

Can nudging overcome procrastinating on preventive health investments?

Willa Friedman^{a,*}, Nicholas Wilson^b

^a Department of Economics, University of Houston, Houston, TX, United States

^b Office of Evaluation Sciences and Department of Economics, Reed College, Portland, OR, United States

ARTICLE INFO

JEL classification:

I12
J13
O12

Keywords:

Advertising
Conditional cash transfers
Framing
Men's health
Preventive health
Procrastination

ABSTRACT

A fundamental puzzle about human behavior is low investment in preventive health inputs. Present-biased preferences have frequently been put forth as a theoretical explanation for this, but with limited empirical evidence supporting it, especially in developing countries. We extend our previous analysis of a field experiment testing advertising strategies to increase demand for a potentially life-saving preventive health technology, voluntary medical male circumcision. Offering compensation of US\$10 conditional on a complement to the procedure, a short counseling session at a providing clinic, tripled uptake of the procedure. This is consistent with the idea that subsidizing a complement encouraged procrastinating men with latent demand to invest in preventive health. In addition, framing the basic advertisement using the statement “Are you tough enough?” doubled uptake.

1. Introduction

A fundamental puzzle about human behavior is the low level of household investment in preventive health inputs. Worldwide, household spending on preventive health inputs is approximately 0.33% of gross domestic product (GDP) (WHO, 2013). This ratio appears to be particularly low in poor countries, where household spending on preventive health inputs may be less than 0.10% of GDP (WHO, 2013). Even small increases in expenditures on preventive health inputs appear to have large benefits (Jones et al., 2003; Liu et al., 2012; Walker et al., 2013; Murray et al., 2014; Say et al., 2014; Wang et al., 2014), making the low level of household investment particularly puzzling.

One theoretical explanation for low take-up of health investments despite stated desires for them is present-biased preferences. This theory (formalized by O'Donoghue and Rabin, 1999) suggests that people who have decided to invest plan to take action in the near future rather than the present. But then they do this repeatedly, procrastinating for years, or even forever. Other potential barriers to preventive health investments include, for example, lack of awareness about or inattention to potential benefits.

Yet limited quantitative empirical evidence of these barriers exists, especially on procrastination in developing countries. We re-analyze evidence from a previous study and present findings that are consistent with present-biased preferences. In particular, we see that a small incentive offered to men to undergo a complement to Voluntary Medical Male Circumcision (a pre-procedure counseling session) triples take-up of the procedure relative to no incentive. We also find qualitative evidence that reflects procrastination among those encouraged to undergo the procedure. This result is unlikely to be consistent with other alternative explanations, including income effects, new information, or relaxing credit constraints. Financial barriers, a lack of information, and credit constraints may also contribute to low investment in health, but our findings suggest that at least some of the gap between current investment and a social planner's optimum, can be addressed by measures that specifically target procrastination.

As we presented in an earlier study (Wilson et al., 2016), we conducted a field experiment in Soweto, South Africa, testing a set of advertising devices – delivered via postcards – designed to increase demand for a widely available potentially life-saving preventive health technology characterized by low uptake, VMMC. This health

* Corresponding author.

E-mail addresses: whfriedman@uh.edu (W. Friedman), nicholas.l.wilson@gmail.com (N. Wilson).

technology, voluntary medical male circumcision (VMMC), dramatically reduces the risk of new HIV infections – the leading cause of adult mortality in sub-Saharan Africa – and is readily available, for free, in high HIV-prevalence countries in the region, yet take-up remains low.¹ To address low take-up despite large benefits and zero sticker price, we tested three strategies to increase take-up of this one-time health decision in a cross-cutting experimental design.

Offering compensation of approximately US\$10 (i.e. South African Rand 100) conditional on completing a counseling session about VMMC approximately tripled uptake of the technology. Framing the basic advertisement with the statement “Are you tough enough?” roughly doubled uptake. Providing statistical information about partner preference for circumcised men did not have a statistically significant effect on take-up of circumcision.²

The difference in take-up between the compensation arms and the non-compensation arms is consistent with encouraging those who are planning to undergo the procedure but putting it off to act on their latent demand. The primary contribution of this study is demonstrating that procrastination is a barrier to investments in health in developing countries. Subsidizing a complement to preventive health decisions can be a non-coercive way to change behaviors that have positive spillovers on others.

These findings confirm the preliminary findings in [Wilson et al. \(2016\)](#), which used a subset of the updated study sample and more restrictive empirical specifications. In this paper, we extend this earlier analysis to investigate – not only a brief evaluation of the direct effects of a specific intervention – but how and whether it can provide evidence of procrastinators with latent demand. To do so, we use a larger sample (6000 postcards compared with a subsample of 4000 postcards), present interactions between the three treatments, check for evidence of differential selection into take-up across the different treatment arms with a survey of those who visited the clinic, incorporate qualitative survey evidence, and evaluate economic explanations for the findings. Together, this allows us to better understand which mechanism did and did not play a role in generating differential take-up across treatment arms.

Our additional analysis confirms the earlier analysis and extends the findings in several key ways. As in the preliminary analysis, conditional economic compensation for clinic attendance tripled VMMC uptake, “Are you tough enough?”, doubled VMMC uptake, and the statement about partner preference had no effect on uptake. We also present several new results. First, our analysis of interaction effects reveals that adding any additional messaging to the conditional economic compensation reduces the effectiveness of the financial incentive. Second, we find little evidence of differential selection into clinic attendance across study arms, albeit in a somewhat underpowered sample. Third, the clinic survey and qualitative evidence supports the procrastination hypothesis. Fourth, as we review below, we are able to rule out the main competing

hypotheses.

Alternative explanations for the effectiveness of the compensation offer do not hold up to scrutiny, as we discuss in Section 6. In particular, an income effect or reducing credit constraints are unlikely explanations both because the amount offered is quite small and because the offer was conditional on a counseling session rather than the procedure itself. Instead, the effect of such a small financial incentive is consistent with the “micro-incentives” that [Datta and Mullainathan \(2014\)](#) point to as evidence of procrastination.

Evidence from our survey of VMMC clients is also consistent with the procrastination hypothesis. Participants in our study who responded to advertising by attending VMMC counseling sessions indicated that they had been considering VMMC, yet they had not previously acted on this demand. Also, close to 90% of men who attended a counseling session chose to complete the VMMC procedure. These facts suggest that one barrier to take-up, which can be addressed through inexpensive interventions, is likely to be procrastination. We examine the evidence on procrastination and competing hypotheses in further detail in Section 6. Our study appears to be the first to find evidence consistent with procrastination in the case of investing in a one-time, irreversible preventive health input, and one of the first demonstrating latent demand for health investments in developing countries.

This study contributes to a few separate areas of research. First, we add to a small set of studies on present-biased preferences in developing countries. Second, our findings on the effect of offering compensation help to understand the mechanisms at work in studies of conditional cash transfers for preventive health. Third, the effectiveness of the “Are you tough enough?” message adds to a growing literature on identity and economic decision-making, and the use of framing. Finally, we build on the existing literature about barriers to take-up of VMMC.

Researchers have shown that large behavioral changes in response to very small incentives suggest procrastinating behavior (see, for example, [Datta and Mullainathan, 2014](#)). There is a small body of empirical evidence demonstrating procrastination can be a barrier to investments in health in developed ([DellaVigna and Malmendier, 2006](#); [Giné et al., 2010](#)) and developing countries ([Banerjee et al., 2010](#); [Barofsky, 2013](#), and [Dupas and Robinson, 2013](#); [Mahajan et al., 2020](#)). [Banerjee et al. \(2010\)](#) show that a small in-kind transfer increased immunization rates in India, and they attribute this to procrastination. They argue that the transfer is too small to have changed behavior through other mechanisms. Our project builds on this, also showing a small incentive that changes take-up of a substantial action, but it goes further by subsidizing a complement of the desired behavior to further reduce the risk of coercion.³

This contributes to the existing economic literature on conditional cash transfers for preventive health (e.g., [Gertler, 2004](#); [Fernald et al., 2008](#); [Barham and Maluccio, 2009](#); [Attanasio et al., 2015](#)). Our novel use of conditioning on a complement to the desired behavior rather than the behavior itself helps us to understand the mechanisms through which cash transfers change behavior. Evaluation of the compensation arm of our experiment appears to be the first economic analysis showing that a small CCT for a one-time clinic visit alone can increase a potentially life-saving preventive health investment. In doing so, we present

¹ VMMC has been shown, in three randomized trials, to reduce the likelihood of female-to-male transmission of HIV by 51–76% ([Auvert et al., 2005](#); [Bailey et al., 2007](#); [Gray et al., 2007](#)). As of the end of 2013, when we designed our study, the fourteen World Health Organization priority countries had completed fewer than 6 million circumcisions out of the target number of approximately 21 million circumcisions ([WHO, 2014](#)). Data available as of the middle of 2016 indicate that fewer than 12 million circumcisions had been performed in these countries ([WHO, 2016](#)).

² Although the overall response rate to our postcards (i.e. approximately 2% take-up) was not large in absolute terms, the response (i.e. circumcision) rate to our direct mailing is broadly consistent with existing evidence on direct mailing response rates. The response rate to direct mailing in the United States is approximately 1% among “prospects” and 4% among “house lists” that contain existing customers ([Data and Marketing Association, 2015](#)). In a study of bank advertisements in South Africa, [Bertrand et al. \(2010\)](#) found that approximately 8% of existing bank clients who received a mailing from their bank advertising a loan applied for the loan.

³ It can be difficult to come up with a transfer that is both large enough to change behavior and small enough to not be coercive. This is especially difficult in places with very low incomes and very high credit-constraints. Local and individual variation in how much a transfer is valued further exacerbates this difficulty. This fear of coercion has meant that US funding cannot be used for payments conditional on VMMC, even though US funding has been a large part of international funding for VMMC efforts in high-HIV-prevalence countries. The US President’s Emergency Plan for AIDS Relief (PEPFAR) states “Paying clients or providing incentives (in money or material goods) to undertake VMMC is not permitted under any circumstances in order to avoid coercion or the appearance of coercion.” ([PEPFAR, 2017](#))

evidence that cash transfers affect behavior through a channel other than a substitution effect or income effect.

Comparisons of take-up among recipients of the “Are you tough enough?” message and the information about partner preference with the control postcard also contribute to several other literatures in economics including those on framing, identity, and partner involvement in human capital investments. As we will discuss in more detail in Section 6, it may have spurred behavior in order to express an identity, as has been discussed by Akerlof and Kranton (2000).

Our study also contributes to the broader economic literature on barriers to and methods to increase demand for VMMC (e.g., Kim et al., 2015; Chinkhumba et al., 2011; Bazant et al., 2016; Djimeu and Brown, 2016; Evens et al., 2016; Godlonton and Thornton, 2016; Kaufman et al., 2016; Semeere et al., 2016; Zanolini et al., 2016). These papers build on earlier work demonstrating low or non-existent increased risk-taking among men who are both circumcised and know about the HIV risk reduction (Wilson et al., 2014; Godlonton et al., 2016). Our study demonstrates that modest cash transfers for preventive health inputs such as VMMC need not be conditioned on take-up of the input itself to increase household investment, that minor adjustments to the framing of these inputs may have relatively large effects on take-up, and that procrastination may contribute to under-use of preventive health measures.

The experiment that we return to in this paper is most closely related to Thirumurthy et al. (2014, 2016). Both of these studies also involved cash transfers designed to increase take-up of VMMC. Similar-sized transfer offers generated similar effect sizes. A key difference is that in those studies, the transfers were conditional on the procedure itself. Conditionality not on the procedure itself provides further evidence of procrastination rather than extreme financial or credit constraints as the barrier that both sets of interventions effectively address.

The paper is organized as follows. Section 2 lays out a simple theory of procrastination applied to VMMC. Section 3 details the design of our field experiment. Section 4 describes the data and statistical analysis. Section 5 presents the results. Section 6 discusses our findings. Section 7 concludes.

2. Theory

Below we explain the intuition for a model of present-biased preferences leading an individual to put-off an activity for much longer than they plan to, in this case men who plan to undergo VMMC, sometime soon, putting it off for years or even forever.

Beginning with Strotz (1956), economists have modeled procrastination as an implication of time-inconsistent preferences. Empirically, studies have found evidence of procrastination by showing the importance of defaults and deadlines. There is evidence of procrastination leading individuals to postpone actions forever in a wide array of cases, including saving (Madrian and Shea, 2000; Thaler and Benartzi, 2004; Brune et al., 2016), submitting assignments for university coursework (Ariely and Wertenbroch, 2002), and purchasing fertilizer (Duflo et al., 2008).

The simplest model used to show present-biased preferences is the quasi-hyperbolic model, attributed to Phelps and Pollak (1968) and Laibson (1997). An individual maximizes present discounted utility with the following functional form:

$$U_t = u(c_t) + \beta \delta u(c_{t+1}) + \beta \delta^2 u(c_{t+2}) + \beta \delta^3 u(c_{t+3}) + \beta \delta^4 u(c_{t+4}) + \dots + \beta \delta^{T-t} u(c_T) \dots \quad (1)$$

or equivalently:

$$U_t = u(c_t) + \beta \sum_{n=t+1}^T \delta^{n-t} (u(c_n)) \quad (2)$$

Estimates of δ are close to 1, representing long-run patience, while estimates of β are much smaller than 1, representing short-run impatience. The addition of β to a traditional exponential discounting model implies time-inconsistent behavior. The optimal time to complete a task from the perspective of period 0 may be different from the perspective of period 1. In particular, as all of the future is discounted by β , it is very appealing to put off an activity with an immediate cost to some point in the future. However, when the individual arrives at that point, utility in that period is no longer discounted by β , but utility in all future periods is. It is again appealing to put off the activity to the future.

As O'Donoghue and Rabin (1999) and others have shown, people do not fully appreciate this time-inconsistency. They develop a theory of naivete and sophistication, whereby sophisticated individuals know that their future preferences will change and naive individuals have no idea. Subsequent research has shown that while people vary in their degree of sophistication, or awareness of their own time-inconsistent preferences, most people fall somewhere between the two extremes, with typically low levels of sophistication (Augenblick and Rabin, 2019). As long as a person is somewhat naive, then they can believe that they are putting off an activity, for example, VMMC, for a short amount of time, repeatedly. A classic example from present-biased preferences in savings involves an individual deciding each day whether or not to make a 30 min phone call to enroll in an employers' retirement savings program. Each day, the employee decides to make the call tomorrow, missing out on only a small amount of savings. But the next day, it is again optimal to postpone the call until tomorrow. This continues, until they have spent years missing out on employer contributions to their 401(k) (e.g., Madrian and Shea, 2000).

In the case of VMMC, a man may be convinced that undergoing the procedure is a good idea because the benefits outweigh the cost. However, the increased risk of doing it next month instead of this month may be small, or at least perceived to be small, and far in the future. Because today is not discounted by β , but every day in the future is, the relative perceived cost of doing it today is substantially higher than the relative perceived cost of doing it in the future. So the man decides to undergo the procedure next month. From today's perspective, both the costs and benefits of the procedure come in the future, and the benefits outweigh the costs. Then next month, the optimization is the same. And he again puts it off. The research on retirement savings has shown that this can go on for a very long time (e.g., Madrian and Shea, 2000).

A small benefit now, and only now, can increase the benefit of undergoing the procedure now relative the future. In this way, the ability to pair the procedure with a \$10 compensation for a counseling session if he undergoes the procedure this month, but not if he does it in the future, can be enough to overcome procrastination and act sooner rather than later.

Some have used the purchase of commitment contracts as evidence of sophisticated present-biased preferences (e.g., Ariely and Wertenbroch, 2002; Giné et al., 2010). Recent work has shown that such a method can only identify a small fraction of even partially sophisticated present-biasedness (Carrera et al., 2019). This suggests other methods of identifying evidence of procrastination, as in this study, can potentially

Table 1
Postcards distributed in cross-cutting experimental design.

	No message (1)	Partner preference (2)	Challenge (3)
No compensation	N = 1000 (control group)	N = 1000	N = 1000
Compensation	N = 1000	N = 1000	N = 1000

Notes: Cell entries are number of postcards distributed. Compensation is the cash transfer offer of approximately US\$10 disbursed conditional on completing the counseling sessions for voluntary medical male circumcision at a participating clinic. No message refers to no additional messaging above and beyond the basic information listed on all postcards, including the control postcard. Partner preference is the statement, “A recent national survey of women in South Africa conducted by the Human Sciences Research Council showed that 2 out of 3 female partners of uncircumcised men would prefer that their partner be circumcised.” Challenge is the statement “Are you tough enough?”

uncover more of the present-biasedness that exists, including those with naive present-bias.

3. Experimental design

In order to test the importance of possible barriers in explaining low take-up of a potentially life-saving preventive health input, we conducted a public health advertising experiment in Soweto, Gauteng Province, South Africa. We distributed six-thousand postcards with six different cross-cutting designs in a random order to households encouraging men to visit any of four participating clinics for a counseling session about voluntary medical male circumcision (VMMC). Below, we describe the study setting, the way the different treatments were presented on the postcards (including the cross-cutting treatment design), and the postcard distribution.

3.1. Setting

The context of our study, Soweto, is an area of Johannesburg in Gauteng Province, South Africa. South Africa has the highest number of people living with HIV in the world (6.4 million) with an HIV prevalence of 12.2% (Shisana et al., 2014). Estimates from 2012 indicate that HIV prevalence in Gauteng Province is 12.4% (Shisana et al., 2014), approximately equal to median HIV prevalence in South Africa (Shisana et al., 2014). Urban informal settlements have the highest HIV prevalence rates in South Africa (Shisana et al., 2014). Although data is unavailable for specific settlements, following this pattern, HIV prevalence likely is higher in Soweto, a dense urban area, than in Gauteng Province as a whole. As of 2007, Gauteng Province also had the lowest rate of circumcision in the country with 25.2% of adult men circumcised (Department of Health et al., 2007). However, by 2012, the rate in Gauteng province had risen to 48.2% (Shisana et al., 2014), higher than the rates in 5 of the other 8 provinces. Gauteng was the site of the first randomized trial demonstrating the effectiveness of circumcision in reducing HIV infections (Auvert et al., 2005) and there is widespread interest among men and their partners in circumcision for HIV prevention.⁴ In South Africa as a whole, circumcision prevalence is rising, with 35% of men age 15 and older circumcised in 2002 (Connelly et al., 2008), nearly 43% circumcised as of 2008 (Peltzer et al., 2014), and 46% circumcised in 2012 (Shisana et al., 2014). In the most recent study, 40.1% of those circumcised reported that they had been circumcised in a hospital or clinic. The fraction undergoing traditional circumcisions has remained flat over this time period (Shisana et al., 2014).

In all study arms, we offered VMMC at zero sticker price, as do most

health facilities in high HIV-prevalence countries in sub-Saharan Africa. All postcards offered refreshments for anybody who brought them to a clinic, making them self-tracking.

3.2. Treatment and control arms

We designed advertising devices to test three main marketing strategies, each addressing a specific possible demand barrier. The first advertising device was an offer of compensation of South African Rand 100 (approximately US\$10), conditional on completing the counseling session about VMMC at one of the four participating clinics. This amount is approximately one-half of one day's wages in the area, although unemployment is high (Magruder, 2012). The postcards clearly stated that the cash transfer offer was conditional on discussing VMMC with a health worker at a participating clinic, not on completing the VMMC procedure. At the clinic, study participants in all study arms were allowed to leave at any time including after the counseling session and before the procedure. We did not prohibit or discourage postcard sharing, yet we believe the prevalence of sharing was low. Without incentives to report either way, 86% of men who visited a clinic reported that they received the postcard directly and 6% of men reported that they received the postcard from a family member, leaving 8% having gotten the postcard from someone outside of their household. Having gotten the postcard from someone else was no more common among those who brought compensation postcards (12.9%) than among those who brought postcards without compensation (16.2%).

The second advertising device provided information about partners' preferences. Based on an earlier survey among women in South Africa (Simbayi et al., 2011), these postcards included the statement “A recent national survey of women in South Africa conducted by the Human Sciences Research Council showed that 2 out of 3 female partners of uncircumcised men would prefer that their partner be circumcised.”⁵

The third advertising device was designed to appeal to a desire to assert a tough-guy identity by including the question “Are you tough enough?” This, like the other advertising devices, was included in addition to the general information (described below) presented on all postcards.

We implemented these devices in a cross-cutting design, yielding six distinct postcards. Table 1 illustrates our cross-cutting design. As listed in Column (2), two-thousand postcards included the message about partner preference (one-thousand postcards with the compensation offer and one-thousand postcards without it). As listed in Column (3), two-thousand postcards included the challenge “Are you tough enough?” (again, one-thousand postcards with the compensation offer and one-thousand postcards without it). Column (1) illustrates that one-thousand postcards included the compensation offer without the partner preference information or the challenge statement, and one-thousand postcards were control postcards that included none of the three aforementioned advertising devices.

All postcards, including the control postcard, stated that VMMC reduces HIV transmission by 51 to 76%, consistent with the existing evidence on the prophylactic benefit of VMMC (Auvert et al., 2005; Bailey et al., 2007; Gray et al., 2007). They listed the four participating clinics and the days when each one would be open as well as the expiration date of August 29, 2014 (i.e. approximately 2 months after postcard distribution) for any compensation provided through the postcard. All postcards also stated that to redeem the postcard, an individual must be male and at least 18 years old, and indicated that the postcard was part of a research project studying VMMC decisions. In order to encourage men to bring the postcard to a clinic so that the research team could know which postcard each man had received, all postcards offered light refreshments to those who brought in the postcard. The postcards are displayed in the

⁴ For example, a national household survey found that more than one-third of uncircumcised men age 15–49 stated that they would consider getting circumcised and two-thirds of partners of uncircumcised men would prefer that their partner be circumcised (Simbayi et al., 2011).

⁵ While we do not focus on the motivation for and implications of this treatment arm in this paper, we include the results to be thorough.

Table 2

Summary statistics of demographic characteristics of respondents.

	All respondents	Initially uncircumcised
Age	29.03 (9.29)	29.07 (9.36)
Married or cohabitating	0.34 (0.48)	0.34 (0.48)
Has any children	0.47 (0.50)	0.49 (0.50)
Worked in the last 7 days	0.46 (0.50)	0.45 (0.50)
Has ever taken HIV test	0.77 (0.42)	0.75 (0.44)
Immediate family member with HIV	0.29 (0.45)	0.29 (0.46)
Had an STI in last 12 months	0.06 (0.23)	0.05 (0.23)
Has ever had STI	0.11 (0.31)	0.11 (0.31)
Has ever had sex	0.93 (0.26)	0.92 (0.27)
Age at which first had sex	16.45 (2.96)	16.62 (2.94)
Used a condom at last sex	0.57 (0.50)	0.59 (0.49)
Had more than 1 partner last month	0.10 (0.30)	0.10 (0.30)
Had more than 1 partner last year	0.52 (0.50)	0.53 (0.50)
Attended any secondary	0.93 (0.26)	0.92 (0.27)
Asset index	0.00 (1.07)	− 0.01 (1.10)
Riskiness index	− 0.37 (0.45)	− 0.38 (0.46)
Present biased	0.36 (0.48)	0.36 (0.48)

Note: Standard deviations in parentheses. The sample sizes in the first column range from 107–123, and in the second column, the range is 95–111.

Supplementary material of this paper.

In case men had questions about the offer, all postcards also provided a number that men could call or text to speak with a VMMC counselor, and the hotline received 125 calls.

3.3. Distribution

Prior to distribution, postcards were placed in sealed envelopes. The sealed envelope meant that distributors would not know which postcard was in each envelope so they would be less tempted to select who got which postcard. Each envelope had a number on it that referred to a pre-specified and randomized order. This order randomized each of the six postcard types into each sequential set of six. In this way, we stratified the sample based on distribution timing, location, and the identity of the distributor.

Distributors were then instructed to hand out the postcards in the pre-specified order indicated on the envelopes to every fifth household, starting at different points where they would not overlap with each other. They were given detailed instructions about flipping a coin at each intersection to choose which direction to turn and which side of the street to follow. At each house, they were to give the postcard to a man if he was present or to a woman if a man was not present. If no adult was present, the distributor continued to the fifth house after the empty one.⁶

⁶ While we did not prevent people from sharing the postcards, 86% of individuals who brought a postcard to a clinic reported that they had received it directly from a distributor.

4. Data and statistical analysis

The primary analysis reported in this paper is based on records of take-up of the counseling session about VMMC, and the VMMC procedure itself.⁷ Below, we describe how each of these was collected and how the analysis was implemented.

4.1. Data collection

Trained clinical staff recorded a register of information for each individual who brought a postcard to a participating clinic. This included which postcard was brought, whether the counseling session was completed, and whether a circumcision was performed. In total, 123 men brought postcards to one of the four clinics by the expiration date. Counseling sessions were offered on arrival and men were offered the opportunity to complete the VMMC procedure at the same visit or at a later date. All 123 of these men completed the counseling and 110 underwent VMMC, all of whom did so the same day as the counseling session.⁸

In addition, men who brought postcards to participating clinics were also asked to participate in a survey about demographic characteristics, knowledge of circumcision, previous risk-taking, and risk preferences. Table 2 presents summary statistics based on these surveys. The first column uses the full sample of respondents and the second column uses the sample who were initially uncircumcised.⁹ The respondents' mean age was twenty-nine years old, the vast majority had attended secondary school, approximately one-half were employed, and nearly all were sexually active. Nearly one-third of respondents had a family member with HIV, broadly consistent with HIV prevalence of more than 10% in Gauteng Province and less than perfect correlation of HIV status within families.¹⁰

4.2. Statistical analysis

Our primary analysis relies on ordinary least squares (OLS) regression. We compare the take-up of the counseling session and the circumcision procedure among those who received a particular advertising device with those who did not in three ways.¹¹

For both outcomes, we first compare take-up among those who received a simple treatment postcard with a single advertising device relative to those who received the pure control postcard. In these regressions, each sample consists of two-thousand postcards (i.e. one-

⁷ We include similar results using calls to the hotline in the Appendix.

⁸ While 123 may seem like low overall take-up, recipients were given only one to two months to use the postcard and a large fraction of recipients would have been ineligible or unlikely to benefit from the procedure. For example, 48.2% of men in Gauteng province were already circumcised in 2012 (Shisana et al., 2014). After years of publicity campaigns and free provision of VMMC services, this fraction was likely to be much higher by the time this campaign began. In addition, men who are already HIV positive and those who do not plan to have unprotected sex with anyone who is HIV positive may consider the procedure unnecessary. Finally, given the low-cost of post-card distribution and the high reduction in HIV infection from take-up of VMMC, an advertising strategy that increases take-up even a very small amount, can still generate a very low cost per HIV infection averted (in our case, between \$500 and \$1500). Details of this calculation presented in Section 6.

⁹ Twelve respondents were already circumcised, with approximately the same proportion of respondents already circumcised in each study arm. The fraction already circumcised among “no money”, US\$10, “are you tough enough?”, “no message”, and “partner preference” was 10.8%, 9.4%, 9.3%, 7.1%, and 13.5%, respectively.

¹⁰ Married respondents and older respondents were more likely to report having a HIV positive family member.

¹¹ Our regression analysis of take-up of the procedure does not condition on take-up of the counseling session.

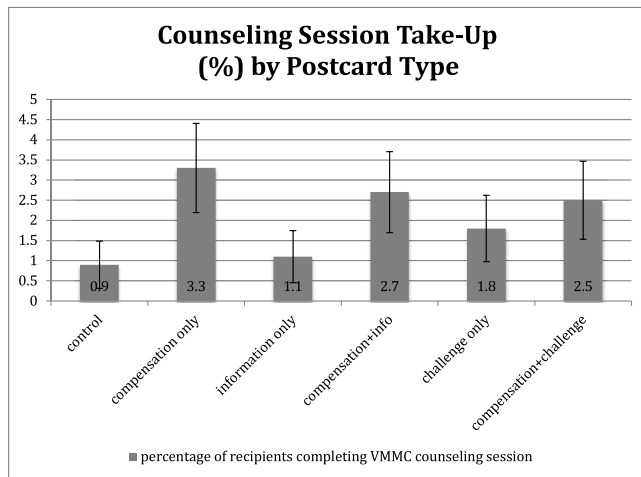


Fig. 1. Counseling session take-up (%) by postcard type.

Table 3

OLS regression estimates of effect of advertising on counseling session and procedure take-up.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Dependent variable: Counseling session take-up						
Compensation	.024*** (.006)			.016*** (.004)		
Partner preference		.002 (.004)			– .002 (.004)	
Challenge			.009* (.005)			.001 (.005)
Observations	2000	2000	2000	6000	4000	4000
Panel B. Dependent variable: Procedure take-up						
Compensation	.025*** (.006)			.015*** (.003)		
Partner preference		.004 (.004)			– .002 (.004)	
Challenge			.010** (.005)			.001 (.004)
Observations	2000	2000	2000	6000	4000	4000

Notes: Heteroskedasticity robust standard errors in parentheses. Each column of each panel presents the results of a single regression with counseling session take-up as the outcome variable in Panel A and procedure take-up as the outcome in Panel B and the single independent variable listed on the left. Estimates in Columns 1–3 are based on simple comparisons between those receiving a postcard with the treatment listed on the left and the pure control, while estimates in Columns 4–6 compare all those with the treatment (including combined with others) with all of those without. Significantly different from zero at 99 (***), 95 (**), 90 (*) percent confidence.

thousand treatment and one-thousand control postcards). For example, we compare the one-thousand postcards offering compensation without any additional message to the one-thousand pure control postcards. We estimate the following equation:

$$Y_i = \alpha + \beta * \text{Treat}_i + \varepsilon_i \quad (3)$$

where Y_i is an indicator variable equal to one if postcard i was returned, Treat_i is an indicator equal to one if postcard i included a particular advertising device, and ε_i is an idiosyncratic error term. The coefficient of interest, β , is equivalent to the difference in means and the p -value of this coefficient is equivalent to that in a t -test of the significance of the difference in the two means.

The second set of regressions measure the difference in means between all of those who received a postcard with a given advertising device and all of those who received a postcard without it. That is, the estimating equation is the same as above, but the comparison samples

are different. In our second set of regressions, we include those postcards with and without additional advertising devices. For example, we compare take-up among all compensation postcards (i.e. pooling compensation-only, compensation-partner preference, and compensation-challenge postcards) to take-up among all postcards not offering compensation.

The first set of regressions is our preferred specification. The second set of regressions assume that there are no interaction effects between the advertising mechanisms. As we demonstrate in Section 5.4, this assumption is not consistent with our findings. In particular, we find that combining the messaging (i.e. “Are you tough enough?” or information about partner preference) with the compensation was less effective than the cash transfer offer by itself. One straightforward explanation is that individuals have limited attention and the messaging distracted attention from the cash transfer offer.

After using these two methods to examine each of the two outcomes, we estimate fully interacted, pooled regression models. These regressions test for interaction effects among the advertising devices (e.g., compensation and challenge). We estimate them using the following equation:

$$Y_i = \alpha + \beta_1 * \text{Comp}_i + \beta_2 * \text{PartPref}_i + \beta_3 * \text{Chall}_i + \beta_4 * \text{Comp}_i * \text{PartPref}_i + \beta_5 * \text{Comp}_i * \text{Chall}_i + \varepsilon_i \quad (4)$$

where Comp_i is an indicator variable equal to one if postcard i included compensation and the other terms are defined similarly. As in Eq. (1), Y_i is an indicator variable equal to one if postcard i was returned to a given step in the VMMC cascade and ε_{ijt} is an idiosyncratic error term.

For each outcome, we also present figures displaying mean take-up (and 95% confidence intervals) disaggregated by each of the six distinct postcard types.

5. Results

5.1. Effects on counseling session

Fig. 1 displays take-up of the counseling session disaggregated by study arm.¹² Mean counseling take-up in the entire study was approximately 2%. Several additional facts emerge from this figure. First, adding the offer of US\$10 to any postcard appears to have increased take-up of the counseling session. Take-up in the money-only arm was more than three times take-up in the control arm. Likewise, adding the offer of US\$10 to either the partner preference information postcard or to the challenge postcard yielded higher take-up than the partner preference information and challenge postcards, respectively. Second, adding the challenge “Are you tough enough?” to the control postcard doubled uptake of the counseling session. Third, adding the information that among female partners of uncircumcised men, 2 out of 3 would prefer that their partner be circumcised had no statistically significant effect on take-up of the counseling session.

Table 3, Panel A displays OLS regression estimates of the effect of the advertising devices on take-up of the counseling session. Columns (1)–(3) present the pairwise comparisons and Columns (4)–(6) present the group comparisons. The pairwise comparisons in Columns (1)–(3) suggest that the compensation postcard and the challenge postcard increased counseling take-up by approximately 2.5 and 1 percentage points, respectively (statistically significant at the 1% and 10% levels, respectively), and that the information postcard did not increase take-up. The group-wise comparisons in Columns (4)–(6) support these inferences for the compensation and information postcards. In contrast, the group-wise comparison in Column (6) suggests that there was no effect of the challenge postcard on counseling take-up. As we discuss in

¹² We include the results on the effect on the hotline in the Appendix.

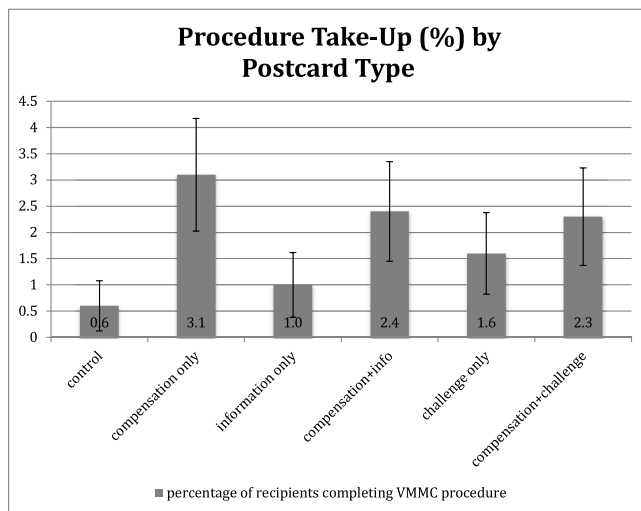


Fig. 2. Procedure take-up (%) by postcard type.

Table 4
OLS regression estimates of interaction effects of advertising.

	Dependent variable			
	Counseling (1)	Procedure (2)	Counseling (3)	Procedure (4)
Compensation	.024*** (.006)	.025*** (.006)	.024*** (.006)	.025*** (.006)
Partner preference	.002 (.004)	.004 (.004)	.004 (.004)	.006 (.004)
Challenge	.009* (.005)	.010** (.005)	.007 (.005)	.008* (.005)
Compensation*partner preference	-.008 (.009)	-.011 (.008)		
Compensation*challenge	-.017* (.009)	-.018** (.009)		
Compensation*(message)			-.013 (.008)	-.015** (.007)
F-stat of difference	1.02	.68		
(p-value)	(.31)	(.41)		
Observations	6000	6000	6000	6000

Notes: Heteroskedasticity robust standard errors in parentheses. Each column presents the results of a fully-interacted OLS regression with the outcome variables listed above. Estimates in Columns 1–2 include interactions between compensation and each type of message, while estimates in Columns 3–4 interact compensation with either type of message in a single variable. In Columns 1–2, we report the *F*-statistic of the difference between the coefficients on the interaction terms with the *p*-value in parentheses below. Significantly different from zero at 99 (***) , 95 (**), 90 (*) percent confidence.

Section 5.4, adding either sort of messaging to the compensation postcard appears to have reduced the effect of the compensation. This means that the group-wise comparisons in Columns (4)–(6) may partly reflect underlying interaction effects between advertising devices and not just the direct effects of a particular advertising device.

5.2. Effects on procedure

Fig. 2 presents take-up of the procedure disaggregated by study arm. A conversion rate (i.e. probability of completing the procedure conditional on completing the counseling session) of approximately 90% in each treatment arm implies that take-up of the procedure across study arms closely follows take-up of the counseling session. Of those who chose not to be circumcised, two thirds reported that they were already circumcised. Thus 96% of those who initially reported that they were

not already circumcised chose to undergo the procedure.¹³ The offer of US\$10 approximately tripled take-up of the procedure, the challenge “Are you tough enough?” roughly doubled take-up, and the information about “2 out of 3 partners” did not have a statistically significant effect on take-up.

Table 3, Panel B displays OLS regression estimates of the effect of the advertising devices on take-up of the procedure. As in Panel A, Columns (1)–(3) present the pairwise comparisons and Columns (4)–(6) present the group comparisons. The regression results in Panels A and B are virtually identical. The very high conversion rate from counseling session to procedure helps explain this consistency.

5.3. Interaction effects

Table 4 tests for interaction effects across the advertising devices (compensation and the two messages), using the full sample of 6000 observations in all regression specifications. Columns (1) and (2) allow for the full set of interaction effects, interacting compensation with each of the messages. Columns (3) and (4) present the results of a specification interacting compensation with an indicator for any message, combining the two messages.

The results in Table 4 suggest that adding additional messaging to the compensation postcard may have significantly reduced the effect of compensation on VMMC take-up. For example, as shown in Column (2), the challenge statement reduced the effect of compensation on procedure take-up by more than half (statistically significant at the 5% level). Because the challenge statement independently increased take-up, adding the challenge to the compensation resulted in take-up that was about a third lower than with the compensation alone. Similarly, the estimate in Column (4) indicates that adding messaging reduced the effect of compensation on procedure take-up by approximately 60% (statistically significant at the 5% level). Although the point estimate of the compensation-partner preference interaction is not statistically different from zero, we cannot reject equality of the two compensation-messaging terms for either outcome in Columns (2) and (3) (*p*-values = 0.31, 0.41, respectively).

5.4. Selection

The magnitude of the benefit of any intervention to reduce HIV-risk depends on how large the risk would have been in the absence of treatment. As we discuss later, with a high HIV prevalence in the area, and a high-rate of unprotected sex, this counterfactual risk of infection could be high. Still, others researchers have noticed that those who are taking advantage of opportunities for medical circumcision may be less risky than the general population. For example, Gummerson et al. (2013) point out that the increase in circumcision rates among men in Tanzania were disproportionately driven by younger, wealthier, and more educated men, who were more likely to use condoms. They suggest that methods to target riskier men could have a larger effect on preventing HIV infections.

An intervention that addresses procrastination may encourage take-up among a risk-taking group. Present-biased preferences have been associated with greater risk-taking (e.g., Dean and Ortoleva, 2019). Among those who completed our survey, 36% reported that they would prefer 200 Rand today to 400 Rand tomorrow, demonstrating a high short-term discount factor. We cannot compare those who visited a clinic after receiving a postcard with those who did not choose to visit a clinic, but we can compare those who visited in response to different postcard types.

Table 5 examines possible differential selection into the counseling

¹³ Possibly because of the small number of control postcards returned to clinics, we are unable to reject that the conversion rates are the same between the control arm and treatment arms.

Table 5
Demographic differences by advertising device.

	Dependent variable						
	Age (1)	Has children (2)	Asset index (3)	Family member HIV+ (4)	More than one partner last year (5)	Risk index (6)	Present biased (7)
Compensation	1.91 (1.85)	.20 (.21)	.22 (.22)	.05 (.10)	– .02 (.05)	– .08 (.10)	.03 (.20)
Partner preference	– 2.88 (2.08)	– .15 (.23)	– .16 (.25)	– .18 (.11)	.01 (.06)	.09 (.11)	.17 (.24)
Challenge	– 1.25 (2.04)	– .02 (.23)	– .02 (.25)	– .05 (.11)	.05 (.06)	– .17 (.11)	– .14 (.21)
Control mean and (SD) of dependent variable	29.89 (11.94)	.55 (.53)	.00 (1.00)	.38 (.52)	.43 (.53)	.00 (1.00)	.375 (.52)
<i>F</i> -stat of difference 1 (<i>p</i> -value)	3.90* (.05)	2.55 (.11)	1.38 (.24)	.39 (.53)	.55 (.46)	1.22 (.27)	.61 (.44)
<i>F</i> -stat of difference 2 (<i>p</i> -value)	.70 (.41)	1.28 (.26)	.34 (.56)	.14 (.71)	.04 (.85)	5.65 (.02)	2.66 (.11)
<i>F</i> -stat of difference 3 (<i>p</i> -value)	1.54 (.22)	.55 (.46)	.43 (.51)	.11 (.74)	.95 (.33)	.74 (.39)	1.54 (0.22)
Observations	123	119	105	123	123	121	

Notes: Estimates from OLS regressions with demographic variables as outcomes and three postcard characteristics as independent variables. The sample for these estimates is the group of men who brought postcards to one of the participating clinics and completed the survey about background demographic characteristics and risk preferences. Heteroskedasticity robust standard errors in parentheses. *Has children* is an indicator for having ever fathered a child, and *Asset index* is a normalized principle component index combining electricity, TV, radio, fridge, telephone, bicycle, motorcycle, and car ownership. *Family member HIV+* is an indicator for having an immediately family member who is HIV positive or has died of AIDS. *Risk index* is a normalized principle component index combining the age at first sex, whether the respondent had sex in the last year current or previous STI infection or symptoms, having been tested for HIV, whether the respondent used a condom the last time they had sex, the number of partners in the last 1 and 12 months. *Present biased* is a binary indicator for preferring 200 Rand today to 400 Rand in one month. We report the *F*-statistic and *p*-value of a test of the difference between the coefficients. The first is the difference between the coefficients on compensation and partner preference. The second is the difference between the coefficients on partner preference and the challenge, and finally the third is the difference between the coefficients on compensation and the challenge. Significantly different from zero at 99 (***) , 95 (**), 90 (*) percent confidence.

session across study arm by observable characteristics.¹⁴ It displays estimates from OLS regressions of various demographic variables and risky sexual behavior on indicator variables for study arm in group comparisons (i.e. regressions corresponding to Columns (4)–(6) in Table 3). The results suggest that men in the compensation arm were older, more likely to have children, (relatively) wealthier, more likely to have a family member with HIV, less sexually risky, and more present-biased compared to men in the control arm. Men in the partner preference and challenge arms were younger, less likely to have children, poorer, less likely to have a family member with HIV, by some measures more sexually risky, and more present-biased compared to men in the control arm. Men in the challenge arm were younger, less likely to have children, less wealthy, less likely to have a family member with HIV, by some measures less sexually risky, and less present-biased. Compared to the control arm, none of these differences by treatment arm are statistically significant. We also report the results of tests (i.e. *F*-statistics and *p*-values) of differences between the coefficient estimates across treatment groups. These results reveal only one statistically significant difference between the treatment groups: men in the compensation arm completing a counseling session at a clinic were approximately 3.9 years older than men in the partner preference arm completing a counseling session at a clinic (*p*-value = 0.05). Overall, the much smaller sample sizes relative to the main analysis greatly reduce our power to detect statistically significant selection effects.

6. Discussion

Compensation for counseling appears to have caused procrastinating men to act on latent demand for this health service. Several facts support this interpretation. We begin by discussing the main competing mechanisms that would link the postcard offers with increased take-up of the

technology, finding evidence that is inconsistent with these explanations. Then we discuss evidence directly supporting the hypothesis that the counseling-session compensation alleviated procrastination.

Three main competing hypotheses for the mechanisms underlying the effects of the counseling-session compensation include increased information, a relaxation of credit constraints, and income effects. The offer of US\$10 did not include any additional informational content beyond that contained in the control postcard and the magnitude of the cash transfer was sufficiently small (i.e. approximately one-half of one day's wages) that it seems unlikely to have reduced credit constraints enough to explain the large increase in take-up. If the income effect hypothesis were true, the implied income elasticity of demand for VMMC in the US\$10 study arm is seemingly implausibly high.¹⁵ If men who are procrastinating are more likely to be induced to undergo the procedure if offered compensation, then we may expect to see that a higher fraction of those who came in with a compensation offer report present-biased preferences. This would be the case if those who undergo the procedure without the offer of compensation are relatively less likely to be procrastinating. We check this in Table 5, Column 7, Row 1. We see a positive but insignificant increase in the likelihood of reporting present-biased preferences with respect to money. The interpretation here is uncertain, because we do not have a comparison with those who did not undergo the procedure, only with those who did, and we do not know how present-biased they are likely to be. This provides no additional evidence in favor of the idea of the compensation offer acting on

¹⁴ An overall conversion rate of 90% means that the results for differential selection into the procedure are very similar.

¹⁵ A rough calculation indicates an implied income elasticity of demand for the procedure of more than 675. The percent change in quantity demanded relative to the control postcard is $(3.1 - 0.6)/((3.1 + 0.6)/2) \times 100$ and the percent change in income for the year is approximately $10/5000 \times 100$, assuming earnings of US\$20 per day and 250 working days per year. As a point of comparison, Acemoglu et al. (2013) estimates the income elasticity of healthcare spending in the United States is 0.7. Baltagi et al. (2017) presents a range of estimates, none of which are much greater than 1.

the latent demand of procrastinators, but it also does not provide evidence against this idea.

Several auxiliary results from our survey analysis provide direct evidence supporting the procrastination hypothesis. More than 60% of men who presented a study postcard at a clinic reported discussing VMMC with their partner and more than 70% reported that their partner had a preference for circumcised men. An even greater fraction, 90%, reported that they were interested in getting circumcised, suggesting that men in the US\$10 study arm did not attend a clinic with the intention to simply take the cash transfer offered conditional on the counseling session and leave without getting circumcised. Fully 100% of the men who chose to receive the procedure chose to do so on the same day as the counseling session, consistent with these men having a latent demand for the circumcision. The fact that the partner preference postcard failed to increase take-up suggests that a diffuse stream of small potential benefit spread over a long time period was not enough to stimulate demand, further reinforcing the procrastination hypothesis.

Previous qualitative research has also provided anecdotal evidence of procrastination of VMMC, although this barrier has rarely been directly discussed. For example, in a study of barriers to circumcision, [Rupfute et al. \(2014\)](#) write that over 46% “of the uncircumcised respondents did not have a reason for not getting circumcised or were just procrastinating,” but the authors do not further discuss procrastination. Similarly, [Price et al. \(2014\)](#) quote a respondent who said, “I knew if I had any procrastination today I wouldn’t go through with it and it would take another year.” One qualitative study following an experiment with compensation for VMMC directly addresses procrastination by mentioning that respondents reported that the compensation “nudged” them toward undertaking a decision that they had previously been intending to undertake in the near future” ([Evens et al., 2016](#)).

The explanation for the response to the “Are you tough enough?” postcard may also come from ideas from psychology incorporated into economics, notably the idea of framing decisions and appealing to identity. [Akerlof and Kranton \(2000\)](#) model taking an action to express a particular identity (e.g., being tough) as conveying a benefit to the individual taking the action. [Bursztyn and Jensen \(2017\)](#) summarize empirical evidence of a wide range of economic decisions motivated by the desire to convey an identity to oneself and others.¹⁶

An important alternative hypothesis deserves additional discussion. One might believe that men may have attended counseling sessions with equal frequency across study arms and our results reflect differences in the incentive to bring the postcard to the counseling session conditional on attending the counseling session. Although all postcards included the offer of light refreshments for postcard holders, the US\$10 postcards provided an additional incentive for returning the postcard. The fact that the “Are you tough enough?” postcard increased take-up suggests this was not the mechanism behind our results. There could have also been differences in the rates of sharing different postcards, but 86% of men who visited a clinic reported that they had received the postcard directly, with another approximately 6% who had received it from family members. Despite no prohibition on postcard sharing, this leaves fewer than 8% who got the postcard from someone outside their household. Having gotten the postcard from someone else was no more common among those who brought compensation postcards (12.9%) than among those who brought postcards without compensation (16.2%).

Our results on the interaction between compensation and messaging suggests that including additional messaging on the compensation offer

inhibited the demand response. This contrasts with some of the existing evidence on this interaction (e.g., [Ashraf et al., 2014c](#)). One explanation for this difference is that our messaging may have been less informative than information provided in other studies and simply displaced attention from the compensation offer. Alternatively, previous research has shown that financial motivations can crowd-out those based on image and identity (e.g., [Ariely et al., 2009](#)). In this way, the two types of motivation to be circumcised (immediate financial compensation and demonstrating a masculine identity) may undermine each other. Additional economic research could help unpack this finding.

While a large contingent of the global health community has been enthusiastic about the potential for VMMC to reduce HIV prevalence rates, others are reasonably skeptical about how much take-up can grow. Knowing how much latent demand exists would help to predict this. While pinning down a precise estimate of the fraction of uncircumcised men who are interested in the procedure is difficult, evidence suggests this could be quite large.

First, take-up of the procedure continues to grow in sub-Saharan Africa, and especially WHO priority countries. Across the 14 priority countries, more than 11.6 million procedures were undertaken since 2008, representing 56% of the 2011 target. In South Africa, 2.3 million were performed in this time, representing 54% of the target ([WHO, 2016](#)).

Second, studies involving surveys of underlying demand can provide some information about the prevalence of latent demanders in sub-Saharan Africa. A review study in 2007 found a median rate of willingness to circumcise of 65% across 13 studies in nine sub-Saharan African countries. Increased take-up of the procedure since then should have decreased this fraction. One study in Lusaka District, Zambia ([Weiss et al., 2015](#)), recruited uncircumcised HIV-negative men, over 18, who visited a clinic for HIV testing and had not proactively requested or planned for voluntary medical male circumcision at the time of enrollment. From this sample, 46% had considered or begun making preparations to undergo VMMC in the next six months. A study from four regions of Swaziland, conducted in 2010, found 31.03% of respondents intended to be circumcised within the next 6 months ([Gurman et al., 2015](#)). A national survey, conducted in Zimbabwe in 2013, found that 55% of uncircumcised male respondents stated that they intended to get circumcised ([Hatzold et al., 2014](#)).

Survey evidence in South Africa also suggests a large number of latent demanders. In South Africa, among those who reported that they were uncircumcised in the 2012 South African National HIV Prevalence, Incidence and Behaviour Survey, 39.6% reported that they would like to be circumcised. In Gauteng Province, where circumcision rates had risen from 25.2% in 2007 to 48.2% in 2012, 36.7% of uncircumcised respondents reported that they would like to be circumcised ([Shisana et al., 2014](#)). An earlier national household survey in South Africa ([Simbayi et al., 2011](#)) found that one-third of uncircumcised men age 15–49 stated that they would consider getting circumcised, further suggesting the existence of latent demand for circumcision in this setting. Procrastination may have been a particularly relevant barrier in our study setting, a setting where VMMC knowledge and take-up was common, and individuals who were less susceptible to the temptation of procrastination had already undertaken the procedure.

Finally, evidence of procrastination – including in this study – suggests that we cannot simply conclude that all of those who have not yet undergone the procedure are uninterested. Across groups in our study, approximately 2% of postcard recipients chose to undergo the procedure at one of the offered clinics within 1–2 months of receipt of the offer. As many recipients were likely already circumcised, did not read the postcard, or could not find a time within this limited offer window, this suggests that at least some latent demand exists. On the other hand, the slow take-up and the prevalence of men with no intention to undergo the procedure suggests that reasonable measures to facilitate take-up of VMMC may never be sufficient to eliminate new HIV infections. Research focused on documenting the extent of latent demand would be

¹⁶ In this sense, the “Are you tough enough?” message may have also encouraged those who were procrastinating to change their behavior by increasing the benefits. That said, the identity benefit would likely still be in place after the deadline for using the compensation on the US \$10 post-card. The message may have changed the benefit of immediate action, while also changing the benefit of delayed action.

valuable in predicting how far offering VMMC can go in reducing new HIV infection rates.

The role of procrastination is important in interpreting the implications of this study. Theory suggests that hyperbolic discounters can plan to take an action, but then procrastinate indefinitely (O'Donoghue and Rabin, 1999). Even if men do not procrastinate forever, circumcision confers a much larger health benefit when it happens before a larger share of unprotected sex with new partners. Because of a spike in viral load 3–6 weeks after infection, frequent partner switching which is more common among those looking for a spouse is particularly risky (Magruder, 2011). HIV incidence for men peaks in the late twenties. Although reliable HIV incidence data do not exist for our study setting, they do exist for Kwa-Zulu Natal Province, a province close to Gauteng Province, where Soweto is located. In Kwa-Zulu Natal, HIV incidence per 100 person years is 2.8, 8.7, 7.6, and 1.9 among 20–24 year-olds, 25–29 year-olds, 30–34 year-olds, and 35–39 year-olds, respectively (Bärnighausen et al., 2008).

The presence of procrastination as a barrier to VMMC demonstrates that entirely non-coercive interventions can effectively increase take-up. If postcard recipients did not want to get the procedure, they could have come for the counseling session, declined the offer a free voluntary medical male circumcision, and still left with the compensation.¹⁷ Thus, this type of intervention that incentivizes a one-time clinic visit without conditioning a cash transfer on uptake of the health technology can encourage those who are interested to make this investment in health while not coercing individuals who are not interested.¹⁸ Beyond the case of VMMC, this type of intervention could be used to address procrastination on other health behaviors for which early action is beneficial. This set could potentially include tests such as cancer screenings, surgeries including ACL repairs, hip and knee surgeries, mastectomies for those at elevated risk of breast and ovarian cancers, or even undergoing the withdrawal phase of quitting addictive drugs. Whether small incentives for clinic visits for preventive health inputs that required repeated visits (e.g., yearly flu shots) can be effective at increasing sustained take-up remains an open question, although our findings provide suggestive evidence that they may be effective.

Our calculations indicate that the offer of a conditional cash transfer for completing the VMMC counseling session would be a highly cost effective method of preventing new HIV infections at scale. We estimate that that this intervention would cost approximately US\$500 to US\$1500 per HIV infection averted (HIA) at scale, or the cost equivalent of approximately five years of antiretroviral therapy.¹⁹ This is comparable to the estimated cost per HIV infection averted of US\$882 in Björkman-Nyqvist et al. (2018). Previous cost-effectiveness meta-analyses of HIV prevention interventions (e.g., Hogan et al., 2005; Galárraga et al., 2009) focus on the cost of service provision and do not measure costs associated with ensuring service take-up, so there appears to be little existing evidence on the cost-effectiveness of any sort of analogous intervention to increase take-up of a HIV prevention intervention.²⁰

¹⁷ The postcards clearly stated that the cash transfer offer was conditional on discussing VMMC with a health worker at a participating clinic, not on completing the VMMC procedure. At the clinic, study participants in all study arms were allowed to leave at any time including after the counseling session and before the procedure.

¹⁸ The United States and other international donors are unwilling to pay individuals to undergo a surgical procedure because of the risk of coercion.

¹⁹ For more details on this calculation, see Wilson et al. (2016).

²⁰ Thirumurthy et al. (2014) and Thirumurthy et al. (2016) do not report cost-effectiveness estimates, yet presumably the cost of demand creation in these studies is similar to that in ours because they find similar effect sizes for economic compensation of similar magnitudes. Thornton (2008) presents evidence indicating that willingness to receive HIV test results conditional on taking a HIV test as part of a household survey can be highly elastic with respect to the offer of a small negative price, yet reports that there is no behavior change associated with receiving these HIV test results.

Traditional CCT programs often suffer from high administrative costs, as high as 30–60% of total costs for programs such as *RPS* and *Oportunidades* (Benhassine et al., 2015). UCT programs aimed at increasing the likelihood of a particular behavior such as schooling may suffer from high non-compliance (Baird et al., 2011). Our cash transfer program required few administrative inputs aside from postcard printing and distribution (which would have a low unit cost at scale), and non-compliance with the desired behavior conditional on receiving cash was only 10%.

The effect of our CCT for the VMMC counseling session on VMMC take-up is remarkably similar to the effects reported in Thirumurthy et al. (2014, 2016). In field experiments conducted in Kenya, Thirumurthy et al. (2014, 2016) offered economic compensation of approximately US\$10 disbursed conditional on completing the VMMC procedure and these offers approximately tripled take-up of the VMMC procedure, increasing take-up from around 2% in the control group to upwards of 6% in the compensation arms. These similarities support the external validity of our results, yet also highlight the puzzle that the effects on procedure take-up were approximately the same across studies despite the pre-specified conditionality differing substantially in our study. The fact that Thirumurthy et al. (2014) found no effect of increasing the compensation offer from US\$8.75 to US\$15.00 suggests that the mechanism underlying behavior change in that study also was not an income effect and may have instead been procrastination.

In addition to contributing to the cash transfer literature as discussed in the introduction, our study contributes to several other bodies of economic literature. These include studies of framing, identity, procrastination, partner involvement in human capital investment, and men's health.

Recent work in behavioral economics has demonstrated that minor differences in presentation can have large impacts on health and other economic investments (e.g., Bertrand et al., 2010; Dupas and Robinson, 2013; Ashraf et al., 2014b; Luoto et al., 2014). This includes work on framing, in which researchers have demonstrated that how information is presented can be as important as the content in changing behavior. For example, Bertrand et al. (2010) find that including an image of a woman on a mailed advertisement for a loan increased take-up among existing bank clients as much as a 25% reduction in the interest rate. Another related strand of literature is work on identity economics, which models individuals as making important decisions in order to express a particular identity (e.g., Akerlof and Kranton, 2000; Bursztyjn and Jensen, 2017). Our study combines these ideas in demonstrating the effect of an advertising device that links a valuable health investment to a tough-guy identity.

Our study contributes to the empirical literature finding evidence of procrastination changing when and whether individuals invest in economically meaningful activities (e.g., Madrian and Shea, 2000; Thaler and Benartzi, 2004; Brune et al., 2016; Duflo et al., 2008) and health specifically (DellaVigna and Malmendier, 2006; Giné et al., 2010; Banerjee et al., 2010; Barofsky, 2013; Dupas and Robinson, 2013).

A literature spanning several decades demonstrates that the gender of the decision-maker and partner involvement affect household human capital investments and other economic outcomes (e.g., Thomas, 1990; Thomas et al., 1990; Duflo, 2003a,b; Ashraf, 2009; Ashraf et al., 2014a). We find that providing information on partner preference had no effect on health input take-up, raising the possibility that asymmetrical information within partnerships, one possible reason partner control over decision-making may affect outcomes, may not be the main barrier to take-up of this health input.

7. Conclusion

Low household investment in preventive health inputs is a fundamental puzzle about human behavior. We conducted a field experiment testing several small advertising devices designed to increase demand for voluntary medical male circumcision (VMMC), a widely available

potentially life-saving preventive health technology currently characterized by low uptake. Demand for this preventive health technology appears to have been highly elastic with respect to factors outside of standard consumer demand models of health behavior. The substantial effects on take-up of the compensation offer suggest that supplementing a complement of the desired behavior may have caused procrastinating individuals to act on latent demand for the health technology, rather than alleviating a barrier such as lack of information or credit constraints.

Our analysis illuminates several questions that future research should address. First, how do cash transfers affect behavior aside from substitution and income effects? Second, can small cash transfers for health clinic visits increase demand for other preventive health inputs, particularly those requiring a single clinic visit? Third, how does framing preventive health inputs affect demand for these inputs? Policymakers should consider cash transfers and framing statements similar to ours for increasing take-up of VMMC and possibly for increasing take-up of other preventive health inputs.

Author statement

The authors collaborated in all phases of this research.

Acknowledgements

We would like to thank an Daniel Bennett, Alden Boetsch, Annette Brown, Aimee Chin, Genevieve Dean, Nancy Diaz, Eric Djimeu, Sasha Frade, John Hoddinott, Katrina Kosec, Jessica Leight, Vikram Maheshri, Dino Rech, Olga Shemyakina, Alexandra Spyrelis, and Dirk Taljaard, Harsha Thirumurthy as well as seminar participants at The Bill and Melinda Gates Foundation, the Center for Effective Global Action (CEGA) Behavioral Economics and Global Health Conference at the University of California, Berkeley, the International Health Economics Association (iHEA) 11th Annual Congress, the 2016 Midwest International Economic Development Conference (MIEDC), Montana State University, the Spring 2017 NBER Health Economics Program Meeting, the 2015 North East Universities Development Consortium Conference (NEUDC), the 2015 Northwest Development Workshop (NWDW), the 2016 Pacific Conference for Development Economics (PACDEV), the 2017 Population Association of America (PAA) Annual Meeting, the 10th Annual Research Conference on Population, Reproductive Health, and Economic Development, the 2016 Southern Economic Association (SEA) 86th Annual Meeting, the University of Houston, the University of North Carolina School of Public Health, the University of South Florida, and the University of Texas School of Public Health, for many excellent comments. We give special thanks to the Centre for HIV and AIDS Prevention Studies (CHAPS) for assisting in the implementation of this study. The International Initiative for Impact Evaluation (3ie) provided generous financial and institutional support. Mitchell Linegar and Sabah Lotia provided excellent research assistance. This study is registered with The American Economic Association RCT Registry with RCT ID AEARCTR-0000419. An earlier version of this manuscript was distributed as “Money, Masculinity, and Men’s Health: Experimental Evidence on Demand for a Preventive Health Input.” All errors are our own. The findings, interpretations, and conclusions expressed in this paper are those of the authors and do not necessarily represent the views of the aforementioned individuals or organizations.

Appendix A

See Fig. A1, Table A.1.

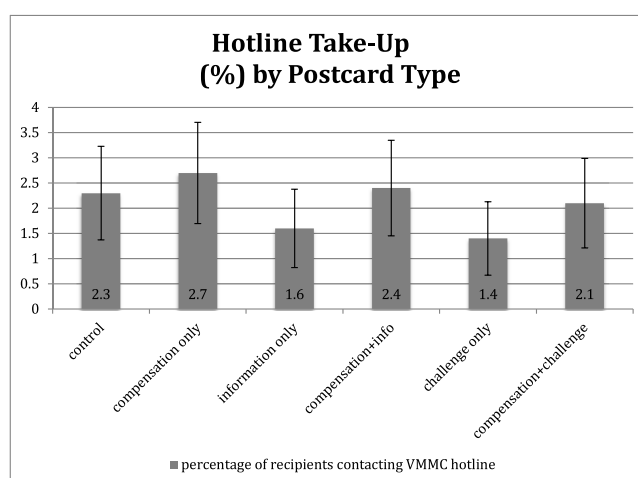


Fig. A1. Hotline take-up (%) by postcard type.

Table A.1

OLS regression estimates of effect of advertising on hotline take-up.

	Dependent variable: Hotline take-up					
	(1)	(2)	(3)	(4)	(5)	(6)
Compensation	.004 (.007)			.006 (.004)		
Partner preference		-.007 (.006)			-.005 (.005)	
Challenge			-.008 (.006)			-.009 (.005)
Observations	2000	2000	2000	6000	4000	4000

Notes: Heteroskedasticity robust standard errors in parentheses. Each column presents the results of a single regression with hotline take-up as the outcome variable and the single independent variable listed on the left. Estimates in Columns 1–3 are based on simple comparisons between those receiving a postcard with the treatment listed on the left and the pure control, while estimates in Columns 4–6 compare all those with the treatment (including combined with others) with all of those without. Significantly different from zero at 99 (***), 95 (**), 90 (*) percent confidence.

Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.ehb.2021.101040>.

References

- Acemoglu, D., Finkelstein, A., Notowidigdo, M.J., 2013. Income and health spending: evidence from oil price shocks. *Rev. Econ. Stat.* 95 (4), 1079–1095.
- Akerlof, G., Kranton, R., 2000. Economics and identity. *Q. J. Econ.* 115 (3), 715–753.
- Ariely, D., Wertenbroch, K., 2002. Procrastination, deadlines, and performance: self-control by precommitment. *Psychol. Sci.* 13 (3), 219–224.
- Ariely, D., Bracha, A., Meier, S., 2009. Doing good or doing well? Image motivation and monetary incentives in behaving prosocially. *Am. Econ. Rev.* 99 (1), 544–555.
- Ashraf, N., 2009. Spousal control and intra-household decision making: an experimental study in the Philippines. *Am. Econ. Rev.* 99 (4), 1245–1277.
- Ashraf, N., Field, E., Lee, J., 2014a. Household bargaining and excess fertility: an experimental study in Zambia. *Am. Econ. Rev.* 104 (7), 2210–2237.
- Ashraf, N., Bandiera, O., Jack, K., 2014b. No margin, no mission? A field experiment on incentives for public service delivery. *J. Public Econ.* 120, 1–17.
- Ashraf, N., Jack, K., Kamenica, E., 2014c. Information and subsidies: complements or substitutes? *J. Econ. Behav. Organ.* 88, 133–139.
- Attanasio, O., Oppedisano, V., Vera-Hernández, M., 2015. Should cash transfers be conditional? Conditionality, preventive care, and health outcomes. *Am. Econ. J. Appl. Econ.* 7 (2), 35–52.

- Augenblick, N., Rabin, M., 2019. An experiment on time preference and misprediction in unpleasant tasks. *Rev. Econ. Stud.* 86 (3), 941–975.
- Auvert, B., Tallaar, D., Lagarde, E., Sobngwi-Tambekou, J., Sitta, R., Puren, A., 2005. Randomized, controlled intervention trial of male circumcision for reduction of HIV infection risk: the ANRS 1265 Trial. *PLoS Med.* 2 (11), 1112.
- Bailey, R., Moses, S., Parker, C., Agot, K., Maclean, I., Krieger, J., Williams, C., Campbell, R., Ndinya-Achola, J., 2007. Male circumcision for HIV prevention in young men in Kisumu, Kenya: a randomised controlled trial. *Lancet* 369 (9562), 643–656.
- Baird, S., Craig, M., Berk, O., 2011. Cash or condition: evidence from a randomized cash transfer program. *Q. J. Econ.* 126 (4), 1709–1753.
- Baltagi, B., Lagravinese, R., Moscone, F., Tosetti, E., 2017. Health care expenditure and income: a global perspective. *Health Econ.* 26 (7), 863–874.
- Banerjee, A.V., Duflo, E., Glennerster, R., Kothari, D., 2010. Improving immunisation coverage in rural India: clustered randomised controlled evaluation of immunisation campaigns with and without incentives. *Br. Med. J.* 340, c2220.
- Barham, T., Maluccio, J., 2009. Eradicating diseases: the effect of conditional cash transfers on vaccination coverage in rural Nicaragua. *J. Health Econ.* 28 (3), 611–621.
- Bärnighausen, T., Tanser, F., Gqwede, Z., Mbizana, C., Herbst, K., Newell, M.-L., 2008. High HIV incidence in a community with high HIV prevalence in rural South Africa: findings from a prospective population-based study. *AIDS* 22 (1), 139–144.
- Barofsky, J., 2013. Seriously, I'll Do It Tomorrow: Procrastination in Health Insurance Enrollment Using Mexico's Seguro Popular. Unpublished working paper.
- Bazant, E., Mahler, H., Machaku, M., Lemwayi, R., Kulindwa, Y., Lija, J.G., Mpora, B., Ochola, D., Sarkar, S., Williams, E., Plotkin, M., 2016. A randomized evaluation of a demand creation lottery for voluntary medical male circumcision among adults in Tanzania. *J. Acquir. Immune Defic. Syndr.* 72 (Suppl 4).
- Benhassine, N., Devoto, F., Duflo, E., Dupas, P., Pouliquen, V., 2015. Turning a shove into a nudge? A "labeled cash transfer" for education. *Am. Econ. J. Econ. Policy* 7 (3), 86–125.
- Bertrand, M., Karlan, D., Mullainathan, S., Shafir, E., Zinman, J., 2010. What's advertising content worth? Evidence from a consumer credit marketing field experiment. *Q. J. Econ.* 263–306.
- Björkman, N., Nyqvist, M., Corno, L., De Walque, D., Svensson, J., 2018. Incentivizing safer sexual behavior: evidence from a lottery experiment on HIV prevention. *Am. Econ. J. Appl. Econ.* 10 (3), 287–314.
- Brune, L., Giné, X., Goldberg, J., Yang, D., 2016. Facilitating savings for agriculture: field experimental evidence from Malawi. *Econ. Dev. Cult. Change* 64 (2), 187–220.
- Bursztn, L., Jensen, R., 2017. Social image and economic behavior in the field: identifying, understanding, and shaping social pressure. *Annu. Rev. Econ.* 9, 131–153.
- Carrera, M., Royer, H., Stehr, M., Sydnor, J., Taubinsky, D., 2019. How Are Preferences for Commitment Revealed? National Bureau of Economic Research, No. w26161.
- Chinkhumba, J., Godlonton, S., Thornton, R., 2011. Demand for medical male circumcision. *Am. Econ. J. Appl. Econ.* 6 (2), 152–177.
- Data and Marketing Association, 2015. DMA Response Rate Report. Data and Marketing Association, New York, USA.
- Datta, S., Mullainathan, S., 2014. Behavioral design: a new approach to development policy. *Rev. Income Wealth* 60 (1), 7–35.
- Department of Health, Medical Research Council, OrcMacro, 2007. South Africa Demographic and Health Survey 2003. Department of Health, Pretoria.
- Dean, M., Ortolave, P., 2019. The empirical relationship between nonstandard economic behaviors. *Proc. Natl. Acad. Sci. U. S. A.* 116 (33), 16262–16267.
- DellaVigna, S., Malmendier, U., 2006. Paying not to go to the gym. *Am. Econ. Rev.* 96, 694–719.
- Djimeu, E.W., Brown, A.N., 2016. Strength of evidence on demand creation for voluntary medical male circumcision from 7 impact evaluations in Southern and Eastern Africa. *J. Acquir. Immune Defic. Syndr.* 72 (Suppl 4), S321.
- Duflo, E., 2003a. Grandmothers and granddaughters: old-age pensions and intrahousehold allocation in South Africa. *World Bank Econ. Rev.* 17 (1), 1–25.
- Dupas, P., Robinson, J., 2013. Why don't the poor save more? Evidence from health savings experiments. *Am. Econ. Rev.* 103 (4), 1138–1171.
- Duflo, E., 2003b. Grandmothers and granddaughters: old age pension and intra-household allocation in South Africa. *World Bank Econ. Rev.* 17 (1), 1–25.
- Duflo, E., Kremer, M., Robinson, J., 2008. How high are rates of return to fertilizer? Evidence from field experiments in Kenya. *Am. Econ. Rev.* 98 (2), 482–488.
- Evens, E., Lanham, M., Murray, K., Rao, S., Agot, K., Omanga, E., Thirumurthy, H., 2016. Use of economic compensation to increase demand for voluntary medical male circumcision in Kenya: qualitative interviews with male participants in a randomized controlled trial and their partners. *J. Acquir. Immune Defic. Syndr.* 72 (Suppl 4), S316.
- Fernald, L.C.H., Gertler, P.J., Neufeld, L.M., 2008. Role of cash in conditional cash transfer programmes for child health, growth, and development: an analysis of Mexico's Oportunidades. *Lancet* 371 (9615), 828–837.
- Galárraga, O.M., Colchero, A., Wamai, R.G., Bertozzi, S.M., 2009. HIV prevention cost-effectiveness: a systematic review. *BMC Public Health* 9 (1).
- Gertler, P., 2004. Do conditional cash transfers improve child health? Evidence from PROGRESA's control randomized experiment. *Am. Econ. Rev. Pap. Proc.* 94 (2), 336–341.
- Giné, X., Karlan, D., Zinman, J., 2010. Put your money where your butt is: a commitment contract for smoking cessation. *Am. Econ. J. Appl. Econ.* 213–235.
- Godlonton, S., Munthali, A., Thornton, R., 2016. Circumcision information and HIV prevention. *Rev. Econ. Stat.* forthcoming.
- Godlonton, S., Thornton, R., 2016. Medical male circumcision: how does price affect the risk-profile of take-up? *Prev. Med.* 92, 68–73.
- Gray, R., Kigozi, G., Serwadda, D., Makumbi, F., Watya, S., Nalugoda, F., Kiwanuka, N., et al., 2007. Male circumcision for HIV prevention in men in Rakai, Uganda: a randomised trial. *Lancet* 369 (9562), 657–666.
- Gumerson, E., Maughan-Brown, B., Venkataramani, A., 2013. Who is taking up voluntary medical male circumcision? Early evidence from Tanzania. *AIDS* 27 (16), 2657–2659.
- Gurman, T.A., Dhillon, P., Greene, J.L., Makadzange, P., Khumalo, P., Shekhar, N., 2015. Informing the scaling up of voluntary medical male circumcision efforts through the use of theory of reasoned action: survey findings among uncircumcised young men in Swaziland. *AIDS Educ. Prev.* 27 (2), 153–166.
- Hatzold, K., Mavhu, W., Jasi, P., Chatora, K., Cowan, F.M., Tarubekera, N., Mugurungi, O., Ahanda, K., Njeuhmeli, E., 2014. Barriers and motivators to voluntary medical male circumcision uptake among different age groups of men in Zimbabwe: results from a mixed methods study. *PLoS One* 9 (5), e85051.
- Hogan, D.R., Baltussen, R., Hayashi, C., Lauer, J.A., Salomon, J.A., 2005. Cost effectiveness analysis of strategies to combat HIV/AIDS in developing countries. *BMJ* 331 (7530), 1431–1437.
- Jones, G., Steketee, R., Black, R., Bhutta, Z., Morris, S., the Bellagio Child Survival Study Group, 2003. How many deaths can we prevent this year? *Lancet* 362 (9377), 65–71.
- Kaufman, Z.A., DeCelles, J., Bhauti, K., Hershow, R.B., Weiss, H.A., Chaibva, C., Moyo, N., Mantula, F., Hatzold, K., Ross, D.A., 2016. A sport-based intervention to increase uptake of voluntary medical male circumcision among adolescent male students: results from the MCUTS 2 cluster-randomized trial in Bulawayo, Zimbabwe. *J. Acquir. Immune Defic. Syndr.* 72 (Suppl 4), S297–S303.
- Kim, B., Kim, H.B., Pop-Eleches, C., 2015. Peer Effects in the Demand for Male Circumcision. Columbia University working paper.
- Laibson, D., 1997. Golden eggs and hyperbolic discounting. *Q. J. Econ.* 112 (2), 443–478.
- Liu, L., Johnson, H.L., Cousens, S., Perin, J., Scott, S., Lawn, J.E., Rudan, I., et al., 2012. Global, regional, and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. *Lancet* 379 (9832), 2151–2161.
- Luoto, J., Levine, D., Albert, J., Luby, S., 2014. Nudging to use: achieving safe water behaviors in Kenya and Bangladesh. *J. Dev. Econ.* 110, 13–21.
- Madrian, B.C., Shea, D.F., 2000. The Power of Suggestion: Inertia in 401(k) Participation and Savings Behavior. National Bureau of Economic Research, No. w7682.
- Magruder, J.R., 2011. Marital shopping and epidemic AIDS. *Demography* 48 (4), 1401–1428.
- Magruder, J.R., 2012. High unemployment yet few small firms: the role of centralized bargaining in South Africa. *Am. Econ. J. Appl. Econ.* 4 (3), 138–166.
- Mahajan, A., C. Michel, Tarozzi, A., 2020. Identification of Time-Inconsistent Models: The Case of Insecticide Treated Nets. National Bureau of Economic Research, No. w27198.
- Murray, C.J.L., Ortblad, K.F., Guinovart, C., Lim, S.S., Wolock, T.M., Roberts, D. Allen, Dansereau, E.A., et al., 2014. Global, regional, and national incidence and mortality for HIV, tuberculosis, and malaria during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 384 (9947), 1005–1070.
- O'Donoghue, T., Rabin, M., 1999. Doing it now or later. *Am. Econ. Rev.* 89 (1), 103–124.
- Peltzer, K., et al., 2014. Prevalence and acceptability of male circumcision in South Africa. *Afr. J. Tradit. Complement. Altern. Med.* 11 (4), 126–130.
- PEPFAR (The US President's Emergency Plan for AIDS Relief), 2017. PEPFAR's Best Practices for Voluntary Medical Male Circumcision Site Operations: A Service Guide for Site Operations.
- Phelps, Edmund S., Pollak, Robert A., 1968. On second-best national saving and game-equilibrium growth. *Rev. Econ. Stud.* 35 (35), 185–199.
- Price, J.E., Phiri, L., Mulenga, D., Hewett, P.C., Topp, S.M., Shiliya, N., Hatzold, K., 2014. Behavior change pathways to voluntary medical male circumcision: narrative interviews with circumcision clients in Zambia. *PLoS One* 9 (11), e111602.
- Rupfute, M., Tshuma, C., Tshimanga, M., Gombe, N., Bangure, D., Wellington, M., 2014. Factors associated with uptake of voluntary medical male circumcision, Mazowe District, Zimbabwe, 2014. *Pan Afr. Med. J.* 19.
- Say, L., Chou, D., Gemmill, A., Tuncalp, O., Moller, A.-B., Daniels, J., Gulmezoglu, A.M., Temmerman, M., Alkema, L., 2014. Global causes of maternal death: a WHO systematic analysis. *Lancet Glob. Health* 2 (6), e323–e333.
- Semeere, A.S., Castelnovo, B., Bbaale, D., Kiragga, A.N., Kigozi, J., Muganzi, A.M., Coutinho, A.G., Kambugu, A., 2016. Innovative demand creation for voluntary medical male circumcision targeting a high impact male population: a pilot study engaging pregnant women at antenatal clinics in Kampala, Uganda. *J. Acquir. Immune Defic. Syndr.* 72 (Suppl 4), S278–S284.
- Shisana, O., Rehle, T., Simbayi, L.C., Zuma, K., Jooste, S., Zungu, N., Labadarios, D., Onoya, D., 2014. South African National HIV Prevalence, Incidence and Behaviour Survey, 2012. HSRC Press, Cape Town, South Africa.
- Simbayi, L., Peltzer, K., Onoya, D., 2011. Prevalence and acceptability of male circumcision in South Africa. In: 10th Annual AIDS Impact Conference. New Mexico, USA.
- Strotz, R., 1956. Myopia and inconsistency in dynamic utility maximization. *Rev. Econ. Stud.* 23 (3), 165–180.
- Thaler, R.H., Benartzi, S., 2004. Save more tomorrowTM: using behavioral economics to increase employee saving. *J. Polit. Econ.* 112 (S1), S164–S187.
- Thomas, Duncan, 1990. Intra-household resource allocation: An inferential approach. *J. Human Resour.* 635–664.
- Thomas, Duncan, Strauss, John, Henriques, Maria-Helena, 1990. Child survival, height for age and household characteristics in Brazil. *J. Dev. Econ.* 33 (2), 197–234.
- Thornton, R.L., 2008. The demand for, and impact of, learning HIV status. *Am. Econ. Rev.* 98 (5), 18–29.
- Thirumurthy, H., Masters, S.H., Rao, S., Bronson, M.A., Lanham, M., Omanga, E., Evens, E., Agot, K., 2014. Effect of providing conditional economic compensation on

- uptake of voluntary medical male circumcision in Kenya: a randomized clinical trial. *J. Am. Med. Assoc.* 312 (7), 703–711.
- Thirumurthy, H., Masters, S.H., Rao, S., Murray, K., Prasad, R., Zivin, J.G., Omanga, E., Agot, K., 2016. The effects of providing fixed compensation and lottery-based rewards on uptake of medical male circumcision in Kenya: a randomized trial. *J. Acquir. Immune Defic. Syndr.* 72 (Suppl 4), S309–S315.
- Walker, C.L.F., Rudan, I., Liu, L., Nair, H., Theodoratou, E., Bhutta, Z.A., O'Brien, K.L., Campbell, H., Black, R.E., 2013. Global burden of childhood pneumonia and diarrhoea. *Lancet* 381 (9875), 1405–1416.
- Wang, H., Liddell, C.A., Coates, M.M., Mooney, M.D., Levitz, C.E., Schumacher, A.E., Apfel, H., et al., 2014. Global, regional, and national levels of neonatal, infant, and under-5 mortality during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet* 384 (9947), 957–979.
- Weiss, S.M., Zulu, R., Jones, D.L., Redding, C.A., Cook, R., Chitalu, N., 2015. The Spear and Shield intervention to increase the availability and acceptability of voluntary medical male circumcision in Zambia: a cluster randomised controlled trial. *Lancet HIV* 2 (5), e181–e189.
- WHO, 2013. Global Health Expenditure Database. <http://apps.who.int/nha/database>.
- WHO, 2014. WHO Progress Brief: Voluntary Medical Male Circumcision for HIV Prevention in Priority Countries of East and Southern Africa. World Health Organization. <http://www.who.int/hiv/topics/malecircumcision/male-circumcision-info-2014/en/#>.
- WHO, 2016. WHO Progress Brief: Voluntary Medical Male Circumcision for HIV Prevention in 14 Priority Countries of East and Southern Africa. World Health Organization. <http://www.who.int/hiv/pub/malecircumcision/brief2016/en/>.
- Wilson, N., Mattson, C.L., Xiong, W., 2014. Is sex like driving? HIV prevention and risk compensation. *J. Dev. Econ.* 106, 78–91.
- Wilson, N., Frade, S., Rech, D., Friedman, W., 2016. Advertising for demand creation for voluntary medical male circumcision. *J. Acquir. Immune Defic. Syndr.* 72 (Suppl 4), S293–S296.
- Zanolini, A., Bolton, C., Lyabola, L.L., Phiri, G., Samona, A., Kaonga, A., Thirumurthy, H., 2016. Feasibility and effectiveness of a peer referral incentive intervention to promote male circumcision uptake in Zambia. *J. Acquir. Immune Defic. Syndr.* 72 (Suppl 4), S262–S268.