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High prevalence of self-reported sexually transmitted diseases among older adults in Tanzania: results from the list experiment

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Abstract

Background: Self-report of sensitive sexual behaviors is often inaccurate and subject to social desirability bias. List experiment is an alternative survey method to mitigate biases. The objective of this study was to estimate the rate of sexually transmitted infections (STIs) among older adults

in urban Tanzania using the list experiment and to compare it with the estimate from direct questioning.

Methods: The study was nested within the Dar es Salaam Urban Cohort Study, the Health and Demographic Surveillance System (HDSS) in Ukonga, Tanzania. Men and women aged ≥40 years were randomly assigned to receive a list of either four control items (i.e., control group), or four control items plus an additional item on having had a disease through sexual contracts in the past 12 months (i.e., treatment group). We calculated the mean difference in the total number of items to which respondents responded "yes" in the treatment vs. control groups, and compared it to the proportion measured in direct questioning. Multivariate linear and non-linear regression models were also fitted.

Results: A total of 2310 adults aged ≥40 years was enrolled in the study: 32% were male, and 48% were aged 40-49 years. The estimated prevalence of having sexually transmitted infections (STIs) in the past 12 months was 17.8% (95% Confidence Interval [CI] 12.3-23.3) in the list experiment, almost 10 times higher compared to 1.8% (95%CI 1.3-2.4) when directly asked ($p<0.001$). The prevalence was higher in men (27.0%; 95%CI 17.0-37.0) than in women (12.9%; 95%CI 6.4-19.4). The prevalence remained high after adjusting for age, multiple lifetime partners, and other sociodemographic factors in multivariate linear regression (15.6%; 95%CI 7.3-23.9).

Conclusions: The study found a higher estimated prevalence of STIs among older adults in urban Tanzania using the list experiment than when directly asked. This highlights the need for screening of STIs including HIV to ensure effective prevention and treatment in older adults.

Words: 2,840

Key words: List experiment, sexually transmitted diseases, prevalence, older adults, Tanzania

List of abbreviations and acronyms

CASI: Computer-assisted self-interview

DHS: Demographic and Health Survey

DUCS: Dar es Salaam Urban Cohort Study

HDSS: Health and Demographic Surveillance System

SSA: sub-Saharan Africa

STIs: Sexually transmitted infections

Introduction

In 2020, there were estimated 374 million new infections of four curable sexually transmitted infections (STIs) (chlamydia, gonorrhea, syphilis, and trichomoniasis) among people aged 15-49 years worldwide, and about 26% (96 million) of these occurred in the African region [1]. In 2016, the World Health Organization made a global priority to better understand the epidemiology of STIs and strengthen STIs screening and treatment programme at national and regional levels [2]. In East Africa, the prevalence of chlamydia and other STIs (except HIV) is estimated approximately 3% among individuals aged 15-49 years in clinic or community settings and 10% in high-risk groups [3]. However, the current surveillance of STIs largely focus on individuals at reproductive age, and there are no estimates available among adults aged ≥50 years.

The society often considers that “older people” do not engage in sexual behaviors therefore not at risk of acquiring STIs, which is clearly misconception [4,5]. There is a trend for increasing STIs in older populations across the globe including North America [4], Asian regions [6,7], and sub-Sharan Africa (SSA) [8,9]. In SSA, the region accounting for more than 70% global burden of HIV infection [10], the emerging epidemic of STIs occurs in parallel as the life expectancy in the population including those living with HIV increases [11]. People living with HIV are also ageing across SSA [12,13]. For example, about 15% of people enrolled in the HIV care and treatment programme were at the age of ≥50 years in Tanzania [14].

In many low-and-middle-income settings with lack of routine laboratory diagnosis for STIs surveillance, the Demographic and Health Survey (DHS) measures self-reported data for STIs and sexual behaviours. However, self-reported measurement of sexual behaviors is subject to biases such as interviewers bias or social desirability bias, leading to under- or over-estimation of sexual behaviors [15–17]. Computer-assisted self-interview (CASI) is an alternative way of face-to-face interviews to standardize data collection and reduce interview-related variability in responses [18] and has been shown feasible for completing quantitative sexual behaviour questionnaires [19]. However, several studies have shown that CASI surveys for sexual behaviors do not necessarily yield more accurate estimates, and responses can greatly vary compared to face-to-face interviews [16].

List experiment is a methodology that can be used to indirectly ask questions about sensitive items, such as sexual behaviors or stigmatized health events, and obtain more accurate estimates of prevalence while mitigating the effect of social desirability bias [20]. Respondents are more likely to honestly report as responses are collected only in an aggregate estimation without revealing answers to specific items. It has been used to measure risky sexual behaviour [21], illicit drug use [22], and abortion [23] in the health research and other social science fields [24]. To our knowledge, no study has applied the list experiment to measure the prevalence of STIs. The objective of this study is to estimate the underlying rate of experiencing STIs in the recent year

among older adults in urban Tanzania using list experiment and to compare that with the estimate from direct questioning.

Methods

Study Population and Setting

We used the cross-sectional survey data from the "Health and Aging in Africa: a Longitudinal Study in three INDEPTH Communities" (HAALSI) survey in Tanzania, which was established to examine specific characteristics and determinants of healthy aging among older adult populations in sub-Saharan Africa. The HAALSI Tanzania was nested within the Dar es Salaam Urban Cohort Study (DUCS) in Dar es Salaam, Tanzania. DUCS is a Health and Demographic Surveillance System (HDSS) that offers a community-based research platform to better understand the health and population dynamics representing urban populations [25]. The HDSS monitors the demographic and health information for approximately 100,000 residents and 21,000 households in the Ukonga and Gongo la Mboto wards, encompassing seven administrative streets (Gongo la Mboto, Guluka kwa lala, Mwembe Madafu, Markaz, Mazizini, Mongo la Ndege and Ulongoni) [25]. The 2013 HDSS census data was used as a sampling frame, and of those enrolled in the DUCS, the HAALSI Tanzania survey randomly selected adults aged 40 year. Field workers identified and visited the selected individuals and conducted home-based interviews from June 2017 to June 2018. Participation in this study was voluntary, and written informed consent was obtained from all participants prior to conducting the survey.

Study Design

All study participants were asked to complete a questionnaire via computer-assisted personal interviewing (CAPI) system. Interviewers used tablet computers to conduct the questionnaire in Swahili. The questionnaire included a comprehensive set of questions on sociodemographic and clinical factors, and physical and mental functions. We employed both list experiment (i.e., also known as unmatched count techniques or item count technique) [20] and direct questioning to estimate the prevalence of having contacted STIs in the past 12 months among the study participants. The tablet randomized each respondent to receive a list of four control items (i.e., control group), or a list of five items (the same four control items plus an additional question regarding whether the respondent had a disease through sexual contracts in the past 12 months) (i.e., treatment group). The list of questions was following: *1) I like reading Swahili newspapers; 2) I prepare food for my family every day; 3) My vision has worsened in the past few years; 4) I have smoked cigarettes in the past 12 months; and 5) I have had a disease which I got through sexual contact during the last 12 months (Randomized).* Respondents were asked to report the total number of items to which they responded "yes" without specifying which item they considered as true. About half of the sample were

randomly assigned to the treatment group. Later in the survey, all respondents were also directly asked whether they got a disease through sexual contacts in the past 12 months. Items within randomization were designed to have negative correlation thus to avoid the likelihood of choosing "yes" to all items ('ceiling effects') or choosing none of the items ('floor effects'), which could indirectly reveal the participants' response to the additional question in the treatment group [26].

Covariates

Sociodemographic and sexual behaviors information were extracted from the HDSS. Baseline demographic information included age, education, and marital status. The self-reported number of different sexual partners in the lifetime and multiple sexual partners in the last 12 months were used to indicate sexual behaviors. Smoking history of any tobacco products and alcohol consumption in the last 30 days to screen excessive drinking were also included.

Statistical analysis

We first estimated the proportion of having STIs in the past 12 months from direct questioning ("direct response"). From the list experiment, we calculated the mean scores of the selected items in the treatment and control groups. The average difference in the mean scores in the treatment and control groups represents the proportion of respondents who chose "yes" to the additional question on whether they had a disease through sexual contacts in the past 12 months ("indirect response"). This could be considered as the estimated prevalence of STIs in the past 12 months in the study population after mitigating social desirability bias and was measured as following:

$$\pi = \frac{\sum Y_{T=1,i}}{N_T} - \frac{\sum Y_{T=0,i}}{N_C}$$

where π represents the proportion of the study individuals who have experienced the sensitivity item, Y is the number of items reported by each respondent, T represents whether being randomized to receive the additional item (T=1 is the treatment list, T=0 is the control list), N_T represents the number of individuals who received the treatment list, and N_C is the number of individuals who received the control list. We then compared the prevalence of having STIs in the past 12 months from the direct response to the indirect response using the t-test.

Second, although the difference in the two means provides the estimated prevalence of SITs in the past 12 months after mitigating social desirability bias, the estimates could be outside the range of 0 and 1 and affected by confounding from other covariates. Several estimators including non-linear regression or maximum-likelihood estimators were developed to address such limitations [24]. We fitted multivariate linear and non-linear regression to estimate the prevalence of STIs using the list experiment, adjusting for the covariates that might be associated with the risk of STIs [26,27]. Specifically, we adjusted for sex (male vs. female), age groups (40-49, 50-59, 60-69, 70+ years), having more than 5+ lifetime sexual partners, alcohol consumption in the last 30 days (yes vs. no), and current smoking status (yes vs.no). The non-linear regression model is implemented in two steps

by minimizing the sum of squared residuals and robust to non-strategic measurement error and potential model misspecification as the model only makes an assumption about the conditional mean functions [28]. The adjusted estimates with 95% confidence intervals are reported. The multivariate regression analyses were conducted using *list* package in R 4.1.3 and other analyses in STATA version 16 [29].

Ethical consideration

The study was approved by the ethical review boards of the Harvard T.H. Chan School of Public Health and Muhimbili University of Health and Allied Sciences.

Results

Of a total of 2,310 individuals approached and participated in the survey, 40 participants had incomplete or missing response, and 2,270 completed the list experiment: 1,120 was randomized to the control, and 1,150 to the treatment group to receive the additional sensitivity item on STIs. Overall, 32% (n=722) were males, 62% (n=139) had some primary education (Table 1). Nearly half of the respondents were aged 40-49 years (48%, n=1394), and 71% were currently married or cohabitating. Less than 5% (n=83) of respondents reported having two or more partners in the last 12 months. The sociodemographic and behavioral characteristics were similar between the treatment and the control groups.

When people were directly asked whether they had a disease through sexual contacts in the past 12 months, the self-reported prevalence was 1.8% (95% CI 1.3-2.4) (Table 2, Figure 1). The prevalence was similar between males (2.4%; 95% CI 1.3-3.5) and females (1.6%; 95% CI 1.0-2.2). However, the estimated “true” prevalence of having STIs in the last 12 months using the list experiment was almost 10 times higher at 17.8% (95% CI 12.3-23.3), compared to the direct response ($p<0.001$). When stratified by sex, the prevalence of STIs in the list experiment was higher in men (27.0%; 95% CI 17.0-37.0) than in women (12.9%; 95% CI 6.4-19.4).

We further examined the responses by other sociodemographic and behavioral covariates. The estimated prevalence of STIs among those aged 40-49 years was 19.5% (95% CI 11.7-27.3%) using the list experiment, compared to 2.7% (95% CI 1.8-3.8%) in the direct question ($p<0.001$). The difference between direct response and list experiment did not significantly differ among those aged 50-59 years though [0.8% (95% CI 0.3-1.9) vs. 6.7% (95% CI -4.1-17.4), $p=0.22$, respectively]. However, the estimated prevalence of STIs among those aged 60-69 years and 70+ years in the list experiment was much higher at 24.3% (95% CI 11.1-37.6%) and 29.3% (95% CI 8.7-49.9%), respectively, compared to the direct response. Of those who were currently married and/or cohabitating, the estimated prevalence of STIs in the past 12 months was 20.0% (95% CI 13.4-26.6%) in the list experiment. Among those with ≥5 lifetime sexual partners, the estimated prevalence of STIs in the list experiment was significantly higher than in the direct response [25.9%

(95% CI 12.3-39.4) vs. 11.5% (95% CI 5.7-20.1), p<0.001]. The estimated prevalence of STIs between direct response and list experiment also significantly differed by alcohol consumption or smoking history.

The estimated prevalence of STIs using list experiment was slightly attenuated but still much higher after adjusting sex, age, number of lifetime partners, alcohol consumption, and smoking history using either a linear regression [15.6% (95% CI 7.3-23.9)] or a non-linear regression [15.8% (95% CI 8.3-30.2)]. When stratified by sex, the estimated prevalence of STIs was 29.2% (95% CI 17.6-40.7) in males and 10.6% (95% CI 3.6-17.7) in females in the multivariate linear regression. Overall, males were significantly more likely to have contracted STIs compared to females adjusting for other covariates (adjusted odds ratio = 2.87; 95% CI 1.20-6.84) (Table 3).

Discussion

We found that the prevalence of self-reported STIs in the recent year among a random sample of adults aged 40 years or older was strikingly high at 17.8% in an urban population in Dar es Salaam, Tanzania. The reported rate was much higher among males compared to females, and the prevalence was almost ten times higher than the reported rate measured via direct questioning. Most demographic, sexual behavior, and HIV surveillances in sub-Saharan Africa are largely limited to the population at reproductive age (15-49 years). In this study, over 20% of adults aged 40-49 and 60+ years reported having a disease through sexual contacts in the past 12 months when they were indirectly asked using the list experiment. Although we could not validate against biomarker tests, our findings highlight that older adults are highly sexually active and at high risk of contracting STIs.

In Tanzania, HIV prevalence was 4.5% among those aged 15-49 years in 2017 while HIV incidence has declined over the past few years [30]. However, as HIV epidemics are ageing across sub-Saharan Africa, older individuals have an increased risk for HIV and other STIs. Our study shows that older adults in urban Tanzania continue to engage in sexual behaviors, and a high proportion may experience STIs and relevant symptoms. We cannot validate our findings against the prevalence of laboratory-confirmed STIs since there are currently no estimates available for the prevalence of HIV and other STIs in adults aged ≥ 50 years in Tanzania and globally. In recent cross-sectional surveys in Tanzania, the laboratory-diagnosed prevalence of trachomatis and vaginalis among adolescent girls were 12% and 19%, respectively [31]. The prevalence of chlamydia was close to 10% in high-risk groups in Eastern Africa although the estimated prevalence was lower in community settings [3]. In South Arica where the HIV prevalence in adults is around 20%, the estimated co-infection prevalence of gonorrhoea and chlamydia was as high as 30-40% among aged 25-49 years [3].

Most DHS collect sexual behaviour information as part of routine household surveys. In the settings where other confirmatory laboratory tests are limited, collecting accurate self-reported behavior data is critical. Face-to-face interviews are prone to biases such as social desirability bias [32,33], thus CASI and other computerized surveys are increasingly used in routine surveillance for sexual behaviors. However, previous studies have shown that responses through CASI still significantly vary in different settings and populations [15,16,18,19]. Regardless of survey modes, people may feel uncomfortable and fear of social stigma to honestly answer questions on sensitive items such as sexual behaviors or diseases, which lead to substantial misclassification of experiencing the sensitive items.

List experiment is a methodology to quantify and mitigate such misclassification by allowing respondents only to report in an aggregate form without revealing their answers to specific items. Studies have shown that respondents are more likely to truly answer to the questions when asked using the list experiment compared to the direct question [34]. List experiment has been used to measure risky sexual behaviour[21] or and abortion [23]. A study in Liberia, where induced abortion is illegal, found that 32% of women reported experiencing lifetime abortion when indirectly asked in the list experiment, compared to the DHS estimate of 6% [23]. To our knowledge, this is the first study to apply the list experiment to measure the prevalence of STIs. We found that people can still significantly under-report sexual behaviors when directly asked in a standardized computer survey. Further replications of our findings in similar settings will be instructive.

Currently, STIs screening is not commonly done in an older population, and HIV surveillance often has the upper age limit at 49-55 years. Our findings show that there is a huge discrepancy in the reported estimates for STIs when measured using direct and indirect questioning. For effective prevention, treatment and management, routine screening for STIs and HIV in older population need to be considered in Tanzania and other similar settings. Methodologically, comparing the estimates from the list experiment to laboratory-based results can be helpful to understand the degree of biases and underlying population estimates for STIs. Nevertheless, these study findings provide evidence that routine DHS or self-reported surveillance data based on direct questions may be substantially under-reported thus needs careful interpretation. Future studies can examine whether reporting of other sensitive behaviors such as alcohol consumption or multiple sexual partners is comparable in direct and indirect questioning.

Strengths and limitations

The study has several important limitations. First, the study was based on self-reported outcomes and could not be validated against laboratory test results. Confirmatory STIs tests among those who reported having disease through sexual contacts could shed further light on the accuracy of estimates measured using the list experiment. Second, although the study used relatively simple questions as control items, it is possible that respondents may have misinterpreted them. However, any potential bias occurred in answering the questions would have

resulted in non-differential bias in the treatment and control groups. Third, we did not specify any specific disease for STIs. Respondents could consider genital irritations or any temporary symptoms as a sign of STIs broadly. Nevertheless, the very high estimate of self-reported disease implies the common engagement of sexual activity and potential presence of STIs. As the study was nested within the existing HDSS surveillance and represented a random sample of the population, our estimates are representative of the urban population in Dar es Salaam in Tanzania. This study provides unique insights as one of the very few studies which measured in-depth data in an urban older population using an innovative technique.

Conclusion

In this study, we found that the prevalence of having STIs in the recent year measured was nearly 20% among older adults in urban population in Tanzania. Further study is warranted to validate our findings against laboratory-confirmed STIs results. This novel application can be considered as a tool to capture the true parameter reported for sexual behaviors.

Conflict of Interest

The authors declare no conflict of interest.

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Table and figure caption

Table 1. Sociodemographic and behavioural characteristics of participants who completed the list experiment by randomization groups

	Treatment n=1120	Control n=1150
	N (%)	N (%)
Sex		
Male	346 (30.9)	384 (33.4)
Female	774 (69.1)	766 (66.6)
Self-reported HIV status		
Negative	725 (64.7)	688 (59.8)
Positive	48 (4.3)	65 (5.7)
Never tested	330 (29.5)	378 (32.9)
Missing	17 (1.5)	19 (1.7)
Age (years)		
40-49	544 (48.6)	545 (47.4)
50-59	303 (27.1)	308 (26.8)
60-69	182 (16.3)	194 (16.9)
70-79	63 (5.6)	71 (6.2)
80+	28 (2.5)	32 (2.8)
Education Level		
No formal education	186 (16.7)	171 (15.0)
Primary (grade 1-7)	681 (61.2)	713 (62.4)
Ordinary secondary (grade 8-11)	193 (17.4)	189 (16.5)
Advanced secondary or above (grade 12+)	52 (4.7)	70 (6.1)
Country of Origin		
Tanzania	1097 (98.5)	1138 (99.4)
Other	17 (1.5)	7 (0.6)
Marital Status		
Currently married or cohabitating	793 (71.2)	803 (70.2)
Separated or divorced	95 (8.5)	101 (8.8)
Widowed	190 (17.1)	205 (17.9)
Never married	35 (3.1)	35 (3.1)
Employment Status		
Employed (part or full time)	523 (47.1)	526 (46.1)
Not working	207 (18.6)	232 (20.3)
Homemaker	380 (34.2)	383 (33.6)
Alcohol consumption in the last 30 days		
Yes	140 (12.7)	172 (15.1)
Ever smoking tobacco products		
Yes	153 (13.8)	152 (13.4)
Number of lifetime sexual partners		
0-4	826 (73.8)	877 (76.3)
5+	206 (18.4)	200 (17.4)
Don't know/Refused	87 (7.8)	73 (6.3)
Multiple partners in the last 12 months		
Yes	36 (3.3)	51 (4.5)

Table 2. The reported proportion of having contracted a disease through sexual contacts in the last 12 months in the list experiment and direct question among 2,270 adults ≥ 40 years in Dar es Salaam, Tanzania

	Total	1) List Experiment					2) Direct Question	
		Treatment		Control		Difference-in-mean scores between treatment and control groups (95% CI)	proportion (95% CI)	p-value*
	N	N	Mean Score	N	Mean Score			
1) Overall								
Having contracted a disease through sexual contacts in the last 12 months	2310	1105	1.806	1131	1.629	0.178 (0.123, 0.233)	0.018 (0.013, 0.038)	**<0.001**
2) By covariates								
Gender								
Male	744	343	1.738	376	1.468	0.270 (0.169, 0.370)	0.024 (0.014, 0.038)	**<0.001**
Female	1555	762	1.837	755	1.709	0.129 (0.064, 0.194)	0.016 (0.01, 0.024)	**<0.001**
Age groups (years)								
40-49	1108	541	1.799	542	1.603	0.195 (0.117, 0.273)	0.027 (0.018, 0.038)	**<0.001**
50-59	615	301	1.834	305	1.767	0.067 (-0.041, 0.174)	0.008 (0.003, 0.019)	0.22
60-69	379	177	1.847	187	1.604	0.243 (0.111, 0.376)	0.005 (0.001, 0.02)	**<0.001**
70+	197	86	1.674	97	1.381	0.293 (0.087, 0.499)	0.028 (0.009, 0.064)	0.01
Marital status								
Never married	1596	35	1.657	35	1.657	0 (-0.336, 0.336)	0.015 (0,	1.00

						0.200 (0.134, 0.266)	0.079) 0.018	
Currently married/cohabitating	196	790	1.822	798	1.622		(0.012, 0.025)	**<0.001**
						0.056 (-0.121, 0.233)	0.041	
Separated or divorced	395	94	1.809	101	1.752		(0.018, 0.079)	0.53
						0.180 (0.049, 0.311)	0.01	
Widowed	70	186	1.769	197	1.589		(0.003, 0.027)	0.01
Number of lifetime sexual partners								
						0.156 (0.093, 0.219)	0.015	
0-4	1703	823	1.79	871	1.634		(0.01, 0.021)	**<0.001**
						0.259 (0.123, 0.394)	0.115	
5+	406	206	1.879	200	1.62		(0.057, 0.201)	**<0.001**
Alcohol consumption in the last 30 days								
						0.198 (0.047, 0.35)	0.026	
Yes	312	140	1.836	171	1.637		(0.011, 0.05)	0.01
						0.169 (0.11, 0.228)	0.017	
No	1998	959	1.799	956	1.630		(0.012, 0.023)	**<0.001**
Smoking status								
						0.153 (-0.003, 0.309)	0.033	
Yes	305	947	1.813	978	1.637		(0.016, 0.06)	<0.001
						0.176 (0.117, 0.235)	0.016	
No	2275	152	1.743	149	1.591		(0.011, 0.023)	0.06

*p-value is estimated using a t-test comparing the proportion of having contracted a disease through sexual contacts in the last 12 months in the list experiment (i.e. difference-in-mean scores between treatment and control groups) to the proportion reported in direct question.

Table 3. Estimated coefficients and odds ratios from the list experiment in multivariate linear or non-linear regressions models*

	Linear regression		Non-linear regression	
Variables	Coefficient	SE	Odds Ratio	95% CI
Sensitive item				
Male (vs. Female)	0.185**	0.075	2.870**	(1.204, 6.841)
Age groups, years				
40-49	Ref		Ref	
50-59	-0.146**	0.067	0.289	(0.055, 1.524)
60-69	0.027	0.080	1.386	(0.572, 3.358)
70+	0.006	0.129	0.878	(0.208, 3.695)
Having more than 5+ lifetime sexual partners (Yes vs. No)	0.042	0.082	1.507	(0.608, 3.737)
Alcohol consumption in the last 30 days (Yes vs. No)	-0.004	0.084	1.183	(0.424, 3.300)
Smoking status (Yes vs. No)	-0.149	0.098	0.500	(0.18, 4.746)
Control items				
Male (vs. Female)	-0.326***	0.052	0.708***	(0.635, 0.789)
Age groups, years				
40-49	Ref		Ref	
50-59	0.189***	0.048	1.214***	(1.104, 1.335)
60-69	0.043	0.059	1.041	(0.924, 1.174)
70+	-0.134	0.088	0.865	(0.72, 1.039)
Having more than 5+ lifetime sexual partners (Yes vs. No)	0.112	0.061	1.131**	(1.001, 1.279)
Alcohol consumption in the last 30 days (Yes vs. No)	0.068	0.058	1.072	(0.953, 1.206)
Smoking status (Yes vs. No)	0.105	0.070	1.122	(0.972, 1.296)

*The coefficients of interest are highlighted in grey. Each variable is adjusted for all other variables shown in the column. Control items indicate the four control items asked both in the treatment group and the control group, while the sensitive item indicates the question on having had a disease through sexual contact during the past 12 months in the treatment group.

**p-value <0.05; *** p-value <0.01

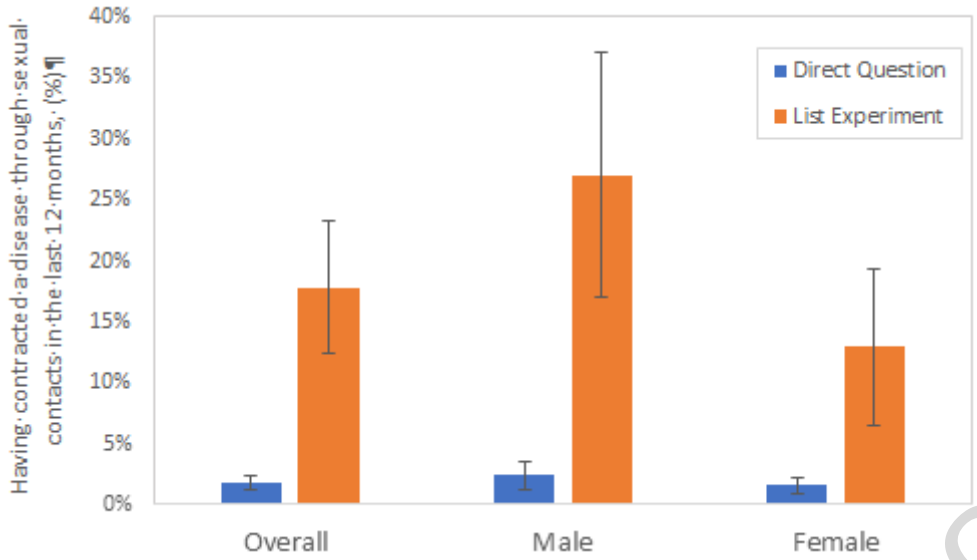

Figure 1. The percentage of reporting to have contracted a disease through sexual contact in the last 12 months among all participants ("overall") and by gender. Blue bars indicate the results from direct question and orange bars from list experiment. The error bars indicate the 95% confidence intervals.

Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐ The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: