



# Pay-it-forward strategy to enhance uptake of dual gonorrhoea and chlamydia testing among men who have sex with men in China: a pragmatic, quasi-experimental study

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## Summary

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**Background** Chinese men who have sex with men (MSM) rarely receive gonorrhoea and chlamydia testing. The purpose of this pilot study was to evaluate a pay-it-forward strategy to increase uptake of gonorrhoea and chlamydia testing among MSM.

**Methods** We performed a quasi-experimental pragmatic study to compare a pay-it-forward model with standard of care at two HIV testing sites for MSM in Guangzhou, China: an STD clinic for MSM and a local MSM community-based organisation. All men who arrived at the STD clinic or the community-based organisation were invited to participate. In the pay-it-forward programme, men were offered free gonorrhoea and chlamydia testing and given the option of donating money toward testing for future participants. In the standard-of-care group, men were offered gonorrhoea and chlamydia testing at the standard patient price of ¥150 (about US\$21.50). The pay-it-forward programme was implemented for 3 months, after which both sites switched to standard of care offering dual testing for 3 months. The primary outcome for this study was uptake of dual gonorrhoea and chlamydia testing, which we compared using  $\chi^2$  test and logistic regression, reported as crude odds ratios (cOR) and adjusted odds ratios (aOR), by adjusting for nationality, marital status, income, and site of testing.

**Findings** The pay-it-forward programme took place from Dec 2, 2017, to Feb 3, 2018, and the standard-of-care control took place from March 11, 2018, to May 1, 2018. 408 men were included in this study. 203 men were offered pay-it-forward, and 205 were offered standard of care. Overall, 109 (54%) of 203 men in the pay-it-forward group and 12 (6%) of 205 men in the standard-of-care group received gonorrhoea and chlamydia testing (cOR 18.65, 9.78–35.54;  $p < 0.0001$ ; aOR 19.73, 95% CI 10.02–38.85;  $p < 0.0001$ ). Of all 121 men who tested, this was the first gonorrhoea test for 97 (80%) men and the first chlamydia test for 104 (86%) men. Five (4%) of these 121 men were diagnosed with gonorrhoea and 15 (12%) were diagnosed with chlamydia. 97 (89%) of 109 men who received testing in the pay-it-forward group donated some money toward testing for future participants.

**Interpretation** Pay-it-forward might be a sustainable model for expanding integrated HIV testing services among MSM in China.

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## Introduction

Gonorrhoea and chlamydia are common sexually transmitted diseases (STDs), which rapidly spread unnoticed through communities of men who have sex with men (MSM). The prevalence of gonorrhoea and chlamydia among Chinese MSM is as high as 10–20%.<sup>1,2</sup> These two STDs are known to increase the risk of HIV acquisition<sup>3</sup> and transmission,<sup>4</sup> but are often asymptomatic at extragenital sites.<sup>5</sup> WHO guidelines recommend regular gonorrhoea and chlamydia testing for MSM.<sup>6</sup> US Centers for Disease Control and Prevention guidelines recommend testing at least once a year for all MSM, and more frequently for men with high sexual risk.<sup>7</sup>

However, few MSM in China receive gonorrhoea and chlamydia testing. Previous studies suggest that less

than half of MSM have ever received a gonorrhoea or chlamydia test in China.<sup>8,9</sup> This major missed public health opportunity is possibly related to poor government support for testing programmes,<sup>10</sup> unlinked systems for HIV testing and other STDs,<sup>11,12</sup> and insufficient community ownership. First, China has no screening guidelines for gonorrhoea or chlamydia testing among MSM nor widespread programmes supporting gonorrhoea and chlamydia testing.<sup>10</sup> Second, the extensive HIV testing system in China is not integrated to facilitate other STD testing.<sup>11,12</sup> Third, China has relatively low MSM community ownership of health services,<sup>13</sup> partly because of the persistent stigma.<sup>14</sup> Any existing community-based services in China are focused on HIV testing.<sup>15</sup>

## Research in context

### Evidence before this study

In China, gonorrhoea and chlamydia are common infections among men who have sex with men (MSM), but there have been few interventions to promote testing. We performed a PubMed search for studies reporting gonorrhoea and chlamydia testing in Chinese MSM with the search terms “gonorrhea” or “chlamydia” with the terms “MSM,” “China,” and “testing” or “screening” or “intervention.” There were no date restrictions, and the search was performed on June 15, 2018. We identified two English language studies reporting rates of lifetime gonorrhoea and chlamydia testing less than 50% among Chinese MSM. We also found one protocol for a randomised trial that aimed to evaluate the impact of automated text message reminders on STD testing in China. We did not find other studies on interventions for gonorrhoea or chlamydia testing among MSM in China. We also searched PubMed and Google Scholar using the terms “pay it forward” or “generalized reciprocity”. We found several studies examining the behavioural economics of pay-it-forward pricing schemes, but we did not identify any studies investigating pay-it-forward

as a promotional strategy or applying generalised reciprocity to public health.

### Added value of this study

This study evaluated a pay-it-forward model for gonorrhoea and chlamydia testing among Chinese MSM. We found that a pay-it-forward model substantially increased test uptake compared with the standard of care. The programme reached many untested MSM and identified new positive cases. This study expands the literature by formally evaluating a pay-it-forward programme focused on improving health.

### Implications of all available evidence

Our study identified a high percentage of previously untested MSM and a large burden of disease, highlighting the low test uptake and the need for improved gonorrhoea and chlamydia testing for Chinese MSM. A pay-it-forward testing programme might be a promising strategy for creating a sustainable programme for integrated testing for HIV and other sexually transmitted diseases among key populations.

In response to this need, several community organisations developed a pilot programme for gonorrhoea and chlamydia testing using a pay-it-forward model. In the pay-it-forward programme, one person receives a gift, then they are asked whether they would like to give a gift to another person (video).<sup>16,17</sup> Pay-it-forward fits within the broader field of behavioural economics, which uses multiple disciplines to understand human decision making. Pay-it-forward chains of giving are sometimes driven by unconnected generous individuals,<sup>18</sup> but more often organised by a group with a common purpose.<sup>19,20</sup> Studies have shown that pay-it-forward can be sustainable and promote generosity.<sup>21</sup>

In this study, a pay-it-forward model was applied to paying for dual testing for gonorrhoea and chlamydia at two free HIV and syphilis testing sites for MSM. Programme organisers contributed an initial pool of funding, and MSM at these sites were offered a free gonorrhoea and chlamydia test with the option to contribute toward testing for future participants. The purpose of this quasi-experimental study is to evaluate a pay-it-forward intervention on gonorrhoea and chlamydia testing among Chinese MSM.

## Methods

### Study design and participants

The study was undertaken in Guangzhou, China, at two sites: an STD clinic that provided services for MSM on weekends and a local MSM community-based organisation (CBO). The STD clinic site was embedded in an outpatient clinic; the CBO site operated within a CBO office in the community. These two sites were chosen because they were developed with strong input

from MSM and provided free testing for HIV and syphilis to all MSM. Both sites were staffed by MSM volunteers, nurses, and public health staff. There were no clinical doctors at either site. Blood draws, testing, results reporting, and follow-up of HIV and syphilis tests were handled by staff at each site. Both sites followed the same study procedures (appendix p 2).

This study was designed as a quasi-experimental pragmatic trial at the two sites. We chose a pragmatic design to evaluate this programme in a real-life context to benefit MSM in Guangzhou. A quasi-experimental study involves evaluating an intervention without the use of randomisation.<sup>22</sup> In this study, we evaluated the pay-it-forward intervention model against a standard-of-care control. The pay-it-forward programme was implemented for 3 months. Both sites then switched to standard of care, offering dual testing at the standard price for 3 months.

Ethics approval for this study was obtained from the institutional review board at the University of North Carolina at Chapel Hill. Only men aged 18 years or older were permitted to receive services at the STD clinic site or the community-based organisation site. All men who presented to these sites were invited to receive testing. Written consent was waived because the study was deemed minimal risk by the institutional review board.

### Procedures

The pay-it-forward intervention was developed through crowdsourcing in three ways: an open challenge contest<sup>23</sup> was used to develop the name and style of the programme materials; at the CBO site, hand-written notes from

See Online for video

See Online for appendix

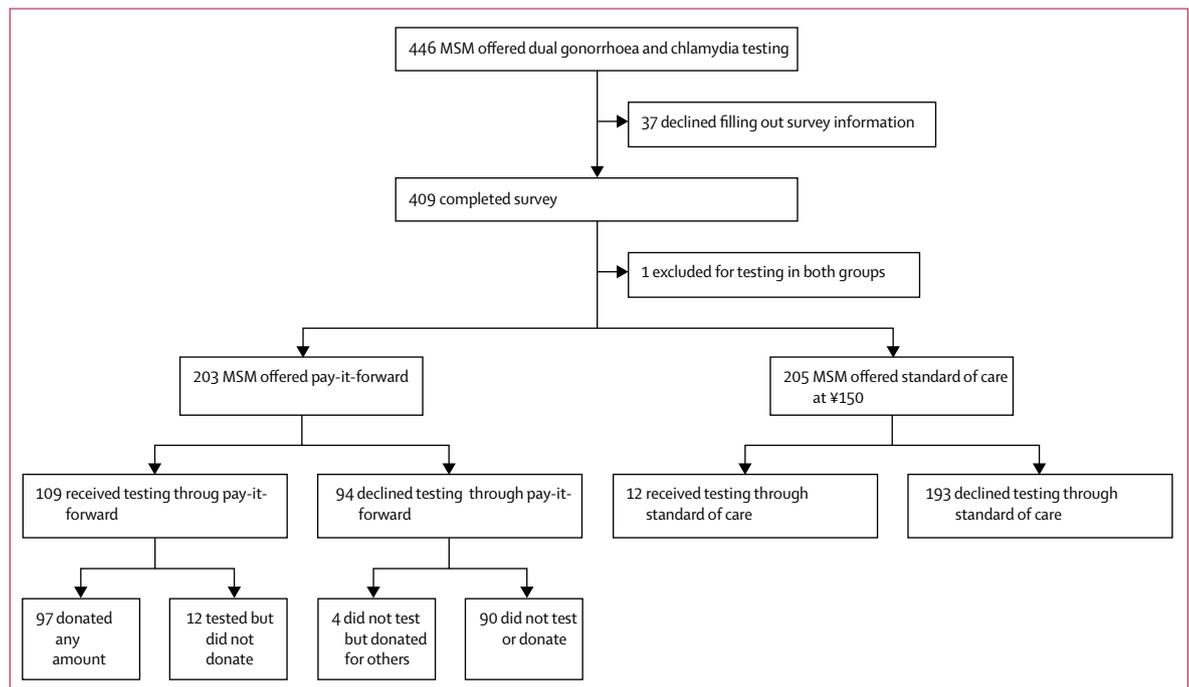
previous participants in the programme encouraged testing for future participants; and community volunteers helped organise the programme. At both of the programme sites, MSM who were waiting for HIV and syphilis testing were offered dual gonorrhoea and chlamydia testing (appendix p 2). First, men were provided a brief (5 min) introduction to gonorrhoea and chlamydia testing using a pamphlet (appendix p 3). Programme organisers then explained the pay-it-forward programme, including the purpose (to promote gonorrhoea and chlamydia testing), the opportunity to receive free gonorrhoea and chlamydia tests, and the voluntary decisions to test and to contribute money (appendix p 4). Men were told that the patient price of gonorrhoea and chlamydia testing was ¥150 (about US\$21.50), but that previous men attending the clinic had donated money to cover this cost. Thus, each man could receive a free gonorrhoea and chlamydia test, then decide whether to donate money (pay-it-forward) for future men to receive the same option. Men were assured that donating was completely optional and advised to pay any amount that was feasible for them. Each man's fees for the gonorrhoea and chlamydia tests were covered by a combination of the initial funding pool from the programme organisers and the donations from previous participants. At the CBO site, men were also shown a postcard with a message written by a previous pay-it-forward contributor and told that they could also write a postcard message for a future participant (appendix p 4). Men then decided whether or not to receive combined gonorrhoea and chlamydia testing. All men were asked to

fill out a brief survey about their sexual history, testing history, and attitudes toward the testing programme, regardless of whether or not they tested.

MSM who received testing were asked about sexual practices (oral, anal receptive, anal insertive) and advised to receive pharyngeal, anal, or urethral testing. All participants were informed that their information would be kept confidential, and results would be sent to them in 1 week. Men who agreed to participate either had a nurse collect the sample (STD clinic site) or self-collected the sample (CBO site).<sup>24</sup> All samples were urine samples, anal swabs, or pharyngeal swabs. At the STD clinic site, samples were immediately delivered to the laboratory. Self-collected samples from the CBO site were stored at room temperature overnight, then transported to the Southern Medical University Dermatology Hospital for laboratory testing within 1 week. Programme organisers informed participants of their test results via WeChat, a popular messaging application with monetary transfer functionality. Men with positive test results were counselled and directed to the WeChat page of Southern Medical University Dermatology Hospital, Guangzhou, where they could make an appointment to receive treatment and follow-up. Counselling included information about condom use, safe sexual practices, and the importance of testing.

During the standard-of-care period, men were offered gonorrhoea and chlamydia testing at the standard patient price (¥150 [about \$21.50]). All men were provided a brief introduction about gonorrhoea and chlamydia testing

For more on WeChat see  
<https://www.wechat.com/en/>



**Figure 1: Study flow chart**

The study used a quasi-experimental design. MSM=men who have sex with men.

using the same pamphlet as the one used for the intervention group, but did not receive the explanation about the pay-it-forward programme or view the associated postcards (appendix p 2).

All urine, anal swab, and pharyngeal swab samples were analysed at Southern Medical University Dermatology Hospital with Cobas 4800 CT/NG DNA detection kits (Roche Diagnostics, Basel, Switzerland). At the STD clinic site, HIV testing was done with the Diagnostic Kit for Antibody to HIV 1/2 (Abon Pharmaceuticals, Northvale, NJ, USA) and syphilis testing with the Treponema Pallidum Antibodies Rapid Test (Abon Pharmaceuticals, Northvale, NJ, USA). At the CBO site, HIV testing was done with the Third Generation Diagnostic Kit for Antibody to HIV rapid test (InTec, Xiamen, China) and syphilis testing with the Syphilis Antibody (anti-Treponema Pallidum) rapid test (InTec, Xiamen, China).

### Data collection

We extracted data from all MSM who were approached regarding gonorrhoea and chlamydia testing. Programme organisers compared the men's WeChat social media IDs and excluded men who tested more than once. The primary outcome for this study was uptake of dual gonorrhoea and chlamydia testing. Testing uptake was confirmed when a sample was received by the laboratory and the test result was delivered to the participant. For each participant in the pay-it-forward group, we recorded the amount that they contributed to the next participant.

Programme organisers also collected data through a paper survey on sociodemographic characteristics such as age, education, marital status, and income; data on sexual behaviour such as previous sex with men, role in anal sex (primarily insertive, primarily receptive, or about half and half), anal sex without condom use in the past 3 months, and number of sex partners in the past 3 months; and previous HIV testing, gonorrhoea testing, and chlamydia testing. For both groups, we collected information on reasons for accepting or declining gonorrhoea and chlamydia testing (appendix p 5). For the pay-it-forward group, we also asked about perceived benefits and barriers of the pay-it-forward programme (appendix p 6). We also collected results of the HIV and syphilis tests for all participants, as well as results of the gonorrhoea and chlamydia tests for those tested.

### Statistical analysis

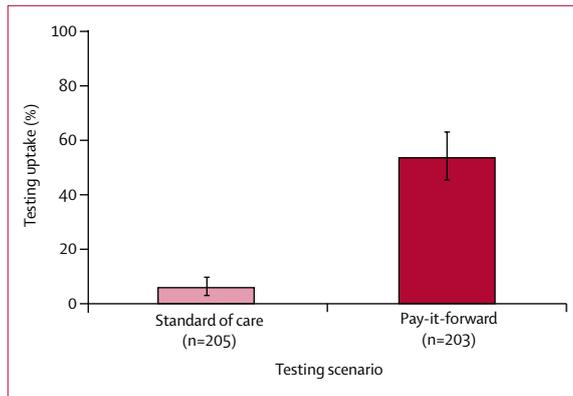
Our main hypothesis was that the pay-it-forward programme would increase uptake of dual gonorrhoea and chlamydia testing compared with the standard of care. This hypothesis was pre-specified during study design. We used descriptive statistics to examine demographic and behavioural characteristics of MSM. We compared the proportion of patients who tested for gonorrhoea and chlamydia between the pay-it-forward group and the standard-of-care group using  $\chi^2$  test and logistic regression, reported as crude odds ratios (cOR) and adjusted odds ratios

	Pay-it-forward group (n=203)	Standard-of-care group (n=205)	p value*
Age	..	..	0.69
≤30 years	153/203 (75%)	158/205 (77%)	..
>30 years	50/203 (25%)	47/205 (23%)	..
Nationality	..	..	0.79
Han Chinese	194/203 (96%)	197/205 (96%)	..
Other	9/203 (4%)	8/205 (4%)	..
Marital status†	..	..	0.08
Never married	177/201 (88%)	191/205 (93%)	..
Ever married	24/201 (12%)	14/205 (7%)	..
Education	..	..	0.89
Below Bachelor's degree	66 (33%)	68/205 (33%)	..
Bachelor's degree and above	137 (67%)	137/205 (67%)	..
Monthly income (US\$)†	..	..	0.80
0-143-80	24/199 (12%)	27/202 (13%)	..
143-81-719-01	64/199 (32%)	58/202 (29%)	..
719-02-1438-02	77/199 (39%)	78/202 (39%)	..
>1438-02	34/199 (17%)	39/202 (19%)	..
Disclosure as MSM to family, friends, or health-care professionals	..	..	0.10
Never	77/203 (38%)	62/205 (30%)	..
Ever	126/203 (62%)	143/205 (70%)	..
Mean number of male sex partners in the past 3 months (SD)	1.90 (2.02)	1.70 (1.57)	0.27
Female sex partner in past 3 months	..	..	0.49
No	191/203 (94%)	196/205 (96%)	..
Yes	12/203 (6%)	9/205 (4%)	..
Position with male partner†	..	..	1.00
Primarily insertive	59/191 (31%)	62/202 (31%)	..
About half and half	64/191 (33%)	68/202 (34%)	..
Primarily receptive	68/191 (36%)	72/202 (35%)	..
Anal sex without use of condom in the past 3 months	..	..	0.57
No	130/201 (65%)	127/205 (62%)	..
Yes	71/201 (35%)	78/205 (38%)	..
Previously tested for HIV	..	..	0.27
No	54/203 (27%)	45/205 (22%)	..
Yes	149/203 (73%)	160/205 (78%)	..
Previously tested for gonorrhoea or chlamydia	..	..	0.86
No	168/203 (83%)	171/205 (83%)	..
Yes	35/203 (17%)	34/205 (17%)	..

Data are n/N (%) unless otherwise indicated. MSM=men who have sex with men. \* $\chi^2$ -squared test. †Denominators are lower than the total sample because some participants chose to omit responses to one or more of the survey items.

Table 1: Participant characteristics by testing scenario

(aOR), by adjusting for nationality, marital status, income, and site of testing. We chose these covariates because they are potential confounders. We also calculated incremental unit costs per test for gonorrhoea and chlamydia and per diagnosis of gonorrhoea or chlamydia. We first calculated the total financial cost for each group, then divided these costs by the number of men tested and by the number of men diagnosed in each group. All data were analysed with SAS version 9.4 (SAS Institute, Cary, NC, USA).



**Figure 2: Uptake of gonorrhoea and chlamydia testing**  
 Multivariable regression adjusted for age, nationality, marital status, education, income, and site of test showed an adjusted odds ratio of 19.73, 95% CI 10.02–38.85,  $p < 0.0001$ .

	Number of participants	MSM who received gonorrhoea or chlamydia testing (%)	Crude odds ratio (95% CI)	Adjusted odds ratio (95% CI)
Standard-of-care group	205	12 (6%)	Ref	Ref
Pay-it-forward group	203	109 (54%)	18.65 (9.78–35.54); $p < 0.0001$	19.74 (10.03–38.85)*; $p < 0.0001$
After adjustment	..	..	..	18.43 (9.48–35.84)†; $p < 0.0001$
After further adjustment	..	..	..	19.73 (10.02–38.85)‡; $p < 0.0001$

MSM=men who have sex with men. \*Model adjusted for age, nationality, marital status, income, and site of testing. †Model adjusted for age, nationality, marital status, and site of testing. ‡Model adjusted for nationality, marital status, income, and site of testing.

**Table 2: Proportion of people tested for gonorrhoea and chlamydia in the control and intervention groups among MSM in Guangzhou, China**

**Role of the funding source**

The sponsor of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

**Results**

The pay-it-forward programme was implemented from Dec 2, 2017, to Feb 3, 2018, and the standard-of-care programme was implemented from March 11, 2018, to May 1, 2018. We approached a total of 446 participants across the two clinics (figure 1). One man who received testing through both groups was excluded from our analysis. 408 were included in the analysis, 161 from the STD clinic and 247 from the CBO site. We analysed data from 203 men who were offered pay-it-forward testing and 205 men who were offered the standard of care.

Demographic characteristics were similar between the pay-it-forward and the standard-of-care groups (table 1). Most participants were aged 30 years or younger, were of Han ethnicity, had a bachelor’s degree or above, had never

married, and had a monthly income of about \$1438 (¥10000) or below. More than half reported ever disclosing their sexual orientation to family, friends, or health-care professionals. About a third of participants reported having had anal sex without condom use within the past 3 months, and about 5% reported a female sex partner in the past 3 months. 76% had previously tested for HIV, while 17% had previously tested for gonorrhoea or chlamydia.

Overall, 109 (54%) of 203 men in the pay-it-forward group and 12 (6%) of 205 men in the standard-of-care group received gonorrhoea and chlamydia testing (cOR 18.65, 9.78–35.54;  $p < 0.0001$ ; figure 2, table 2). Testing uptake rates were similar at the STD clinic and CBO site. In the pay-it-forward group, testing uptake was 54% (57 of 106) at the STD clinic and 54% (52 of 97) at the CBO site ( $\chi^2$  test  $p = 0.981$ ). In the standard-of-care group, testing uptake was 5% (three of 52) at the STD clinic site and 6% (nine of 141) at the CBO site ( $\chi^2$  test  $p = 0.883$ ). Multivariable regression models adjusting for marital status, education, income, and study site showed that the odds of receiving a gonorrhoea and chlamydia test were significantly higher in the pay-it-forward group than in the standard-of-care group (aOR 19.73, 95% CI 10.02–38.85,  $p < 0.0001$ , table 2).

Of all 121 men who tested, this test was the first gonorrhoea test for 97 (80%) men and the first chlamydia test for 104 (86%) men. Five (4%) of 121 men were diagnosed with gonorrhoea and 15 (12%) were diagnosed with chlamydia. 16 (4%) of the 408 men included in this study were diagnosed with HIV and four (1%) with syphilis.

Within the pay-it-forward group, 49 (49%) of 102 participants who tested and answered the question regarding the reason for testing reported that their primary reason for getting tested was the pay-it-forward programme (appendix p 5). In both groups, the most common reasons for not testing were “I don’t need to get tested” (38 respondents in the pay-it-forward group and 86 respondents in the standard-of-care group) and “I don’t know about gonorrhoea and chlamydia” (35 respondents in the pay-it-forward group and 62 respondents in the standard-of-care group; appendix p 5). The most commonly cited benefits of the pay-it-forward programme were awareness of one’s own health status (111 participants), increasing testing among the MSM community (110 participants), and reciprocal giving (85 participants; appendix p 6).

Of the 109 MSM who received testing through the pay-it-forward programme, 97 (89%) chose to contribute some amount. The mean donation per participant was ¥64.84 (SD 56.92), which is about \$10. The largest donation was ¥200 (about \$32) and the median donation was ¥50 (IQR 81.5, about \$8; appendix p 7). Additionally, four men who did not receive gonorrhoea and chlamydia testing contributed a total of ¥470 (about \$75). We initially invested enough funding for 81 tests (ie, ¥12150, about \$1751). 31 additional tests were covered entirely by

contributions from previous testers, and at the end of the programme period, there remained funding for 19 more tests.

The incremental unit cost per gonorrhoea and chlamydia test in the pay-it-forward group was \$67 (about ¥465) compared with \$503 (about ¥3491) in the standard-of-care group (87% reduction). The incremental cost per newly diagnosed gonorrhoea or chlamydia infection was \$456 (about ¥3165) in the pay-it-forward group and \$1210 (about ¥8398) in the standard-of-care group (70% reduction; figure 3).

## Discussion

Low STD testing rates represent a major missed public health opportunity among MSM in China. We evaluated a pay-it-forward STD testing model and found that the model substantially increased test uptake compared with the standard of care. From a financial perspective, most of the costs associated with testing were supported by local MSM, suggesting a viable pathway to sustainable service delivery.

Our data shows that the pay-it-forward strategy can increase gonorrhoea and chlamydia testing uptake. We were unable to find published work demonstrating that pay-it-forward increases service uptake. Pay-it-forward programmes are usually presented to individuals who have already committed to purchasing the services. In this case, increased STD testing could be related to reduced testing fees, increased community engagement, or contagious kindness. The cost of testing for gonorrhoea and chlamydia might be a barrier for men to get tested, and men participating in the pay-it-forward programme did not have to pay. Further, the pay-it-forward spurred community engagement by actively engaging MSM in the development and implementation of the service. Previous studies have shown that community engagement in sexual health is associated with increased HIV testing among MSM.<sup>25</sup> Finally, by participating in the programme, pay-it-forward participants receive not only the test, but also the benefit of feeling cared for by others and the opportunity to help others.<sup>26</sup> Most men in the pay-it-forward group reported that getting other MSM to test or helping someone else were benefits of pay-it-forward. This is consistent with research showing that generous behaviour can spread through communities.<sup>27</sup>

The pay-it-forward programme reached a subset of high-risk, untested MSM. Among all MSM who tested, this was the first gonorrhoea test for 80% of participants and the first chlamydia test for 86% of participants. Overall, we identified five (4%) cases of gonorrhoea and 15 (12%) cases of chlamydia. These numbers are consistent with prevalence data from a previous study of MSM in Guangzhou.<sup>2</sup> Previous studies have evaluated and recommended combined HIV and syphilis testing.<sup>11,28</sup> Our study extends this published work by demonstrating a feasible approach for integrating gonorrhoea and chlamydia testing with HIV testing.

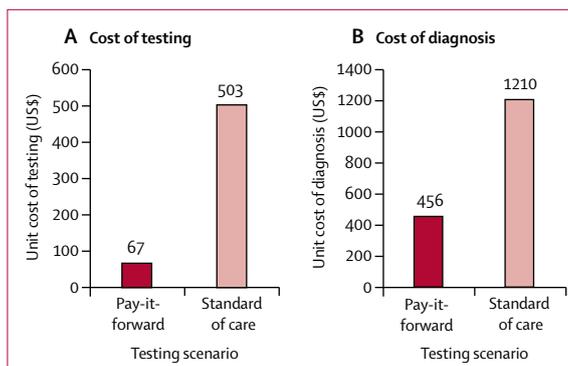


Figure 3: Incremental unit cost per test of gonorrhoea and chlamydia test (A) and per diagnosis of gonorrhoea or chlamydia diagnosis (B)

Among testers in the pay-it-forward group, 89% (97 of 109) chose to donate to future men. The average donation was \$10. This sum is notable and suggests that MSM are willing to invest in their health care despite accessing free HIV and syphilis testing services. In our programme, we initially invested enough funding for 81 tests. 31 additional tests were covered entirely by contributions from previous testers, and at the end of the programme period, there remained funding for 19 more tests. Compared with free testing, a pay-it-forward model can increase the number of available tests by distributing part of the cost to test recipients without making cost a barrier to access.<sup>29</sup> From an implementation perspective, a pay-it-forward model that combines institutional funding with patient contributions could allow a limited amount of funding to go a longer way.<sup>30</sup> Future programmatic efforts can investigate ways to make a pay-it-forward gonorrhoea and chlamydia testing programme independent and self-sustaining.

Our study has implications for research and implementation. The concept of pay-it-forward has often been used as a promotional tool,<sup>19-21</sup> but its application to public health is novel. Future research should analyse the cost-effectiveness of pay-it-forward, as well as evaluate pay-it-forward in a randomised controlled trial over a longer duration of time. Qualitative research on understanding the motivations and optimal implementation might also be helpful. Our preliminary findings suggest that a pay-it-forward model could be an effective tool in promoting screening and that it has potential to help create a self-sustaining service. We did not find differences between test uptake rates at the two sites despite some differences in implementation, suggesting that pay-it-forward programmes might be feasible across multiple settings. In low-income and middle-income countries, there is insufficient funding for many screening and preventive health services.<sup>30</sup> Pay-it-forward might be a useful tool in promoting and funding these essential services.

Several important limitations merit discussion. First, this study is limited by its quasi-experimental design, which

prevents us from making direct inferences about causality. There might have been other unmeasured differences between the two groups. However, the two groups of men were similar in terms of socio-demographic and behavioural characteristics. Second, the pay-it-forward programme was only piloted at two sites in Guangzhou aimed at HIV and syphilis testing for MSM. This setting limited our analysis to MSM who were already connected with community-based organisations willing to receive an HIV test. Third, the pay-it-forward intervention included both free testing and creating a sense of moral obligation to contribute to the health of other MSM. Our study could not differentiate to what extent these two factors individually contributed to the success of the programme. Finally, the success of the programme might vary depending on how embedded it is in a trusted MSM service. Although both sites showed similar rates of gonorrhoea and chlamydia testing, both sites are trusted by the Guangzhou MSM community. It is not known whether such a programme would be successful in other settings or among other populations, and further research is needed.

#### Contributors

JDT conceived the study. KTL, WT, SWP, and JDT designed the study. KTL, DW, WH, FW, AL, and HF coordinated and conducted the study. LY secured funding and assisted with program logistics for the study. WT, LH, and VM contributed ideas for study design and analysis. KTL, WT, and JDT developed the analysis plan, and KTL analysed the data. KTL, and JDT wrote the first draft of the manuscript. All authors edited and approved the final draft for submission.

#### Declaration of interests

JDT and WT are on the advisory board for SESH Global, which was involved in organising the study. All other authors declare no competing interests.

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