Title: Conformity and communal decision-making: First-tester effects on acceptance of home-based HIV counseling and testing in Uganda

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Abstract

Background Individuals' observation of how group members ahead of them behave can profoundly shape their perceptions, judgements, and subsequent behaviors. Moreover, social influence theories from the sociology of networks suggest that individuals' social status and social network position determine the scope of their influence on other group members. We set out to examine the role of conformity and communal decision-making in shaping individual decisions to test for HIV during home-based TB contact investigation in Kampala, Uganda.

Methods We analyzed the HIV testing decisions of individuals who were offered free, optional, home-based HIV testing during a home visit by community health workers. We used to generalized estimating equations (GEE) to estimate how the testing decision made by the first individual in a household offered testing influenced the subsequent testing decisions of other household members.

Results Community health workers visited 55 households with two or more eligible household members and offered 160 individuals HIV testing. Seventy-five (47%) declined the test. Individuals in households where the first person invited declined HIV testing had four times the risk of declining themselves (RR: 3.96, 95% CI: 1.7-9.0, p=0.001) compared to individuals in households where the first person invited agreed to HIV testing, controlling for individual age and gender.

Conclusions The decision of the first individual offered HIV testing seems to influence the decisions of subsequent household members when they are also offered testing. Even when

results are confidential, individual decisions may be shaped by the testing behavior of the first

household member offered the test.

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Introduction

UNAIDS targets call for 90% of persons living with HIV (PLHIV) to know their HIV status, 90% of PLHIV to be treated, and 90% of those treated to be virally suppressed.[1,2] Home-based HIV counseling and testing (HCT) may be an important tool for reaching these targets by dramatically increasing the proportion of individuals who know their status.[3-7] However, uptake of home-based testing is mixed in sub-Saharan Africa, with acceptance rates ranging from 35% to 95%.[8-11] Understanding what factors influence uptake of home-based HCT is critical for improving its reach and yield.

Our recent analysis of barriers to home-based HCT found that social influences from other household members on the day of the visit may contribute to individual testing decisions.[12] While home-based HCT clients describe the home as a more private setting for HIV testing than a health facility[7] and value that test results are confidential, the household environment gives rise to both implicit and explicit social pressure. Our qualitative analysis showed that fellow household members can encourage one another when they choose to test, and discourage testing for others in the household when they individually decline.

Nearly a century of experimental research in social psychology and sociology has demonstrated that individuals' observation of how group members ahead of them behave can profoundly shape their perceptions, judgements, and subsequent behaviors.[13-15] Moreover, social influence theories from the sociology of networks suggest that that social status of individuals and their position within social networks regulate the scope of their influence on other group members.[16,17] We

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sought to test the effect of the first testing decisions on subsequent decisions within households,

and evaluate the roles of two markers of status and position within the household: age and gender.

Methods

Study setting

This study took place in Kampala, Uganda, where HIV prevalence is estimated at 7.1% among

15- to 49-year-olds and tuberculosis (TB) prevalence at 262 per 100,000 population.[18] In

previous studies, 69% to 95% of those approached for home-based HCT in Uganda accepted

testing, unadjusted for household clustering.[6,7,9]

Study design

We carried out a secondary analysis of prospectively collected data from a household-

randomized, controlled trial of enhanced household TB contact investigation that took place

from July 2016 to July 2017. Households allocated to the intervention arm received optional, free,

home-initiated sputum collection and TB testing with results reporting by SMS, and optional,

free, home-based HIV counseling and testing.

Study population

Community health workers at seven public-sector TB units in Kampala invited newly diagnosed

pulmonary TB patients to participate in a study of household contact investigation for TB. TB

patients who had a mobile phone, resided within 20 kilometers of Kampala, and reported one or

more household contacts were eligible to participate. After consenting the index patient, the

community health worker visited the patient's home in order to screen his/her household contacts

for symptoms and risk factors for TB using an electronic tablet and a purpose-built decision-

support and data-capture application (Commcare, Dimagi, Cambridge, MA).

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Household contacts who were at least 15 years old and who did not report living with HIV were offered home-based HIV testing. HIV testing and post-test counseling were carried out in private, away from other household members, and results were confidential.

Variables

To test the hypothesis that the testing decision of the first individual offered HCT on a given visit influences subsequent testing decisions in the household that day, we constructed a variable indicating each individual's position in the testing sequence during a household visit. Sequential order was determined by the date and time that a community health worker offered HIV testing to each household member, which was automatically recorded as a system variable in the survey software used for clinical data capture. The sequential variable was used to construct a household-level variable indicating the testing decision of the first household member invited to test during a given visit.

Analysis

We fit a series of models using generalized estimating equations (GEE) to adjust for between-household differences and estimate the population-averaged effect of the first household member's testing decision on subsequent testing decisions during the same home visit. We first fit an unconditional, hierarchical, generalized linear model with random intercepts and a logit link for the outcome of individual test acceptance, in order to estimate intra-class correlation (ICC) within households. We anticipated household-level heterogeneity in factors that could affect the testing decisions of first as well as subsequent household members; however, we were interested in determining only the population-averaged effect of the first testing decision on the

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outcome of all subsequent testing decisions. Therefore, we fit a GEE-based model with a log link and exchangeable correlation structure. We used a bootstrapped covariance estimator to reduce small sample bias. As part of a sensitivity analysis, we also fit models testing the effects of the last tester on the outcome of all previous testing decisions, in order to ensure that effect estimates were not merely capturing the non-causal effects of communal decision-making. Finally, we added relevant individual-level variables (gender and age) to the model to assess their significance, effect size, and contribution to model fit. We reported parameter estimates in terms of adjusted risk ratios with 95% confidence intervals.

Human subjects

Each participant or their parent/guardian provided written informed consent. Participants under 18 years old also provided written assent. The School of Medicine Research Ethics Committee at the Makerere College of Health Sciences, the Uganda National Council for Science and Technology, and the Human Investigation Committee at Yale University approved the study (1505015812).

Results

Community health workers offered HIV counseling and testing to 228 individuals across 123 households. In 55 (45%) of these households, they offered testing to two or more household members.

Seventy-five (47%) of 160 household members who were offered HIV testing in these 55 households declined the test (Table 1). Community health workers offered tests to a median of 3 household members per visit (range 2-8). Fifty-one (32%) household members offered the test were men; the median age was 24 (range 15-103). For approximately half of those offered testing (78, 48%), the first household member declined testing; for 42% (67), the final household member declined testing.

A man was offered the test first during 16 (24%) visits; a woman was offered the test first during 51 (76%) visits (p=0.07). There was a high degree of clustering of HIV testing decisions within households (ICC of individual testing decisions within households = 0.59).

In unadjusted bivariate tests, men were significantly more likely to decline the test than women (59% vs 41%, RR: 1.43, 95% CI: 1.03-1.96, p=0.04) (Table 2). Among household members offered testing after at least one other household member had accepted or declined, those for whom the first household member had declined were significantly more likely to decline compared to those for whom the first household member had accepted the test (71% vs 20%, RR: 3.45, 95% CI: 1.92-6.20, p<0.001). Neither the age category nor the HIV status of the index patient were significantly associated with declining HIV testing.

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Household-adjusted model for effect of first tester on subsequent testing decisions

In the final, GEE-based model, the testing decision of the first household member was significantly associated with subsequent testing decisions in the family (Table 3). Accounting for household clustering in testing decisions and controlling for individual age, individuals in households where the first person offered testing declined it had 4 times the risk of declining (adjusted risk ratio (aRR): 3.96, 95% CI: 1.7-9.0, p=0.001) compared to individuals in families where the first person offered testing decided to test. In the multivariable model, individual age (aRR: 1.01, 95% CI: 0.999-1.02, p=0.09) and gender were not significantly associated with risk of declining the test.

Discussion

We found that the first household member's decision not to test for HIV substantially increased the risk that subsequent household members would decline to test. This suggests that the behavior of earlier household members influences the decisions of subsequent household members. These findings demonstrate that the sequence in which tests are offered may shape individual testing decisions and therefore has implications for the success of home-based HCT interventions. Future interventions to improve acceptance rates for home-based HCT could optimize the order of offers to test for HIV by targeting household members who are demographically more likely to accept testing first, increasing the likelihood that the first testing choice is affirmative. An alternative strategy could be to invest more resources into improving acceptance rates among the first-approached members of the household in order to increase acceptance among other household members.

Certain household members may play an outsized role in influencing testing uptake for the entire household regardless of the order in which they are approached. For example, a study of home-based HCT in Malawi found that husbands refusing testing increased the odds of women refusing 15 times compared to women whose husbands accepted testing.[19] In our study, fewer men were offered testing first than women (p=0.07), and there was no evidence that gender of the first person offered testing modified their influence on the testing decisions of other household members. Larger-scale, well powered studies are needed to understand how position in the household and position in the sequence of testing decisions interact with one another.

Other researchers have used multilevel modeling to account for heterogeneity at the household and community levels and analyze determinants of individual testing uptake.[20-23] Such work highlights the role of community-level factors, like the views of local religious leaders, and household-level factors, like household wealth, in individual testing uptake.[21,23] However, we are not aware of other studies that have examined the influence of earlier household members on individual testing decisions, making our findings a novel contribution to the literature on HIV testing uptake.

This study has some limitations. First, the sample size is relatively small and GEE may be subject to small sample bias and artificially low p-values under certain conditions.[24] However, simulation studies demonstrate that the p-value should approximate the true type 1 error rate when there are 50 or more clusters. All the models we present were fit to data with at least 50 independent clusters. Second, our sensitivity analysis indicates that some of the effect we observe is likely to be affected by unobserved heterogeneity at the household level, such as differences in income. Relatedly, our analysis was limited by the lack of sufficient socioeconomic data for approximately half the sample, making it impossible to fit models that included household income or education. Future research must examine the independent effect of socioeconomic status on home-based HIV testing decisions, as well as the possibility that the effect of the first family member's decision is modified by household socioeconomic status.

This study also has some strengths. First, we test hypotheses generated thorough qualitative research carried out with households that had been offered HIV tests. Second, we have identified a novel application of classical social theories of conformity to a major challenge in global health.

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These findings have substantial implications for community health practice in sub-Saharan

Africa and in other high HIV-prevalence settings where home-based HIV testing is important

strategy for HIV case-finding. This would represent an important application of social and

behavioral theory in the service of increasing the quality and reach of HIV screening in countries

hit hardest by HIV/AIDS.

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Table 1. Characteristics of the study population

Characteristic	n (%)
Individuals (n=160)	
Declined test offer	75 (47%)
Age (median, range)	24 (15-103)
Male	51 (32%)
First member declined	78 (48%)
Final member declined	67 (42%)
Households (n=55)	
Index patient living with HIV	12 (22%)
Test offers (median, range)	3 (2-8)

Table 2. Unadjusted associations

Characteristic (n=160)	Test declined	Risk ratio (95%CI)	p-value
Individual-level			
Sex			
Male (n=51)	30 (59%)	1.43 (1.03-1.96)	0.04
Female (n=109)	45 (41%)	--	
Age			
≤ 20 years old (n=58)	27 (45%)	0.99 (0.70-1.40)	0.95
>20 years old (n=102)	48 (47%)	--	
Household-level			
Index HIV status			
Living with HIV (n=29)	12 (41%)	0.86 (0.54-1.37)	0.51
No known HIV (n=131)	63 (48%)	--	
Decision of first member*			
Declined test (n=44)	31 (71%)	3.45 (1.92-6.20)	<0.001
Accepted test (n=49)	10 (20%)	--	

*Among subsequent test offers.

Table 3. Household-adjusted GEE model for effect of first tester's decision on subsequent household members declining the test

Parameter	RR estimate (95%CI)	p-value
First tester declined	3.96 (1.63-9.63)	0.002
Age	1.01 (0.99-1.02)	0.09
Constant	0.14 (0.05-0.37)	0.001

Legend: We fit a multivariable GEE population-averaged model using a bootstrapped covariance estimator to adjust standard errors for clustering by household.
Abbreviation: GEE, generalized estimating equations. RR, risk ratio.