Why Did She Quit?

Understanding Contraceptive Use Trajectory and Discontinuation through Data Visualization and Machine Learning

Amy Finnegan, PhD [1, 2, 3,4], Megan Huchko, MD, MPH[1, 2, 5], Kelly Hunter [1, 2]; Daisy Fang, Katherine Gan, Anu Kandadai, Colby Matthiasson, Celia Mizelle, Molly Paley, Nicole Rapfogel, Saumya Sao, Liz Shulman, Samhitha Sunkara, & Melanie Lai Wai

Introduction

- 1/3 of women who begin using a modern method of contraception in low-income countries discontinue within the first year[1], putting them at risk for unintended pregnancies, maternal morbidity and mortality.
- Understanding contraceptive use dynamics (discontinuation, failure, and method switching) is crucial to reaching the FP2020 goals.

Data

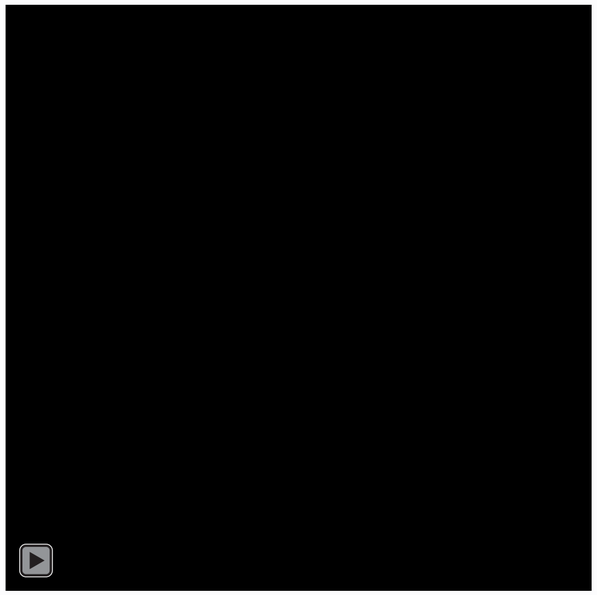
- We use the Demographic & Health Survey[2], a cross-sectional, population-representative survey of reproductive age women (ages 15 to 49).
- We use the DHS contraceptive calendar, which is retrospectively reported contraceptive use in each month during the 5-year period before each survey.

Interactive Visualization: See the Switch

- "See the Switch" shows contraceptive calendar **data as a trajectory.**
- **User tests** showed the usefulness of a chord diagram, after a brief tutorial.
- Visualizing contraceptive use can lead to **fresh insights about churn** in contraceptive use.

Tutorial

- **Colors** encode **contraceptive efficacy** with typical use.
- Each **"arc"** represents a group of women using the same contraceptive method.
- Each **"chord"** represents the trajectory users take between the starting and ending month.



Machine Learning to Understand Contraceptive Use

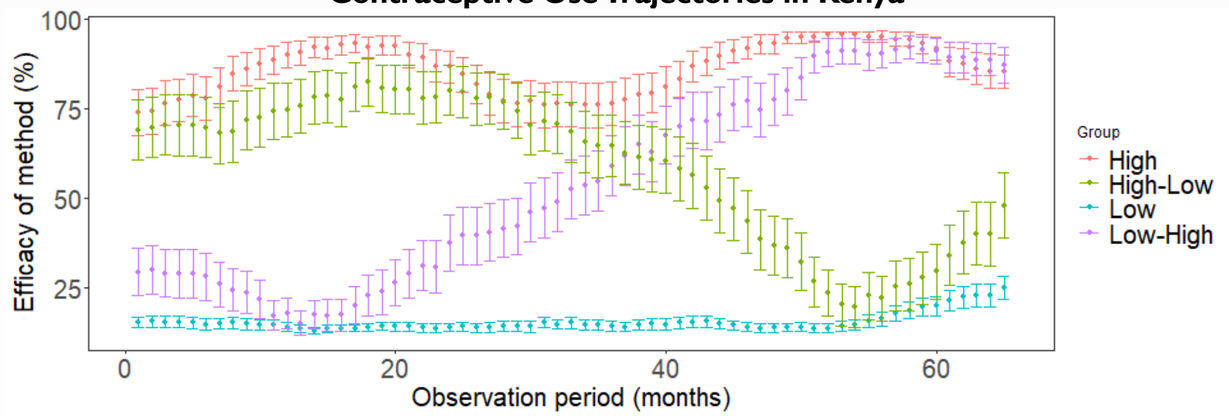
Methods

- Subset the data for women who are age 30 at the DHS survey and **summarized their contraceptive trajectory** over the past 5 years (i.e. ages 25 to 30).
- Efficacy of contraceptive method used at each month for individual women is grouped into a longitudinal trajectory using the *kml* package from R which employs **unsupervised machine learning** (k-means clustering) to identify patterns.

Results

- K-means clustering identified **four groups** of women:
  - **High:** Users of high efficacy methods
  - **High-Low:** Users who switch to less effective methods
  - **Low-High:** Users who switch to more effective methods
  - **Low:** Users who do not use or use low efficacy methods

Contraceptive Use Trajectories in Kenya



K-means unsupervised, unweighted contraceptive use trajectories for women aged 25 to 30 years with 95% confidence intervals. Kenya DHS 2014. Author's calculations.

Advocacy Impact

- Comprehensive data on contraceptive use dynamics are collected by the DHS program through a *contraceptive calendar*; however, there is a large **technical skill barrier** to use of this data.
- By introducing novel methods of visualizing and utilizing DHS data, we aim to help researchers and program implementers **understand and predict contraceptive behaviors**.
- Accessible DHS data can drive evidence-based programming and policies **to improve contraceptive access and reduce discontinuation.**

References

1. Castle, S., & Askew, I. (2015). *Contraceptive Discontinuation: Reasons, Challenges, and Solutions.* Retrieved from http://www.familyplanning2020.org/microsite/contraceptive-discontinuation
2. The DHS Program. DHS Contraceptive Calendar Tutorial. Retrieved from https://www.dhsprogram.com/data/calendar-tutorial/
3. Big Data for Reproductive Health (2018-2019). (2018). Retrieved from https://bassconnections.duke.edu/project-teams/big-data-reproductive-health-2018-2019

Acknowledgements: We are very grateful to the Duke Data+ and Bass Connections programs, the Duke Global Health Institute, and the Duke Center for Global Reproductive Health for funding and support.