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

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"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)*

Why is this important?

- Maternal mortality ratio ≅ 600 (*per 100K live births*)
- Lifetime risk of maternal death ≅ 1 in 35
- Unintended pregnancies are a major factor in persistently high maternal mortality…

Why is this important?

- Loss of welfare for the mother
- Low age at first birth → 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…

- Long-acting reversible contraceptives (LARCs) are close to 100% effective in preventing unintended pregnancies.

- But, no one is using them (*at least until very recently*)
  - Especially in developing countries
  - Even more true for:
    - Adolescent females
    - Unmarried women, and
    - Nulliparous women

Interventions to maximize human capital accumulation among adolescent females

- Of the interventions, say, the World Bank supports (and others that you can think of), such as:
  - CCTs/UCTs,
  - Girls' clubs,
  - Vocational training, etc.
- It's quite possible that an effective intervention to increase the uptake of modern contraceptives would be the most cost-effective option…
  - **But, what would such an intervention look like?**

It's a complicated problem…

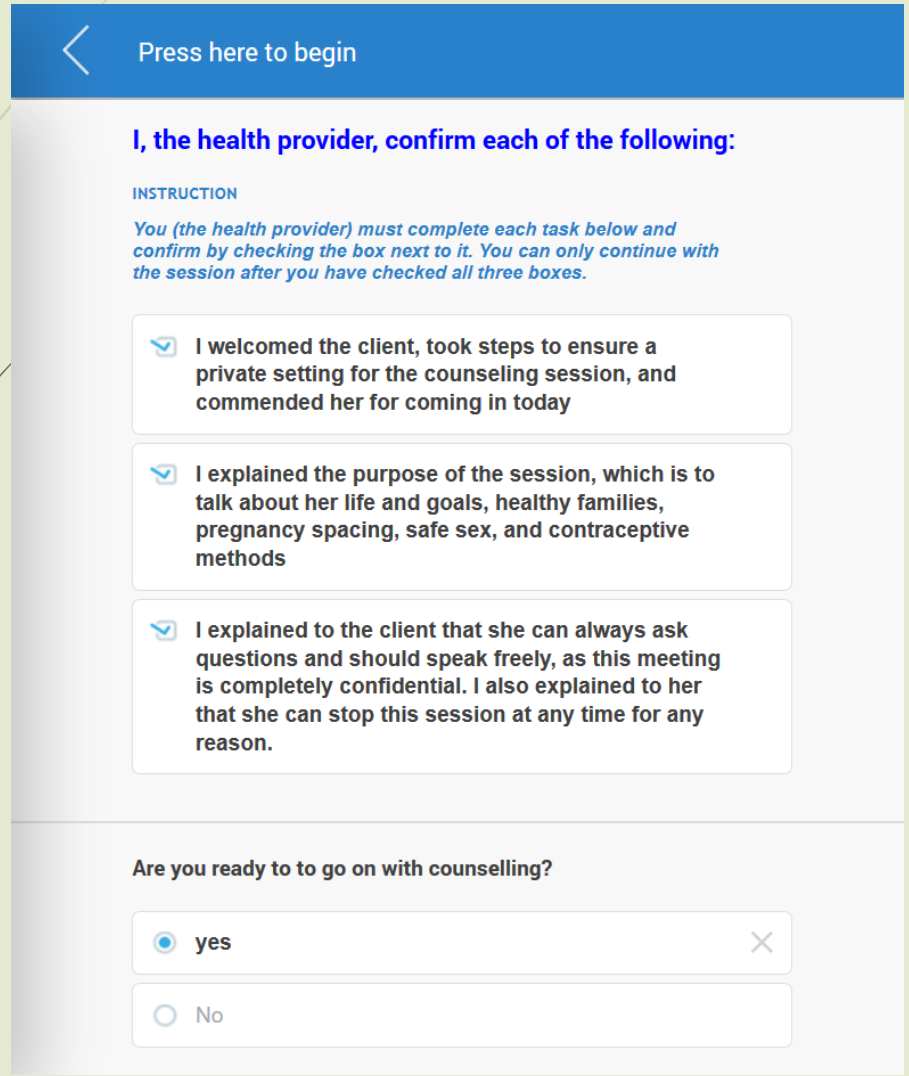
- **Big picture**: There exists no contraceptive method that is highly effective, convenient to use, and has, on average, minimal side effects.
  - Worse, the side effects are highly idiosyncratic.
  - So are individual preferences…
  - A journey to find the right method for you (for a period of time)
- **Smaller picture**: Supply- and demand-side problems galore…
  - Lack of training and provider bias
  - Misinformation, fear, culture, religion
  - Cost

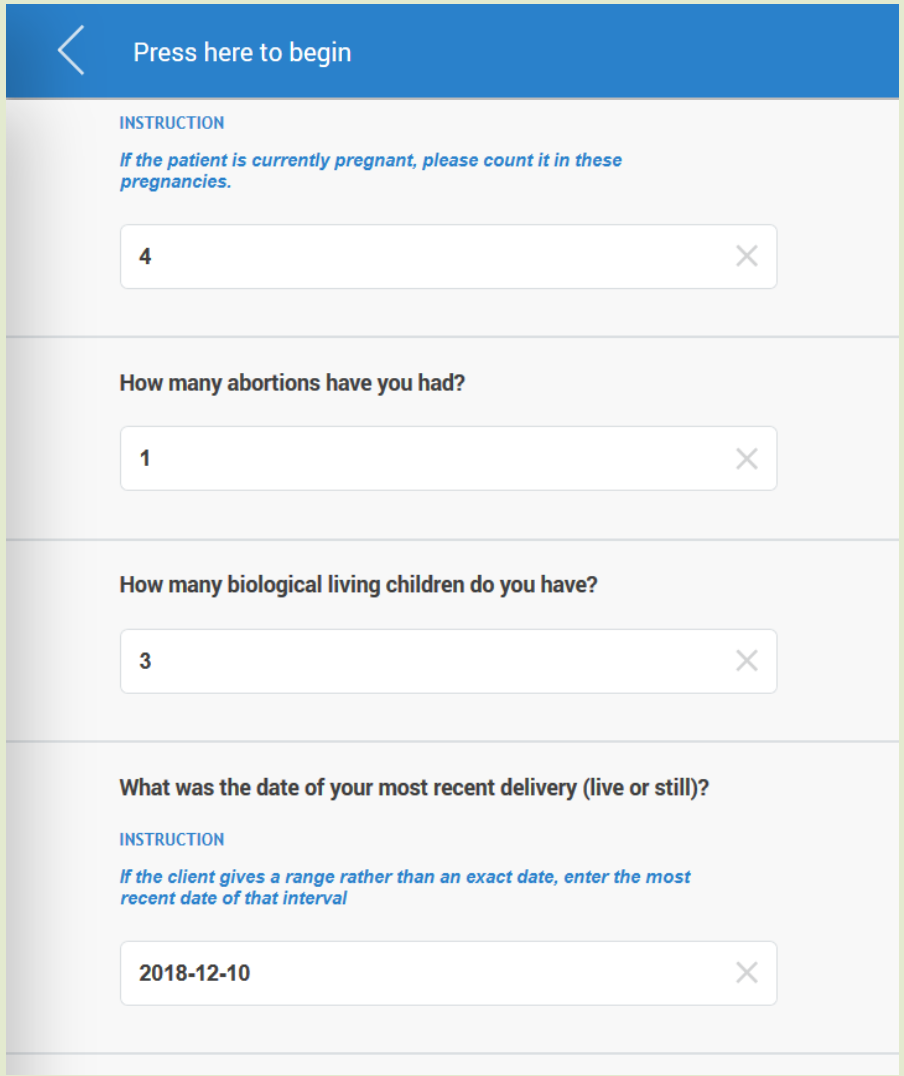
Redefining the "counseling approach"

- **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 Tablet-based Counseling "App"





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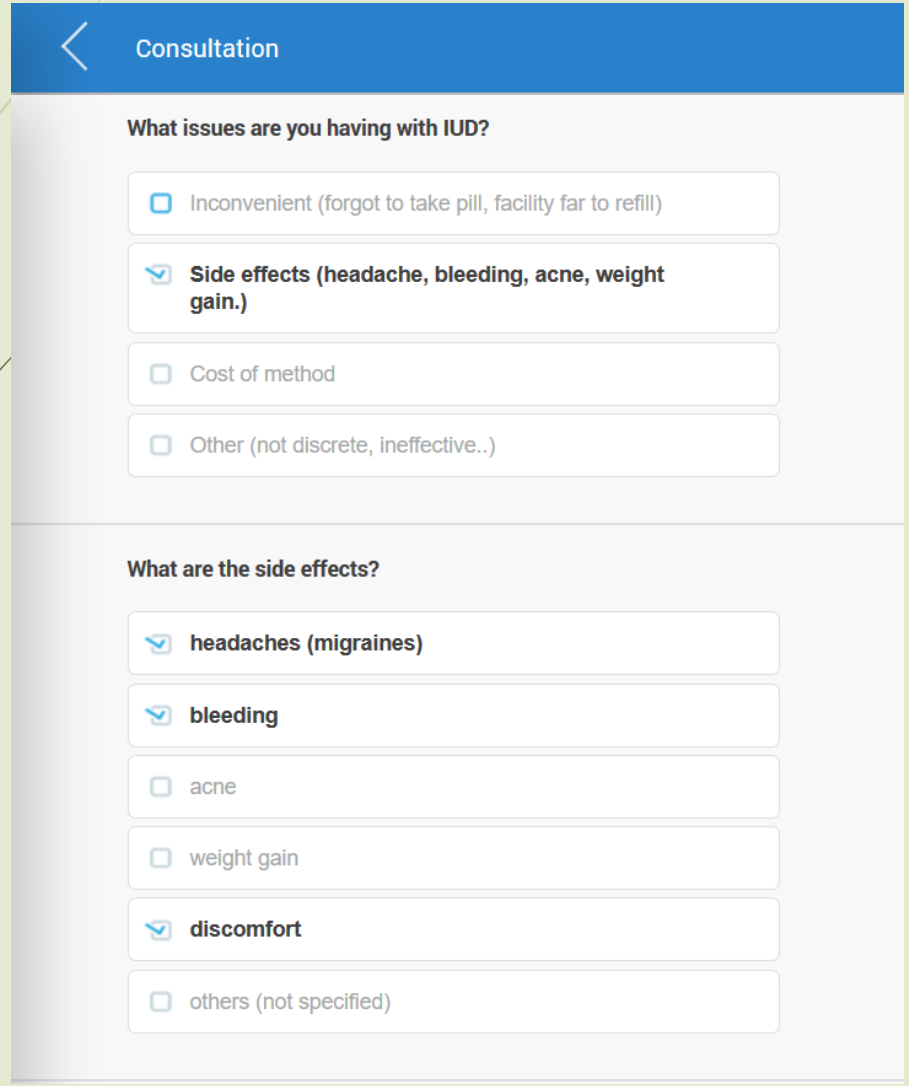

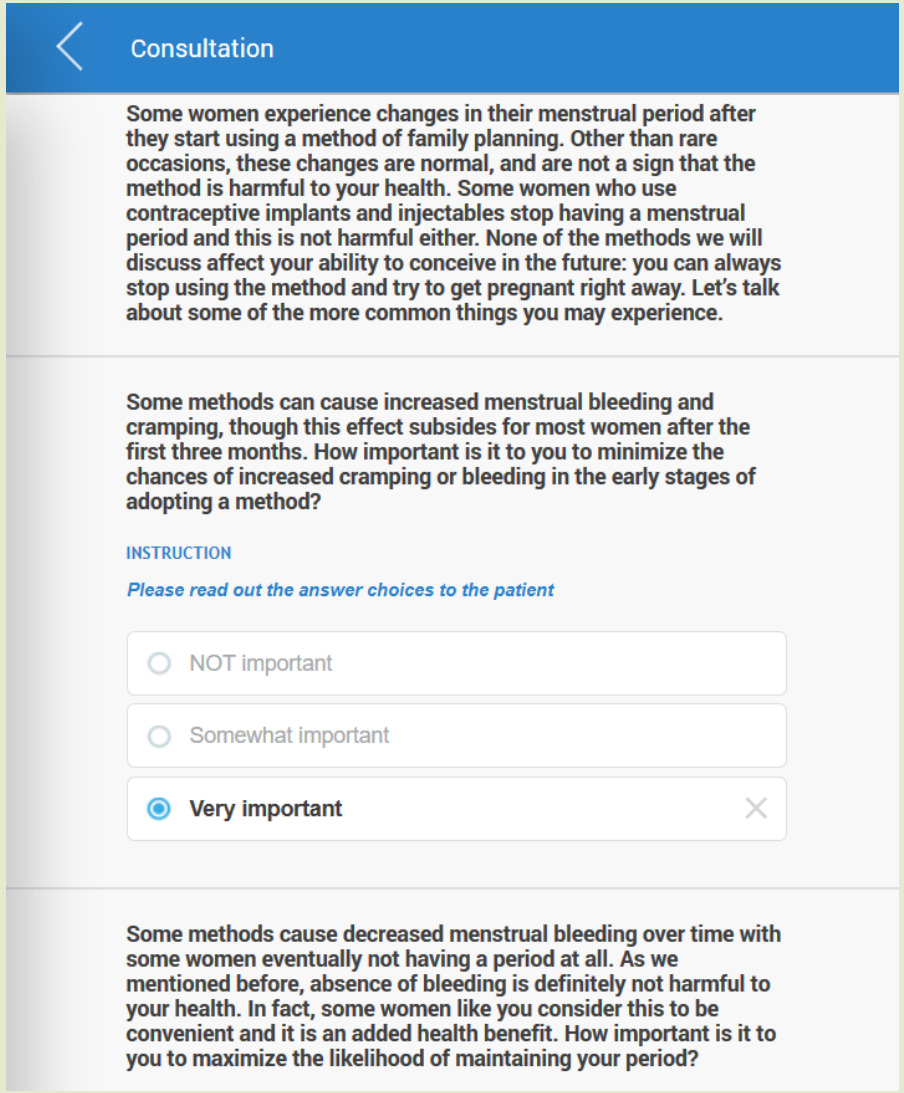

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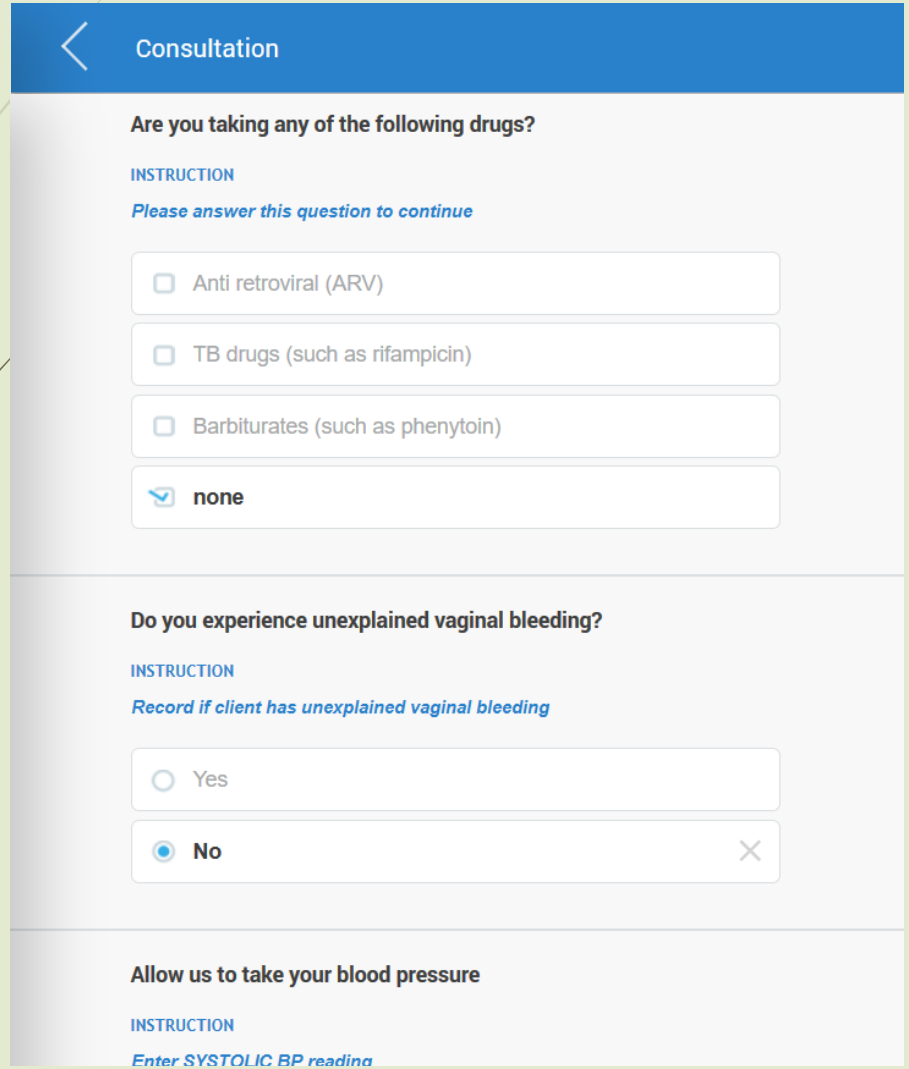

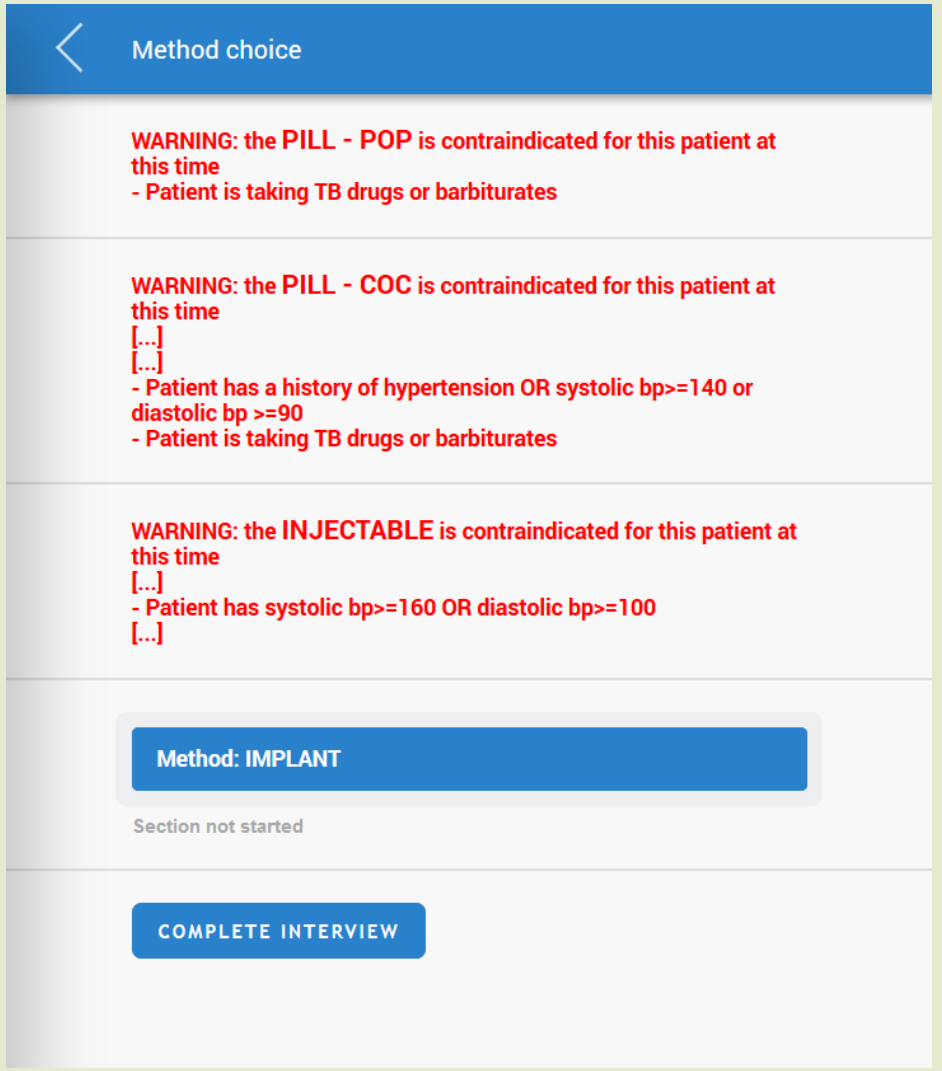

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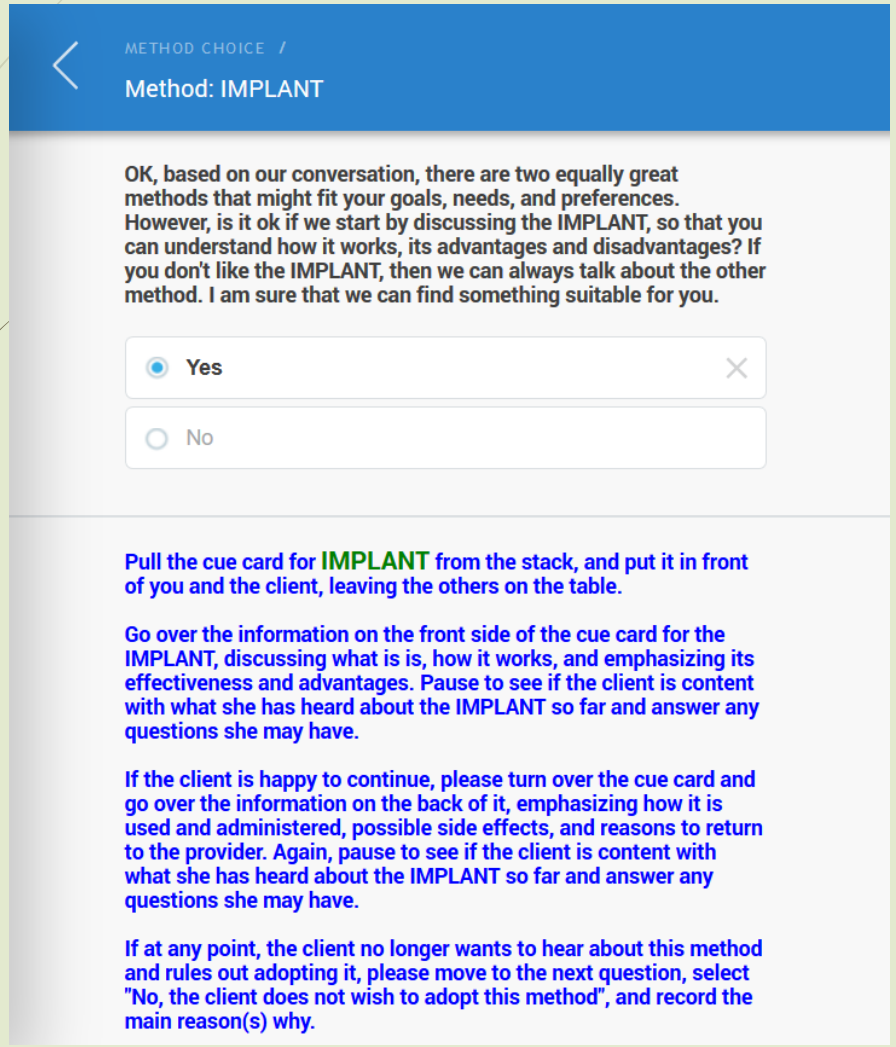
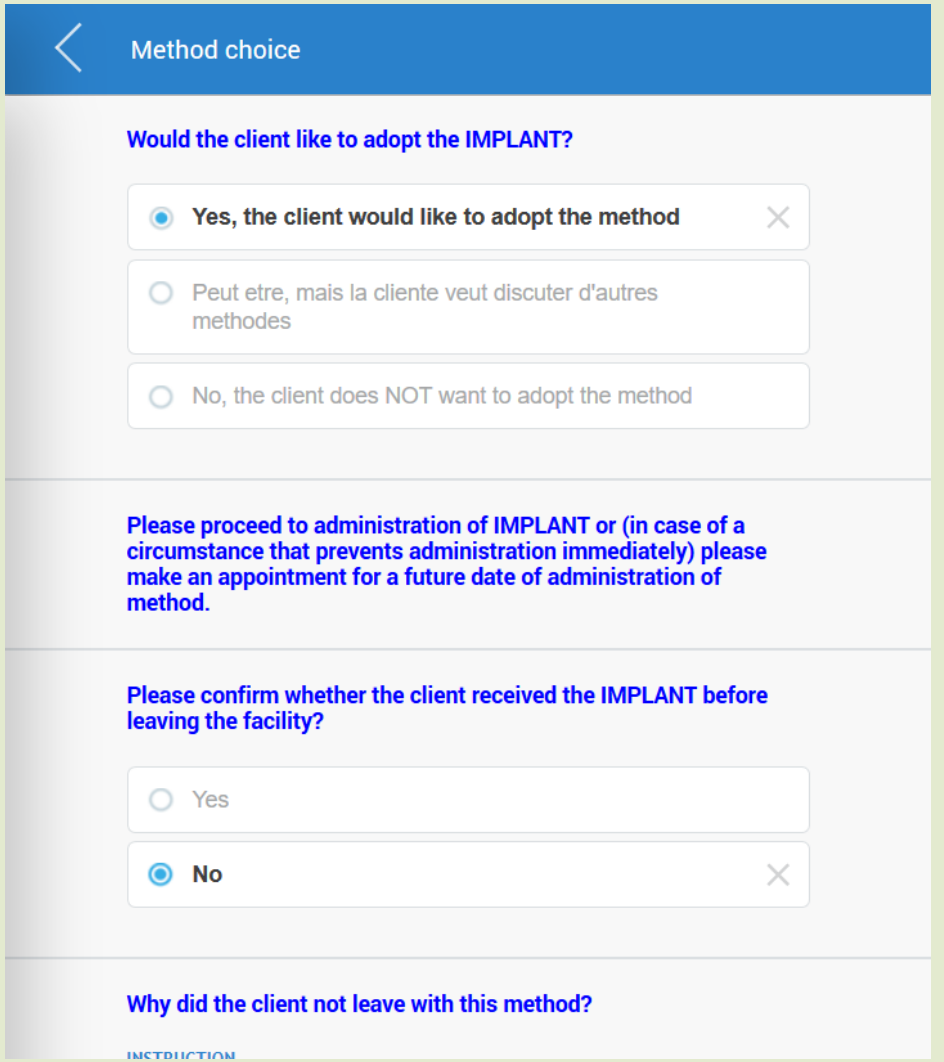




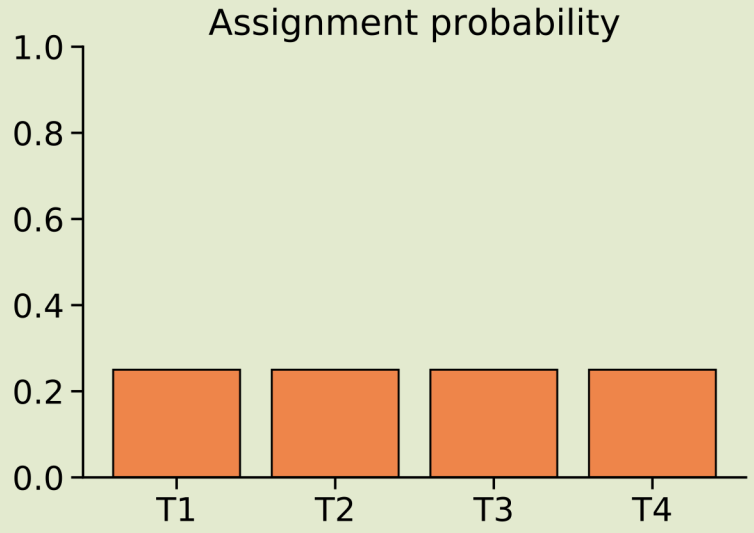
Advantages of FP3.0

- Makes the nurse's job easier
- Empowers the client
- Produces rich data on client characteristics, preferences and outcomes
- And, allows for experimentation…

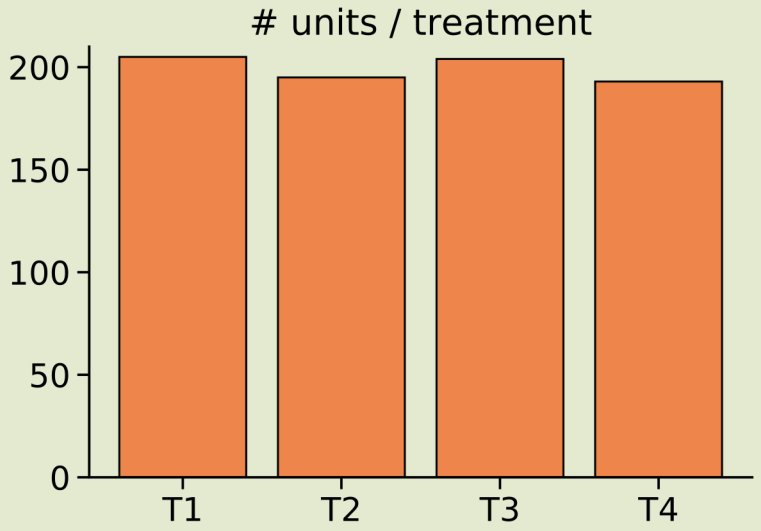
An adaptive experiment…

- Trying to increase the uptake of LARCs – particularly among adolescents and nulliparous/unmarried women – by:
  1. Randomly vary the **counseling approach** (mimicking the old and the new paradigms within the "app")
  2. Offering random discounts to learn about the (cross-) **price elasticity** of demand and its heterogeneity by context
- Tailoring counseling to the client *(using contextual bandit algorithms)*

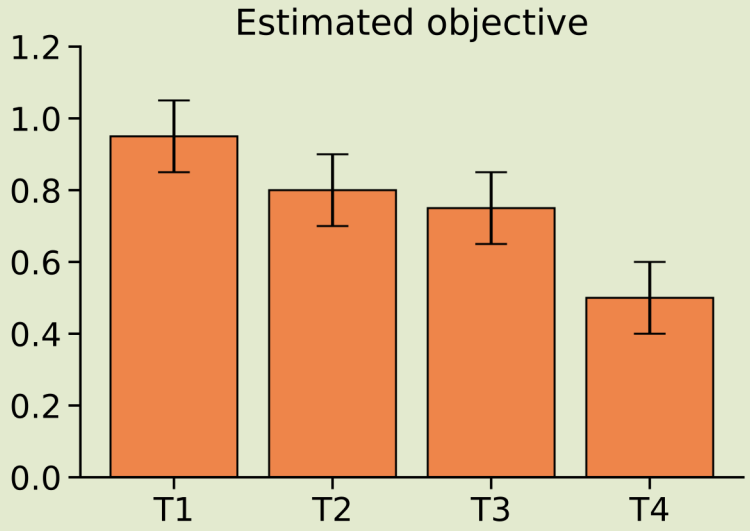
Randomized control trials



Fixed probability of assignment to each treatment*.



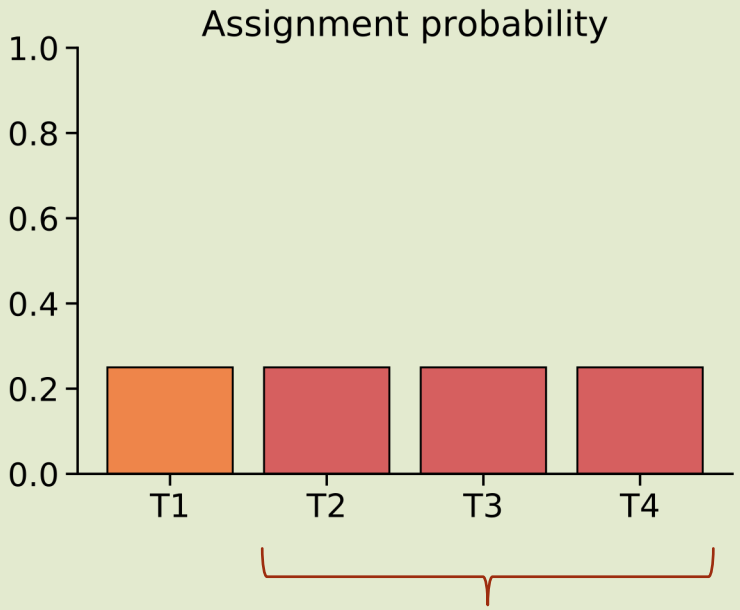
Roughly equal number of units assigned to each treatment.

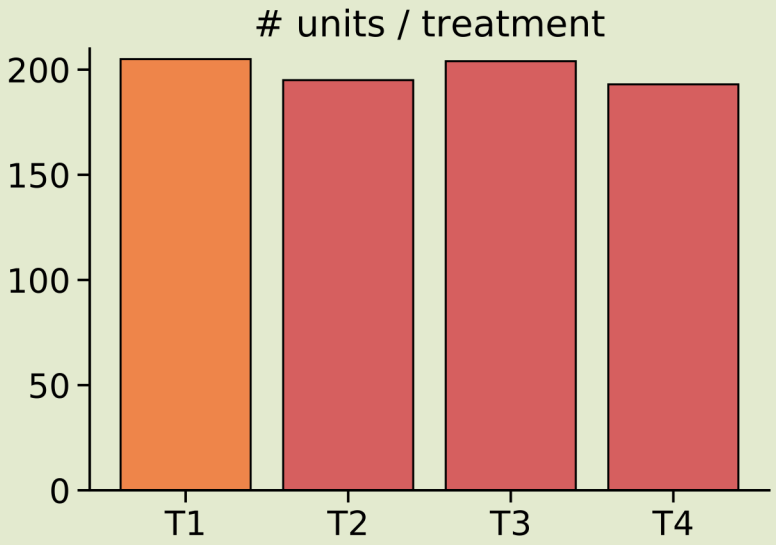


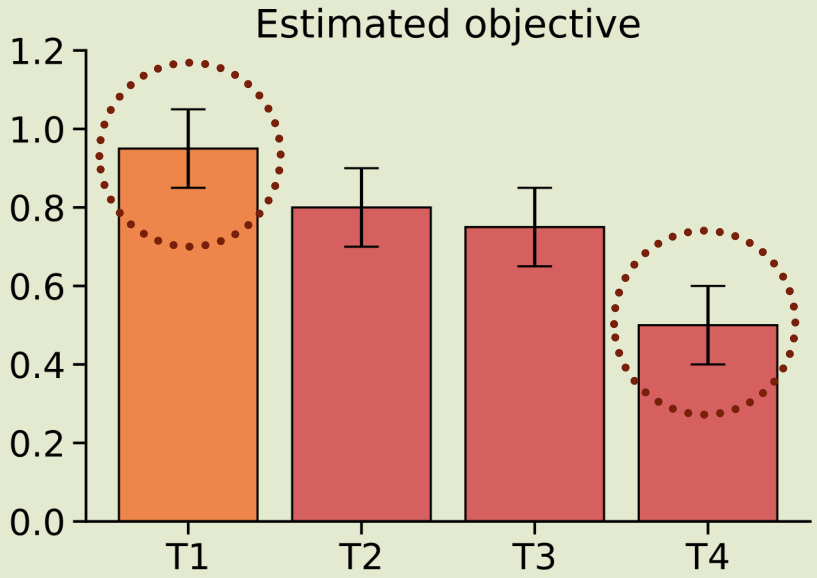
Treatment value estimate

*Note: for illustration only. In our experiment there are 20 treatments.

Randomized control trials





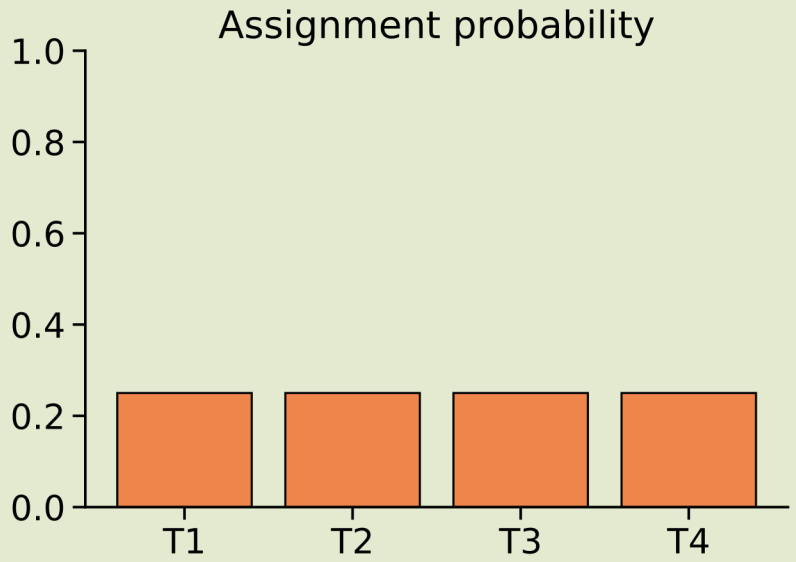


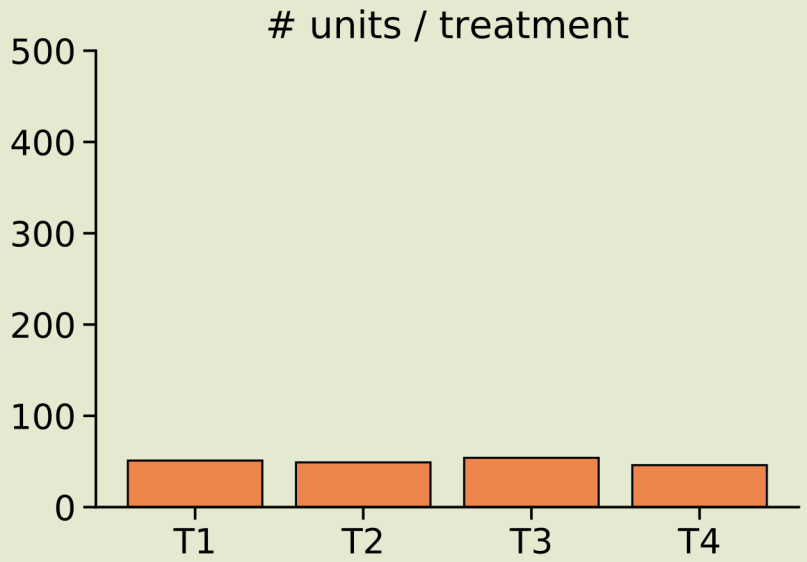
Many individuals assigned to suboptimal treatments (regret).

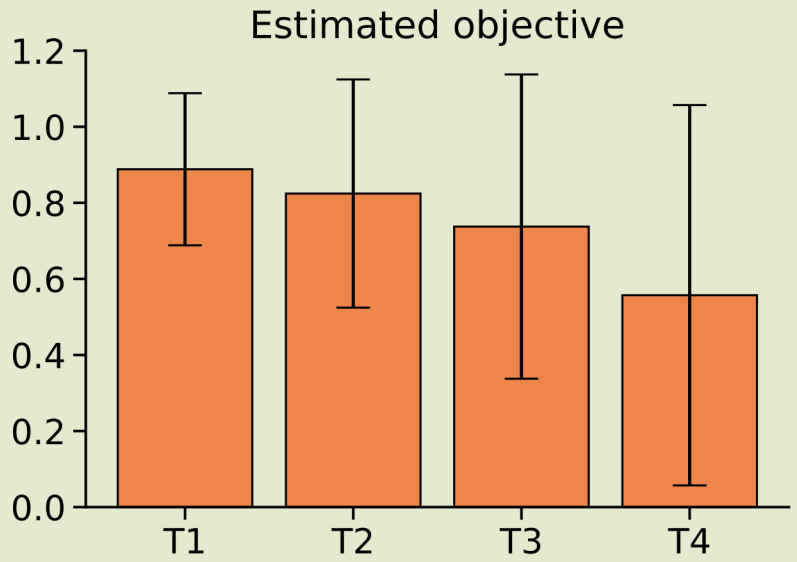
Good treatments not necessarily estimated more accurately than bad ones.

Adaptive experiments

(multi-armed bandits)



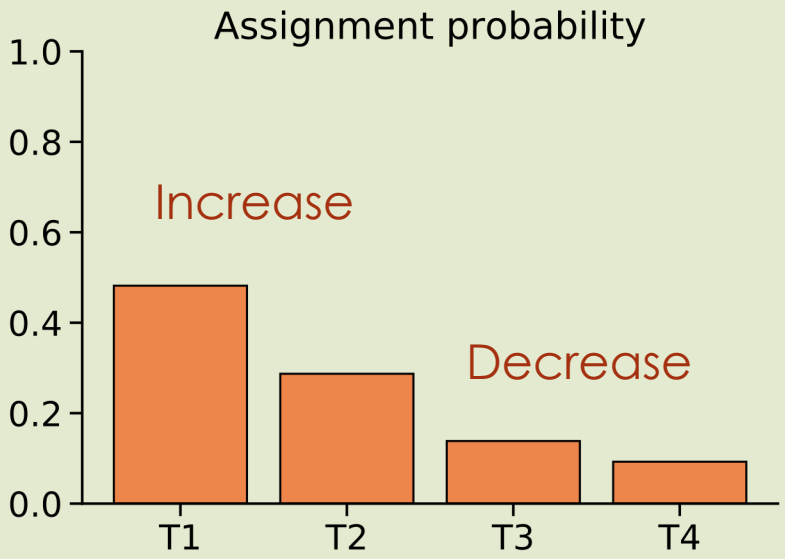


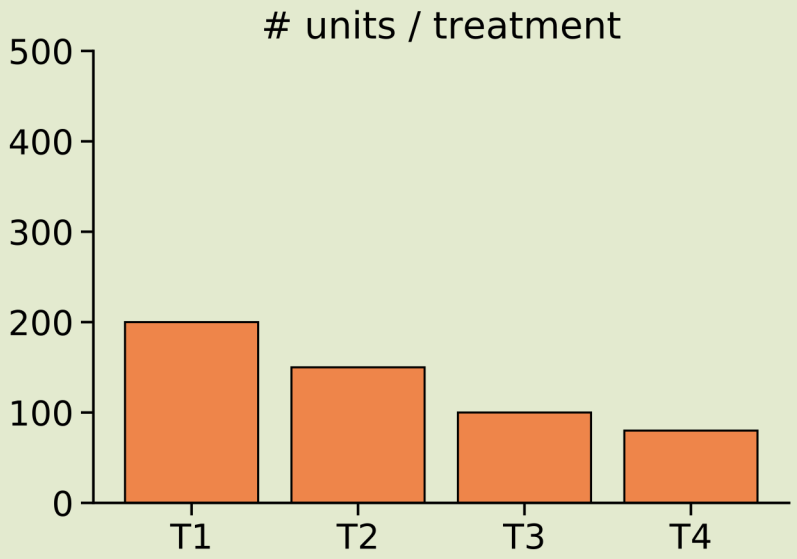


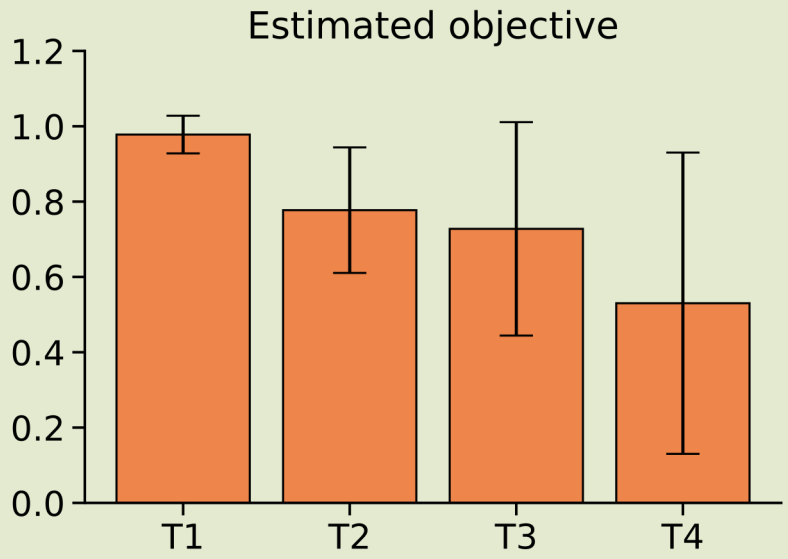
Step 1: At the *beginning* of the experiment, assign treatments uniformly at random

Adaptive experiments

(multi-armed bandits)



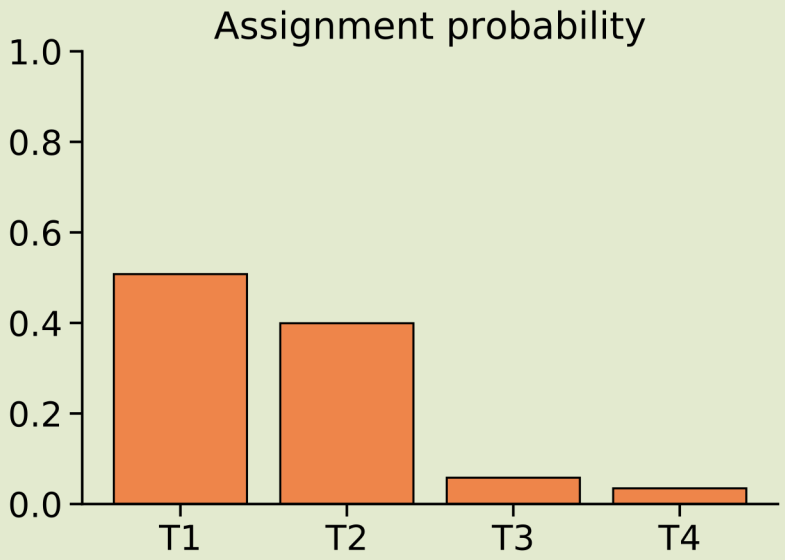


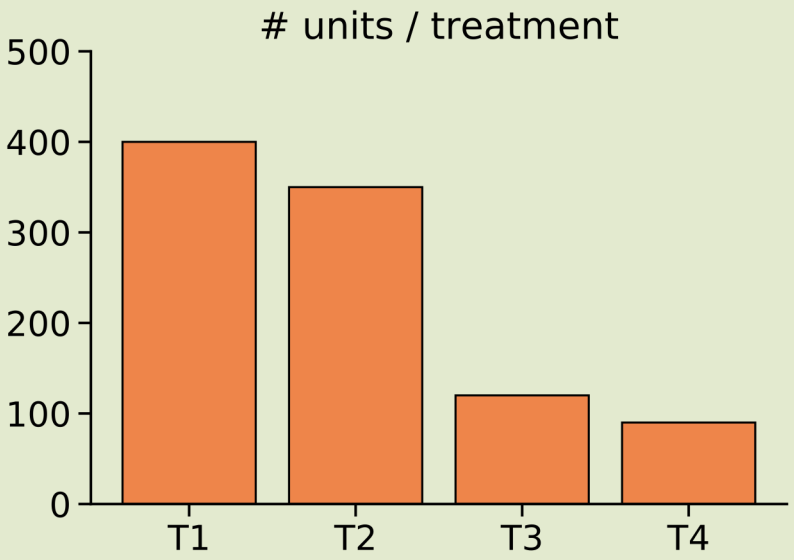


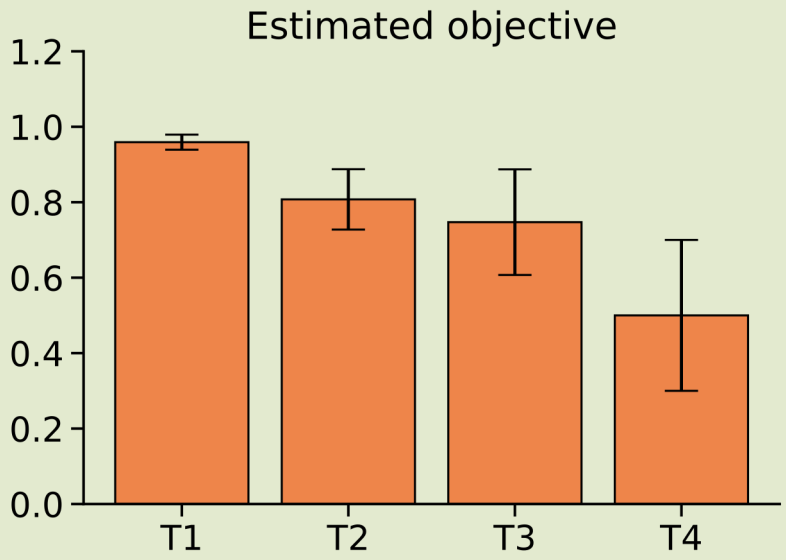
Step 2: Once some data has been collected, increase the probability of assignment to more promising arms.

Adaptive experiments

(multi-armed bandits)



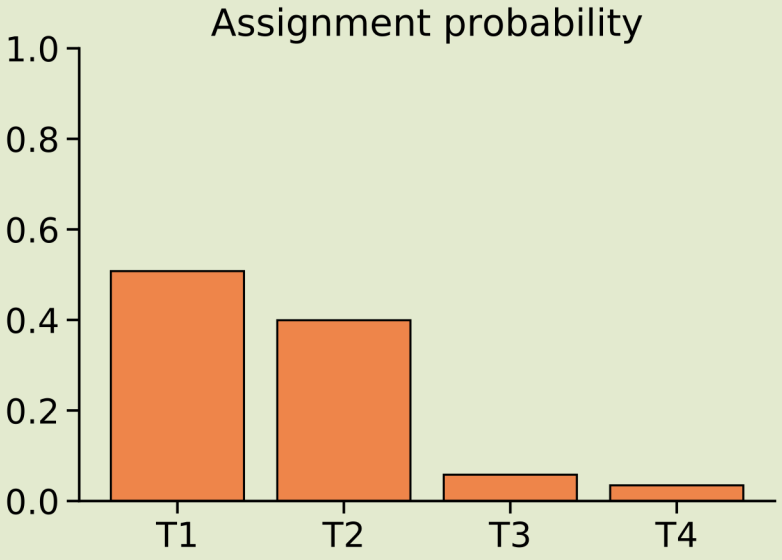




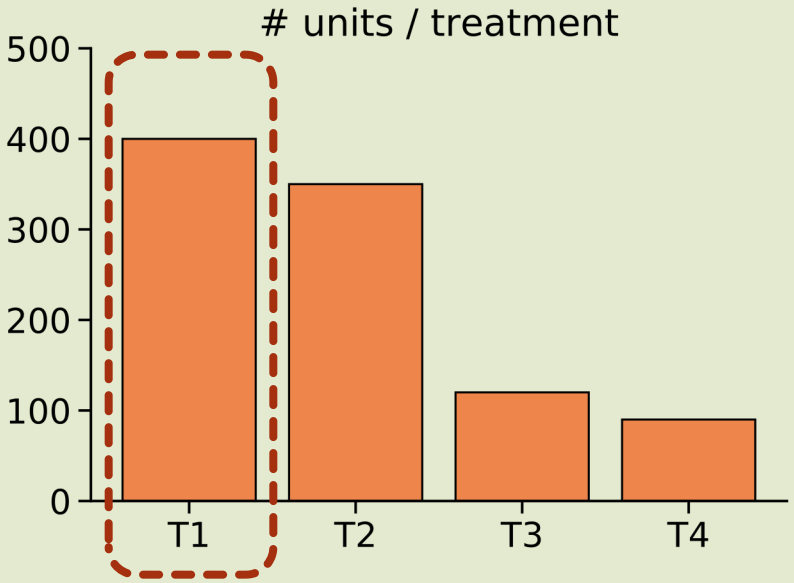
Step k: Repeat this procedure in batches, increasing probabilities one assignment as we become more certain about which treatments are good.

Adaptive experiments

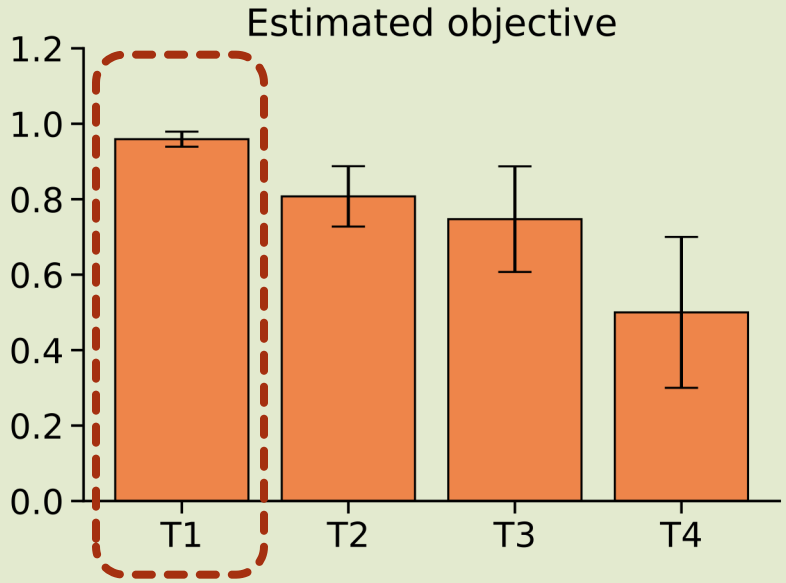
(multi-armed bandits)



As experiment progresses, suboptimal treatments are assigned less frequently…



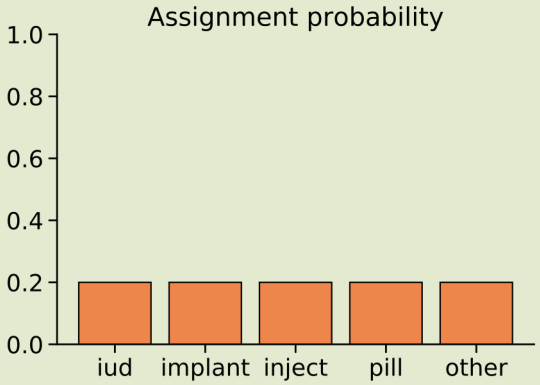
…in the end, more observations assigned to optimal treatments (lower regret).



Tighter confidence intervals around optimal treatment value estimates (more power for hypotheses about better treatments).

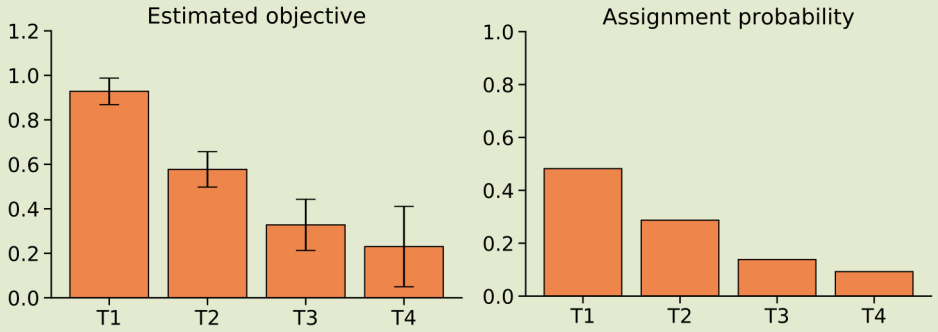
Adaptive experiments

(*contextual* bandits)

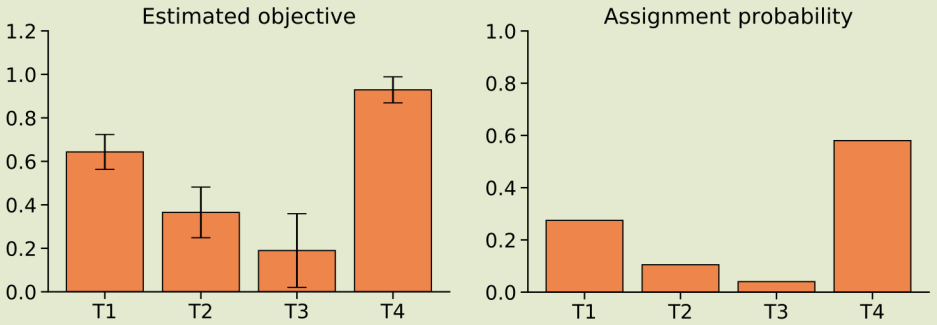


Step 1: Treatments assigned uniformly at random.

Age ≤ 26

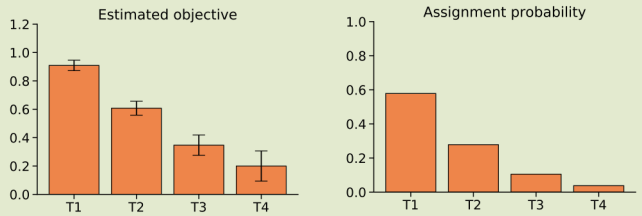


Age > 26

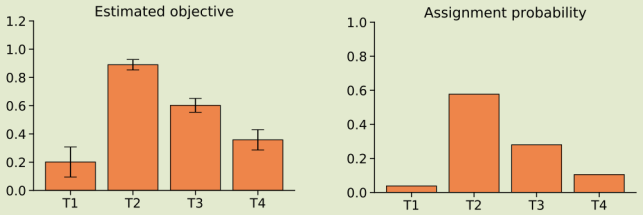


Step 2: Using *contextual* (personal) information, discover *subgroups* and update assignment probabilities for each group.

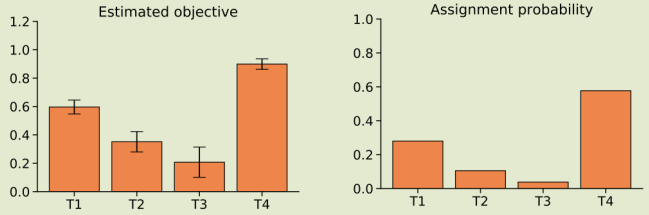
Age ≤ 22 and children ≤ 2



Age > 22 and children ≤ 2



22 ≤ Age < 28 and children > 3



(...etc....)

Step k: Retrain algorithm, discover more refined subgroups. Update probabilities to increase personalization.

time

Contextual bandits

- Tailoring the treatment to the individual client:
  - Random assignment probability not only depends on success (reward) in previous batches, but also on the individual characteristics (context) of the individual.
  - Best treatment in each subgroup can be estimated more accurately.
  - However, new statistical inference challenges due to adaptivity (e.g. *Hadad et al, 2019*; *Deshpande et al, 2017*)

- In our adaptive experiment, we are trying to minimize the probability of unintended pregnancies within 12 months for a given budget.
  - We are in the process of identifying a few contexts (adolescent/adult; married/unmarried; nulliparous/higher parity, etc.)

The pilot phase has begun ;-)