

**MODERN CONTRACEPTION USE IN RURAL KENYA: INTERVENTION
ANALYSIS THROUGH SIMULATION OF COMPLEX DIFFUSION PROCESSES**

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ABSTRACT

Promoting the use of modern contraception (MC) is a critical health issue in rural Kenya. Understanding how MC use is adopted by and diffuses among a given population can aid policy-makers, funders, and program implementers in their attempts to promote use of MC in these populations. In this study, we demonstrate how simulation can be used to understand and intervene in these complex systems of social influence. In order to capture mechanisms behind social influence, we develop an agent based model of the diffusion of health-related beliefs and resulting patterns of MC use in rural villages. Data solicited from all adults (N = 1507) in two villages is used to estimate the strength of different social influence mechanisms. After estimating model parameters using Approximate Bayesian Computation, we apply the model towards the selection of an optimal intervention strategy for maximizing contraception use.

1 INTRODUCTION

Previous work in Kenya has shown that individual use of contraception is influenced both by individuals' beliefs about health related outcomes and discussions about family planning with other individuals in their social network (Kohler et al. 2001). We seek to identify the social structures that sustain the (non-)use of modern contraception in areas of rural Kenya. Innovations in measurement and program planning, that rigorously account for the social explanations of high non-use in high unmet need areas, are required to design collective behavior change interventions that lead to increases in the diffusion, adoption, and sustained use of MC.

2 MODELING DIFFUSION

To understand social influence, we develop an agent based model in which individuals influence one another's beliefs relating to contraception use through a series of interactions over a weighted network of contacts. We model social influence based on normative, behavioral, and control beliefs in accordance with the Theory of Planned Behavior (Aizen 1991). Individuals decide whether to use modern contraceptives based on a complex interplay among these three beliefs. Developing an agent based model allows us to be informed by, and expand on, existing statistical models of social influence and diffusion, such as Autologistic Actor Attribute Models (Lusher et al. 2013), by incorporating the co-evolution of multiple beliefs throughout sequences of interactions over time. We simulate changes in beliefs and behaviors which may occur every time two individuals discuss modern contraception over the course of one year.

3 RESULTS AND ANALYSIS

To calibrate the model, data was collected from two villages in Kilifi county, Kenya. We collected demographic data on respondents' characteristics, family planning use, attitudes towards family planning (having children and using MC), and MC use and intention of future use. We collected data about social relationships (e.g., MC communication and health advice), which was used to generate large-scale sociocentric networks that provide complete pictures of direct and indirect connections among individuals in the communities (Figure 1 and Figure 2). Village 1, which had a 24.8% Modern Contraceptive Prevalence (MCPR), contained 576 individuals connected by 876 links. Village 2, which had a 36.4% MCPR, contained 931 individuals connected by 690 links. To understand social influence, separate parameters are included in the mode for each theorized mechanism of social influence (such as diffusion of a specific belief, or moderators such as gender similarity). Using our data, credible regions for each parameter are estimated using approximate Bayesian computation (ABC). We validate the generalizability of our findings by testing parameter estimates from one village on predicting attitudes and behaviors in the other village.

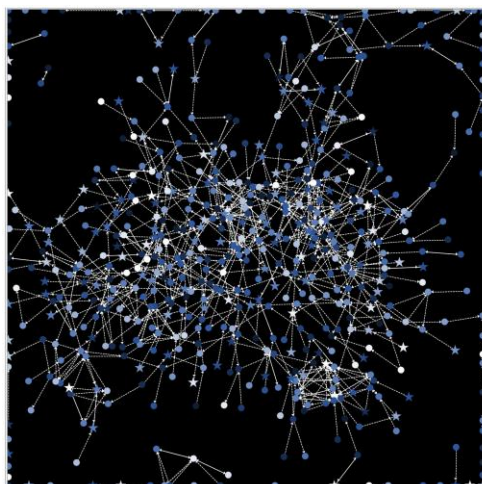


Figure 1: Village 1 social relations.

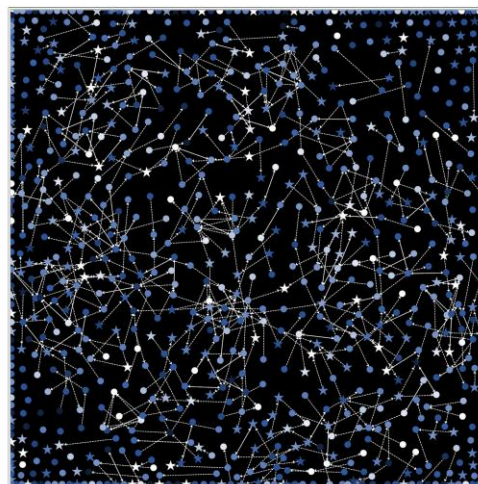


Figure 2: Village 2 social relations.

4 APPLICATION

The model, after being calibrated and validated, is applied to identify intervention strategies that would maximize MC use in each village. These strategies include targeting of certain key individuals and social connections to influence within each village. We demonstrate how, given the population and demographic composition of any village, we can identify central individuals likely to influence the opinions of others.

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REFERENCES

- Ajzen, I. 1991. "The Theory of Planned Behavior". *Organizational Behavior and Human Decision Processes* 50(2):179–211.
- Kohler, H. P., J. R. Behrman, and S. C. Watkins. 2001. "The Density of Social Networks and Fertility Decisions: Evidence from South Nyanza District, Kenya". *Demography* 38(1):43–58.
- Lusher, D., J. Koskinen, and G. Robins (Editors). 2013. *Exponential Random Graph Models for Social Networks: Theory, Methods, and Applications*. New York, New York: Cambridge University Press.