothing	(3) Adopted a LARC	(4) Adopted nothing
LARC price: Free/Low	0.137*** (0.0503)	-0.156*** (0.0486)	0.249** (0.104)	-0.258*** (0.0908)
LARC price: Mid	0.0809 (0.0503)	-0.105** (0.0486)	0.197* (0.107)	-0.119 (0.0973)
Control group mean	0.447	0.491	0.258	0.645
F-test Low prices=Mid prices, F-stat	1.804	1.684	0.379	3.239
p-value	0.180	0.195	0.539	0.074
Obs.	669	669	196	196

Notes: Robust standard error in parentheses * $p < .10$ ** $p < .05$ *** $p < .01$; All regressions include age and FP department dummy centered and fully interacted with LARC and SARC prices; ; Free/low price group were offered LARCs at CFA 0 or 150, Mid group at CFA 1,000 or 2,000, and the control group at CFA 4,000; columns (1) and (2) report results estimated on the full sample, columns (3) and (4) report results estimated on the sample of clients who received a consultation after the case deletions stopped.

[Further robustness checks...](#)

Impact estimates- heterogeneity

	Endogenous stratification		Department		Age group	
	(1) Low pred. prob.	(2) High pred. prob.	(3) Maternity & Others	(4) Family Planning	(5) Adolescents	(6) Adults
LARC price: Free/Low	0.292*** (0.0777)	0.015 (0.0936)	0.336*** (0.0718)	0.0300 (0.0666)	0.123 (0.0924)	0.177*** (0.0584)
LARC price: Mid	0.157** (0.0792)	0.009 (0.0897)	0.235*** (0.0673)	-0.0139 (0.0690)	-0.00400 (0.0927)	0.120** (0.0589)
Control group mean	0.246	0.679	0.186	0.606	0.444	0.449
Obs.	334	335	261	408	213	456

Notes: Bootstrapped standard errors with 1000 reps. in columns 1-2; Robust standard error in parentheses for columns 5-6, * $p < .10$ ** $p < .05$ *** $p < .01$; ; Free/low price group were offered LARCs at CFA 0 or 150, Mid group at CFA 1,000 or 2,000, and the control group at CFA 4,000; regressions shown in columns 1 and 2 report results from endogenous stratification method as in Abadie et al. (ReStat-2018) using the leave-one-out estimator, endogenous stratification consists of estimating a predicted probability of success using the control group only and then stratifying the sample in two groups with a high/low predicted probability of success; regressions shown in columns 3 and 4 include age centered and fully interacted with LARC and SARC prices; regressions shown in columns 5 and 6 include a FP department dummy centered and fully interacted with LARC and SARC prices.

What predicts take-up?

Department and adolescents

	Maternity & Others		Family Planning	
	(1) Adolescents	(2) Adults	(3) Adolescents	(4) Adults
LARC price: Free/Low	0.328** (0.149)	0.366*** (0.0759)	-0.0298 (0.117)	0.0645 (0.0813)
LARC price: Mid	-0.0127 (0.126)	0.366*** (0.0755)	0.00248 (0.132)	-0.0258 (0.0824)
Control group mean	0.316	0.083	0.538	0.644
N	91	170	122	286

Robust standard error in parentheses * p<.10 ** p<.05 *** p<.01; All regressions include SARC prices fully interacted with LARC prices;

Expected % of women experiencing an unintended pregnancy within 12 months...

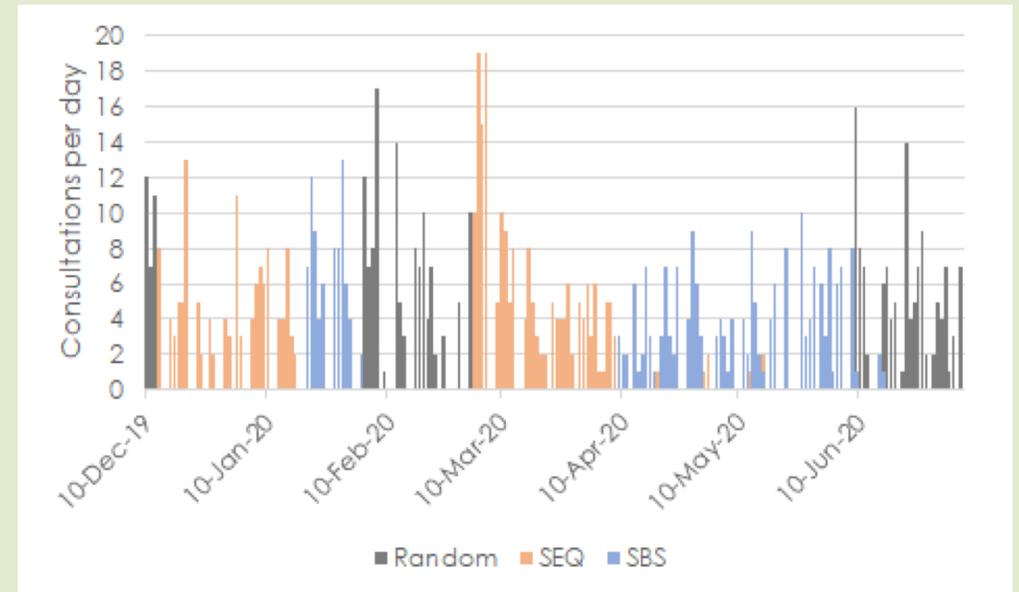
	(1)	(2)	(3)
	Adopted a LARC	Adopted nothing	Expected prob. of pregnancy (12 months)
LARC price: Free/Low	0.137*** (0.0503)	-0.156*** (0.0486)	-0.0390*** (0.0118)
LARC price: Mid	0.0809 (0.0503)	-0.105** (0.0486)	-0.0257** (0.0118)
Control group mean	0.447	0.491	0.130
F-test Low prices=Mid prices, F-stat	1.804	1.684	1.884
p-value	0.180	0.195	0.170
Obs.	669	669	669

Notes: Robust standard error in parentheses * $p < .10$ ** $p < .05$ *** $p < .01$; All regressions include age and FP department dummy centered and fully interacted with LARC and SARC prices; Free/low price group were offered LARCs at CFA 0 or 150, Mid group at CFA 1,000 or 2,000, and the control group at CFA 4,000; the expected probability of pregnancy is calculated by assigning each client the 12 month typical use effectiveness rate of their adopted method, clients who are not using a method, who are using the condom, or who are using a non-modern method are assigned a conservative 25% likelihood of becoming pregnant in the next 12 months.

Preliminary impacts - Consultation type

- ▶ For training purposes, the consultation type was locked in the Sequential or Side-by-side regime
 - ▶ Once providers proved to be comfortable with the app the client level randomization was enabled
 - ▶ Between December and March the study was ongoing only in the Family Planning department only
 - ▶ In March the study was expanded to three new departments and the cycle was repeated

Consultations and randomization regime over time



Preliminary impacts - Consultation type

	CFA 4,000	CFA 1,000/2,000	Free / CFA 150
<i>Panel A: Clients who get randomized into a consultation type (n=347)</i>			
SBS (n=199)	30.3%	42.9%	50.0%
SEQ (n=148)	44.4%	38.0%	42.3%
<i>Panel B: Clients who do NOT get randomized into a consultation type (n=322)</i>			
SEQ	53.7%	62.6%	73.6%

[See results for SARCS and none...](#)

Preliminary impacts - Consultation type

	CFA 4,000	CFA 1,000/2,000	Free / CFA 150
<i>Panel A: Clients who get randomized into a consultation type (n=347)</i>			
SBS (n=199)	30.3%	42.9%	50.0%
SEQ (n=148)	44.4%	38.0%	42.3%
<i>Panel B: Clients who do NOT get randomized into a consultation type (n=322)</i>			
SEQ	53.7%	62.6%	73.6%

[See results for SARCS and none...](#)

Preliminary impacts - Consultation type

	CFA 4,000	CFA 1,000/2,000	Free / CFA 150
<i>Panel A: Clients who get randomized into a consultation type (n=347)</i>			
SBS (n=199)	30.3%	42.9%	50.0%
SEQ (n=148)	44.4%	38.0%	42.3%
<i>Panel B: Clients who do NOT get randomized into a consultation type (n=322)</i>			
SEQ	53.7%	62.6%	73.6%

[See results for SARCS and none...](#)

Preliminary impacts - Consultation type

	CFA 4,000	CFA 1,000/2,000	Free / CFA 150
<i>Panel A: Clients who get randomized into a consultation type (n=347)</i>			
SBS (n=199)	30.3%	42.9%	50.0%
SEQ (n=148)	44.4%	38.0%	42.3%
<i>Panel B: Clients who do NOT get randomized into a consultation type (n=322)</i>			
SEQ	53.7%	62.6%	73.6%

[See results for SARCS and none...](#)



Concluding discussion

The impact findings from the pilot phase are encouraging and intriguing:

1. Discounts increase take-up of LARCs
2. Important to identify women not seeking FP services and offer them counseling
3. Free provision can increase take-up among adolescents
4. Improved counseling may increase take-up at regular prices, but may have interaction effects with prices...



Questions for the main study

1. Optimal discounts (possibly tailored to client context)
 - Discontinuity of demand at a low price?
2. Client satisfaction and discontinuation rates (as well as 12-month pregnancy rates)
3. Is improved counseling more effective than discounts?
 - Does it act like a nudge, affecting price elasticity of demand?
4. If experimental interventions are successful in creating a fertility gap, long-term follow-ups on child health and HC accumulation...



Thank you!

Golub Capital Social Impact Lab

Led by Prof. Susan Athey (Faculty Director), our lab uses digital technology and social science research to improve the effectiveness of leading social sector organizations.

We have partnerships with a wide range of partners, from for-profit large companies to smaller non-profit organizations. We have several other applications that involve adaptive experimentation, including about charitable giving, behavioral nudges, and online misinformation regarding COVID-19.

Website: <https://www.gsb.stanford.edu/faculty-research/centers-initiatives/sil>

Twitter: [@GSBsiLab](https://twitter.com/GSBsiLab)



SI Lab



 Scan me

APPENDIX SLIDES



	Reassign confirmed cases		Re-assign all suspicious cases		Rules based re-assignments	
	(1) Lower bound	(2) Upper bound	(3) Lower bound	(4) Upper bound	(5) Lower bound	(6) Upper bound
Panel A: Adopted a LARC						
LARC price: Free/Low (CFA 0-150)	0.137*** (0.0503)	0.273*** (0.0493)	0.0976* (0.0515)	0.280*** (0.0488)	0.0933* (0.0507)	0.335*** (0.0473)
LARC price: Mid (CFA 1,000-2,000)	0.0809 (0.0503)	0.216*** (0.0494)	0.0434 (0.0513)	0.226*** (0.0486)	0.0100 (0.0502)	0.252*** (0.0469)
Control group mean (CFA 4,000)	0.447	0.298	0.479	0.281	0.530	0.254
F-test Low prices=Mid prices	1.804	1.804	1.644	1.644	3.877	3.877
p-value	0.180	0.180	0.200	0.200	0.049	0.049
Panel B: Adopted nothing						
LARC price: Free/Low (CFA 0-150)	-0.156*** (0.0486)	-0.292*** (0.0494)	-0.119** (0.0499)	-0.301*** (0.0489)	-0.124** (0.0484)	-0.366*** (0.0471)
LARC price: Mid (CFA 1,000-2,000)	-0.105** (0.0486)	-0.240*** (0.0494)	-0.0680 (0.0496)	-0.251*** (0.0487)	-0.0384 (0.0483)	-0.280*** (0.0469)
Control group mean (CFA 4,000)	0.491	0.640	0.463	0.661	0.418	0.694
F-test Low prices=Mid prices	1.684	1.684	1.590	1.590	4.648	4.648
p-value	0.195	0.195	0.208	0.208	0.031	0.031
Obs.	669	669	669	669	669	669

Notes: Robust standard error in parentheses * $p < .10$ ** $p < .05$ *** $p < .01$; All regressions include age and FP department dummy centered and fully interacted with LARC and SARC prices; Free/low price group were offered LARCs at CFA 0 or 150, Mid group at CFA 1,000 or 2,000, and the control group at CFA 4,000; columns (1) and (2) report results estimated after re-assigning clients who the providers confirmed their case was deleted and restarted into the CFA4,000 group ($n=17$), columns (3) and (4) report results estimated after re-assigning all suspicious cases identified manually to the CFA4,000 group ($n=24$), columns (5) and (6) report results estimated after re-assigning all clients whose consultations satisfied a pre-specified set of rules deeming their consultation suspicious of having been deleted and restarted ($n=37$); Lower bounds are obtained by setting the outcome variable for all re-assigned equal to a failure (i.e. did NOT adopt a LARC, adopted something) and vice versa for the upper bounds.

[Back...](#)

Endogenous stratification

	Endogenous stratification	
	(1) Low pred. prob.	(2) High pred. prob.
LARC price: Free/Low	0.292*** (0.0777)	0.015 (0.0936)
LARC price: Mid	0.157** (0.0792)	0.009 (0.0897)
Control group mean	0.246	0.679
Obs.	334	335

Notes: Bootstrapped standard errors with 1000 reps. in columns 1-2; * $p < .10$ ** $p < .05$ *** $p < .01$; ; Free/low price group were offered LARCs at CFA 0 or 150, Mid group at CFA 1,000 or 2,000, and the control group at CFA 4,000; regressions shown in columns 1 and 2 report results from endogenous stratification method as in Abadie et al. (ReStat-2018) using the leave-one-out estimator, endogenous stratification consists of estimating a predicted probability of success using the control group only and then stratifying the sample in two groups with a high/low predicted probability of success.

	(1) Low pred. prob. Mean	(2) High pred. prob. Mean	Difference (1)-(2) p-value
Department: Gynecology/Maternity	0.675	0.105	0.000
Age	28.257/(0.347)	29.15/(0.443)	0.113
Adolescent	0.316	0.32	0.913
Education: Tertiary	0.51	0.272	0.000
Client is working (salaried or self-employed)	0.624	0.464	0.000
Domestic activities	0.128	0.311	0.000
Children, alive today	2.185	3.132	0.000

Note: *the 'Difference' columns show the p-value from a t-test of the difference in means between the two indicated groups; Standard errors included in parenthesis for non-binary variables.

[Back...](#)

PRELIMINARY IMPACTS - CONSULTATION TYPE

		CFA 4,000	CFA 1,000/2,000	Free / CFA 150
<i>Panel A: Clients who get randomized into a consultation type (n=347)</i>				
SBS (n=199)	LARC	30.3%	42.9%	50.0%
	SARC	6.1%	3.6%	11.0%
	None	63.6%	53.6%	39.0%
SEQ (n=148)	LARC	44.4%	38.0%	42.3%
	SARC	3.7%	16.0%	8.5%
	None	51.9%	46.0%	49.3%
<i>Panel B: Clients who do NOT get randomized into a consultation type (n=322)</i>				
SEQ	LARC	54.7%	63.0%	74.2%
	SARC	5.7%	7.2%	4.7%
	None	39.6%	29.7%	21.1%

[Back...](#)