



The impact of STI test results and face-to-face consultations on subsequent behavior and psychological characteristics

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ABSTRACT

Sexually transmitted infection (STI) testing without face-to-face counselling is increasingly offered at sexual health centers (SHC), and ordering self-sampling tests online is becoming more popular. However, the impact of testing without counselling on behavior is unknown. We examine the impact of STI testing with and without consultation and the combined effect of a positive test result and treatment consultation, on behavioral and psychological characteristics over time. Data from a longitudinal study among heterosexual SHC visitors aged 18–24 years was used. The impact of a test consultation (participants who tested chlamydia negative with vs. without consultation) and treatment consultation/positive test result (participants who tested chlamydia positive vs. negative), was assessed by comparing behavioral and psychological characteristics before testing (baseline), and at three-week and six-month follow-up, using generalized estimating equation models. Changes after testing were similar between participants who tested chlamydia negative with and without test consultation, namely decreased risk perception, shame, number of partners, and increased knowledge. However, participants who tested chlamydia positive reported stronger increases in health goals and intentions towards condom use, and stronger decreases in the number of partners and stigma, compared to participants who tested negative. Furthermore, condom use increased in chlamydia positive, and decreased in chlamydia negative participants. A treatment consultation/positive test result had a risk-reducing impact on behavioral and psychological characteristics, whereas the impact of a test consultation was limited. Since the majority of young heterosexuals test chlamydia negative, alternative interventions (e.g., online) achieving risk-reducing behavior change targeted to individuals who tested negative are needed.

1. Introduction

Sexually transmitted infection (STI) testing through self-collected sampling at sexual health centers (SHC), without a face-to-face consultation, is increasingly offered to cope with high demands in testing at the clinic, and to increase testing uptake (Lunny et al., 2015; Smith et al., 2014; van Rooijen et al., 2016). In addition, internet-based self-sampling test kits are becoming more popular (Herrmann et al., 2019; Turner et al., 2019; Wilson et al., 2019). Health care professionals often apply risk reduction counselling during a face-to-face consultation (e.g., motivational interviewing) (Rietmeijer, 2007). Risk reduction

counselling is guided by behavior change theories (Kuyper et al., 2009; Lanjouw et al., 2016; Rietmeijer, 2007; Workowski et al., 2015), such as the health belief model, theory of planned behavior, or self-perception theory (Hetteema et al., 2005; Taylor et al., 2006). Previous research showed that face-to-face counselling based on behavior change theories can change sexual behavior, and STI incidence in young people (Boman et al., 2018; Long et al., 2016). It is unknown what the impact of STI testing without a face-to-face consultation on subsequent behavior and psychological characteristics is.

In the Netherlands, high-risk individuals are offered free of charge STI testing at SHC (Slurink et al., 2019). In 2015, budget restrictions

Abbreviations: STI, sexually transmitted infection; SHC, sexual health centers

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resulted in a stricter triage at multiple SHC. Since then, heterosexuals aged < 20 years can choose between a self-sampling test kit with or without a test consultation. Heterosexuals aged 20 to 24 years, who do not have any other risk factor (i.e., born (or partner born) in an area with high STI prevalence, notified for an STI by a partner, being a sex worker or victim of sexual abuse, or have STI-related symptoms), are offered to come to the SHC for testing through self-collected sampling without a consultation. Therefore, individuals who test negative will not receive any face-to-face counselling. Individuals who test positive are invited for a consultation, including provision of treatment, risk reduction counselling, and partner notification, according to national guidelines for STI management in many Western countries (Lanjouw et al., 2016; Workowski et al., 2015).

In a longitudinal cohort study named 'Mathematical models incorporating Psychological determinants: control of Chlamydia Transmission' (iMPaCT), young heterosexual SHC visitors were followed over a period of one year. Participants filled out questionnaires assessing psychological and behavioral characteristics before and after testing, which provided a unique opportunity to allow for comparison of these characteristics over time between individuals with and without a test and/or treatment consultation. The aim of the current study was to explore the impact of an STI test consultation, and the combined impact of a treatment consultation and positive test result on behavioral and psychological characteristics over time.

2. Methods

2.1. Setting

In this study, data was used from the iMPaCT study (November 2016–June 2018). Details of the iMPaCT study can be found elsewhere (van Wees et al., 2018). Briefly, heterosexual SHC visitors aged 18–24 years in the regions Amsterdam, Kennemerland, Hollands-Noorden, and Twente, were invited to participate. In line with Dutch guidelines (Slurink et al., 2019), participants were routinely tested for chlamydia and gonorrhoea and, if indicated (e.g., notified for or symptoms related to syphilis, HIV or Hepatitis B (HBV)), additionally for syphilis, HIV and/or HBV at the SHC. As part of the iMPaCT study, participants filled out an online questionnaire about sexual behavior and psychological characteristics at different time points during the iMPaCT study: before testing (baseline), and after testing (and treatment) at three-week, six-month and one-year follow-up. The iMPaCT study was approved by the Medical Ethical Committee of the University Medical Center Utrecht, the Netherlands (NL57481.094.16/METC18-363/D/Dutch Trial Register NTR-6307).

Here, all participants who completed the baseline questionnaire, completed at least one follow-up questionnaire, and visited the SHC in Amsterdam, Kennemerland, or Hollands-Noorden were included in the analyses. Participants who tested negative for chlamydia, but positive for gonorrhoea, were excluded, because young heterosexuals diagnosed with gonorrhoea are different in terms of demographic characteristics and sexual behavior compared to those diagnosed with chlamydia (Slurink et al., 2019). Hence, psychological and behavioral characteristics and possible changes in these characteristics after treatment might be different. All variables obtained from the questionnaires at baseline, and after testing at three-week, and six-month follow-up were included in the models. Missing data at six-month follow-up was complemented with available data at one-year follow-up to limit loss to follow-up (van Wees et al., 2019).

2.2. Data collection

The questionnaires in the iMPaCT study included questions on sexual behavior, such as condom use, number of partners in the past six months, and frequency of sexual intercourse in the past four weeks (the last two variables were not included in the three-week follow-up

questionnaire). The questionnaire also included questions on psychological characteristics, including: health goals (i.e., perceived importance of (sexual) health), attitudes regarding prevention of chlamydia, anticipated shame, stigma, impulsiveness, knowledge regarding sexual health and prevention of chlamydia, and consequences of chlamydia diagnosis, self-efficacy regarding condom use, social support after chlamydia diagnosis, and social norms regarding condom use and STI testing, self-esteem, risk perception for chlamydia, and intentions regarding condom use and STI testing.

The national STI surveillance database, containing data of all SHC visitors, was used to complement the questionnaire data with demographic and sexual health-related information of the participants, including the STI test results, and whether they had a test consultation. iMPaCT participants signed an informed consent, and agreed to linking their questionnaire data to the national STI surveillance database using an anonymous study identification number. A detailed description of all variables included in the statistical analyses is provided in supplementary material, text S1.

2.3. Statistical analyses

The impact of a test consultation was assessed by comparing differences in changes in behavioral and psychological characteristics over time between individuals who tested chlamydia negative with and without a test consultation. The impact of a treatment consultation/positive test result on behavioral and psychological characteristics over time was explored by comparing all individuals who tested chlamydia negative to all individuals who tested chlamydia positive (Fig. 1). We assumed that at three-week follow-up, all participants had received the test results, and all participants who were diagnosed with chlamydia were treated. Chi-squared tests were used to assess baseline differences in demographic characteristics between individuals who tested chlamydia negative with and without test consultation, and between participants with and without a treatment consultation/positive test result. Since this study was conducted as part of routine care, individuals without a test consultation were, by definition, lower risk than individuals with a test consultation.

To explore the impact of a test or treatment consultation, the absolute change in the proportion of participants with certain behavioral and psychological characteristics at three-week and six-month follow-up compared to baseline was calculated in percentage points. For example, when the proportion of individuals without consultation reporting high risk perception changed from 48% at baseline to 39% at three-week follow-up, the absolute difference was 9 percentage points. Generalized estimating equation (GEE) models were constructed to examine differences in changes in behavioral and psychological characteristics over time between individuals who tested chlamydia negative with and without test consultation, and between individuals with and without a treatment consultation/positive test result. A p-value lower than 0.05 was considered a statistically significant difference in percentage change within groups and between the groups.

All variables were entered in the model one by one as independent variables. Since the outcomes were binary (i.e., test or treatment consultation/positive test result: yes or no), a binomial distribution with a logit link was used. In addition, the GEE models were adjusted for covariates, including demographic characteristics, such as age, gender, and STI clinic location, that were no triage criteria. Covariates were added to the model when including a covariate or interaction term significantly improved model fit. An exchangeable correlation matrix was used, assuming that there is a constant correlation between the repeated measurements, which is more appropriate for short time intervals (e.g., months instead of years follow-up). As a sensitivity analysis, the GEE models were repeated using an autoregressive AR(1) correlation matrix, which assumes that correlations decrease over time. All statistical analyses were performed in R version 3.6.0 (R Development Core Team, 2019).

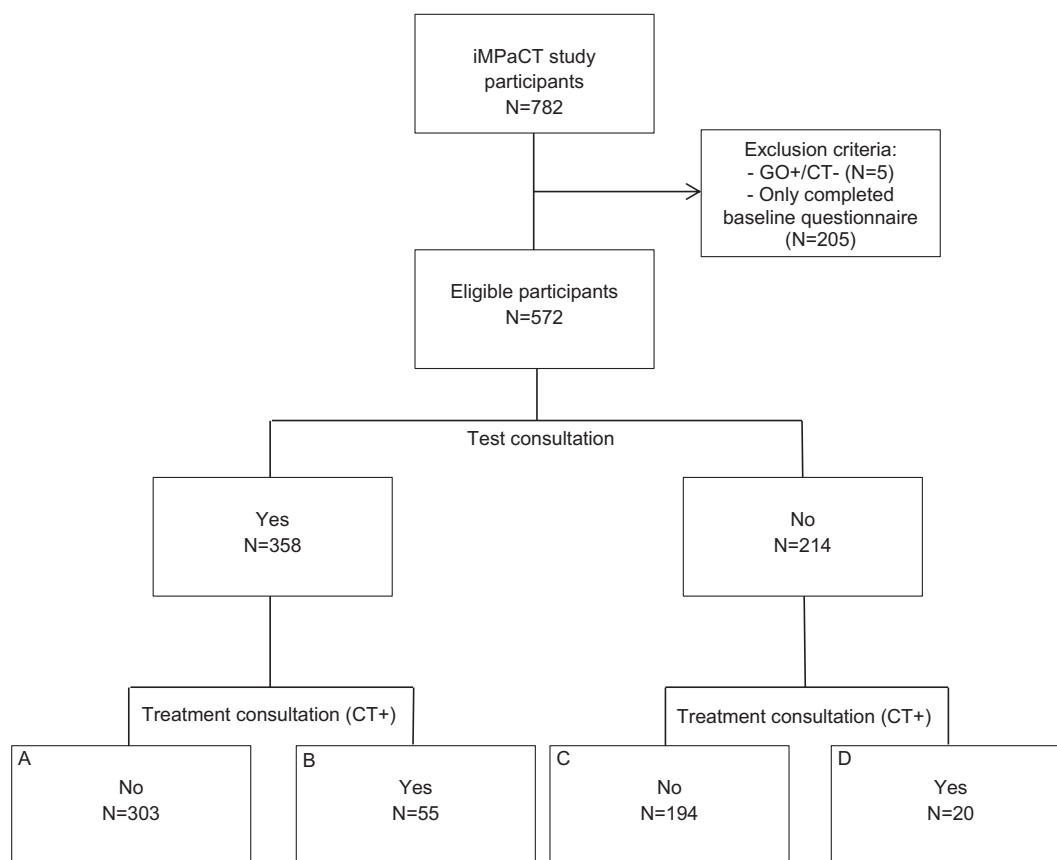


Fig. 1. Flowchart of the iMPaCT study.

Abbreviations: STI = sexually transmitted infection; CT- = Chlamydia trachomatis negative; FU = follow-up data available; GO+ = gonorrhoea positive.

Footnote: Impact test consultation = A vs. C; impact treatment consultation/positive test result = (A + C) vs. (B + D).

3. Results

3.1. Study participants

Of the 782 iMPaCT participants, five participants were excluded because they were gonorrhoea positive, and another 205 participants were excluded, because they only completed the baseline questionnaire. Thus, 572 (74%) participants were eligible for inclusion in this study (Fig. 1). Of all eligible participants, 75 (13.1%) did not fill out the questionnaire at six-month follow-up, and the questionnaire at one-year follow-up was used instead.

Conform the guidelines, participants without a test consultation did not fulfil any of the triage criteria other than being under the age of 25 (Supplementary Table S1). Chlamydia positivity at baseline and during follow-up was higher in participants with a test consultation (15%, 95% confidence interval (CI): 12.0–19.5) compared to participants without a test consultation (9%, 95% CI: 6.1–14.0). None of the participants with an indication ($n = 197$) tested positive for either syphilis, HIV, or HBV.

3.2. The impact of a test consultation

Chlamydia negative participants with a test consultation ($n = 303$) were less likely to be highly educated compared to participants who tested chlamydia negative without test consultation ($n = 194$) (p -value < 0.05 denoted in bold in Table 1). Furthermore, condom use, and impulsiveness, at baseline (before testing) was higher in participants with a test consultation, compared to participants without a test consultation (p -values < 0.05 , denoted in bold in Table 2).

The GEE models for anticipated shame, knowledge, self-efficacy, intentions, and sex frequency were adjusted for gender, and the model

for anticipated stigma was adjusted for age. When looking at changes over time, both participants with and without a test consultation reported decreased risk perception and anticipated shame at three-week follow-up, and decreased risk perception and number of partners, and increased knowledge at six-month follow-up, compared to baseline (p -values < 0.05 , denoted in bold in Table 2). No differences in changes over time between the groups were observed for any of the variables at three-week or at six-month follow-up (p -values ≥ 0.05). The sensitivity analyses showed similar results (Supplementary Table S2).

3.3. The impact of a treatment consultation/positive test result

Participants with a treatment consultation/positive test result ($n = 75$) were less likely to be highly educated compared to participants without a treatment consultation/positive test result ($n = 497$) (p -value < 0.05 , denoted in bold in Table 1). Furthermore, they reported higher number of partners, and higher risk perception at baseline, compared to participants without a treatment consultation/positive test result (p -values < 0.05 , denoted in bold in Table 3).

The GEE models for health goals, attitudes, anticipated shame, knowledge, self-efficacy, intentions, and sex frequency were adjusted for gender, and the model for anticipated stigma was adjusted for age. Changes in behavioral and psychological characteristics over time differed between participants with and without a treatment consultation/positive test result (p -values < 0.05 , denoted in bold in Table 3). Participants with a treatment consultation/positive test result increased condom use and decreased self-esteem at three-week follow-up, whereas participants without a treatment consultation/positive test result decreased condom use and increased self-esteem at six-month follow-up. Furthermore, participants with a treatment consultation/

Table 1

Baseline demographic characteristics of participants who tested chlamydia negative with and without test consultation, and of participants with and without treatment consultation/positive test result.

	With test consultation		Without test consultation		Chi-squared test	With treatment consultation		Without treatment consultation		Chi-squared test
	N	%	N	%	p-Value	N	%	N	%	p-Value
Total	303	61	194	39		75	13	497	87	
Age					0.517					0.071
18–19 years	26	9	20	10		12	16	46	9	
20–24 years	277	91	174	90		63	84	451	91	
Gender					0.153					0.139
Female	253	83	171	88		59	79	424	85	
Male	50	17	23	12		16	21	73	15	
Education level ^a										
Low	29	10	8	4	0.024	12	16	37	7	0.012
High	274	90	186	96		62	84	460	93	
STI clinic location										
Amsterdam	256	84	169	87	0.279	60	80	425	86	0.433
Hollands-Noorden	20	7	15	8		8	11	35	7	
Kennemerland	27	9	10	5		7	9	37	7	

The total number of participants with and without a test consultation adds up to the total number of participants without treatment consultation/positive test result. Statistical associations are shown in bold when the p-value is smaller than 0.05.

Abbreviations: CT = Chlamydia trachomatis; STI = sexually transmitted infection.

^a The categories do not add up to the total number of participants, as missing values present in this variable are not shown.

positive test result reported a stronger decrease in anticipated stigma at three-week follow-up and in the number of partners at six-month follow-up, and a stronger increase in health goals and intentions at three-week and six-month follow-up, compared to participants without a treatment consultation/positive test result. Again, the sensitivity analyses yielded similar results (Supplementary Table S3).

4. Discussion

Participants who tested chlamydia negative with and without test consultation both reported similar changes after testing, including decreased risk perception, shame, and number of partners, and increased knowledge. Furthermore, we found that among participants who tested chlamydia negative, individuals with a test consultation were more impulsive, and reported higher condom use, compared to participants without test consultation. A treatment consultation/positive test result, however, had a risk-reducing impact on subsequent behavior. Participants with a treatment consultation/positive test result changed their behavioral and psychological characteristics, including the number of partners, condom use, health goals and intentions towards condom use and STI testing, in a risk-reducing direction. In contrast, participants without a treatment consultation/positive test result (i.e., those who tested chlamydia negative with and without a test consultation) showed riskier behavior, such as decreased condom use. It should be kept in mind that the impact of a test or treatment consultation and the impact of the test results on behavioral and psychological characteristics cannot be distinguished in the data.

A strength of this study is that it is, to our knowledge, the first to explore the impact of an STI test and treatment consultation/positive test results on a variety of behavioral and psychological characteristics over time. There are also some limitations to mention. First, as this study was conducted as part of routine care, randomization was not possible. Furthermore, it was impossible to distinguish between the impact of a positive test result and a treatment consultation, because all participants who tested positive also received a treatment consultation. Second, due to low numbers, some interesting stratifications were not possible. For example, we were unable to stratify by gender. A previous study showed that the impact of STI testing on behavioral and psychosocial characteristics is stronger for women compared to men, but the direction of behavior change was the same (Kangas et al., 2006), suggesting that the observed effects in this study apply to both women

and men. Furthermore, we were unable to stratify the effect of the treatment consultation into those with and without a test consultation, as there were only 20 participants with a treatment consultation but without test consultation. Possibly, the observed effects are the combined effects of a test and treatment consultation/positive test result rather than the treatment consultation/positive test result alone, as multiple consultations might be more effective than a single consultation (LeFevre, 2014). Third, complementing missing data at six-month follow-up with one-year follow-up data might have led to biased results. However, this was only done for 13% of all participants, and repeating the GEE analyses excluding these participants yielded similar results (results not shown). Fourth, 26% of the participants only completed the baseline questionnaire, and they might be different from participants who were included in the analyses. However, previously we showed that chlamydia positivity rates were comparable between both groups (van Wees et al., 2019), which suggests limited non-response bias. Fifth, young participants (aged < 20 years) were able to choose between a test consultation or self-sampling test kit without consultation. This means that young participants who requested a test consultation, without any other risk factors, or young participants with one or more additional risk factors, who requested a self-sampling test kit, were misclassified. Nevertheless, as this concerns only 3% of the study population, the impact of this limitation is assumed to be limited. Last, behavior change could have been induced by other reasons for testing, which were not measured, such as starting a monogamous relationship (Fortenberry et al., 2002). However, the impact of non-measured reasons for testing on behavioral and psychological characteristics was assumed to be similar in all groups.

This study was conducted as part of routine care, where only high-risk individuals are offered a test consultation. Therefore, those who received a test consultation were, by definition, higher risk than those without a test consultation. We also found differences in other baseline characteristics between groups, such as differences in education level and impulsiveness. These differences between groups should be kept in mind when interpreting the behavior change results. For example, we showed that the decrease in number of partners after testing was significantly stronger in participants with a treatment consultation/positive test result compared to participants without a treatment consultation/positive test result. This might be explained by the proportion reporting three or more partners in the past six months at baseline, which was already significantly lower in participants without a

Table 2

Generalized estimating equation models of behavioral and psychological characteristics over time in participants who tested chlamydia negative with and without a test consultation.

	With test consultation				Without test consultation				GEE difference in % change	
	Baseline		3-week	6-month	Baseline		3-week	6-month	3-week	6-month
	N	%	% change compared to baseline ^e	% change compared to baseline ^e	N	%	% change compared to baseline ^e	% change compared to baseline ^e	p-Value	p-Value
Total	303				194					
Condom use										
Never/sometimes	186	61			137	71				
Usually/always	117	39	-4%	-9%	57	29	+4%	-1%	0.11	0.18
Number of partners in past 6 months										
0–2 partners	104	34			81	42				
3+ partners	199	66	-	-16%	113	58	-	-14%	-	0.82
Sex frequency in past 4 weeks										
0–2 times	129	43			99	51				
3+ times	174	57	-	-6%	95	49	-	-6%	-	0.91
Health goals										
Low (score < 4.00)	139	46			77	40				
High (score ≥ 4.00)	164	54	0%	+7%	117	60	-1%	+5%	0.59	0.68
Attitudes ^a										
Low (score < 4.25)	122	40			71	37				
High (score ≥ 4.25)	181	60	-4%	+1%	123	63	0%	-4%	0.49	0.27
Anticipated shame										
Low (score < 3.75)	122	40			71	37				
High (score ≥ 3.75)	181	60	-16%	0%	123	63	-9%	+1%	0.63	0.71
Impulsiveness										
Low (score < 2.63)	130	43			109	56				
High (score ≥ 2.63)	173	57	+2%	0%	85	44	+5%	+4%	0.29	0.54
Knowledge ^b										
Low (score < 6)	141	47			83	43				
High (score ≥ 6)	162	53	+8%	+10%	111	57	+3%	+12%	0.41	0.53
Self-efficacy										
Low (score < 3)	136	45			105	54				
High (score ≥ 3)	167	55	+3%	+6%	89	46	+2%	+6%	0.79	0.61
Social norms and support										
Low (score < 3.2)	115	38			59	30				
High (score ≥ 3.2)	188	62	+5%	+6%	135	70	+2%	-2%	0.77	0.18
Self-esteem										
Low (score < 4)	98	32			61	31				
High (score ≥ 4)	205	68	+2%	+8%	133	69	+3%	+2%	0.63	0.07
Risk perception ^c										
Low (score < 27.50)	158	52			97	50				
High (score ≥ 27.50)	145	48	-9%	-13%	97	50	-6%	-15%	0.91	0.52
Intentions ^d										
Low (score < 2.67)	114	38			81	42				
High (score ≥ 2.67)	189	62	+9%	+5%	113	58	+4%	+8%	0.43	0.63
Anticipated stigma										
Low (score < 2.17)	130	43			101	52				
High (score ≥ 2.17)	173	57	-3%	-2%	93	48	-4%	+5%	0.64	0.12

Numbers of each variable do not all add up to the total number of testers, as missing values are not shown.

Statistical associations are shown in bold when the p-value is smaller than 0.05.

Abbreviations: GEE = generalized estimating equation.

^a Attitudes regarding prevention of chlamydia.

^b Knowledge regarding sexual health, prevention of chlamydia and consequences of chlamydia diagnosis.

^c Own risk perception for chlamydia.

^d Intentions regarding condom use and STI testing.

^e Change expressed in percentage point.

treatment consultation/positive test result. Furthermore, it is unclear what the impact on subsequent behavioral and psychological characteristics would be when STI testing without face-to-face counselling would be routine care for all high-risk groups, including vulnerable people such as young heterosexuals who report additional risk factors.

In the current study, all participants, irrespective of test or treatment consultation/positive test result, reported increased intentions towards condom use and STI testing, and decreased shame after testing. This is in agreement with earlier observations (Hartney et al., 2015), showing that individuals who tested for chlamydia reported higher intentions to get tested again in the future, and less shame, compared to

individuals who were not tested. However, we found that participants who tested negative reduced their numbers of partners, while other studies found no changes or increased numbers of partners over time in individuals testing negative (Soetens et al., 2015; Sznitman et al., 2010). Reasons for this discrepancy might include differences in study population and reasons for testing (i.e., generally low risk random sample of the population vs. higher risk SHC visitors in this study).

We showed that individuals who tested chlamydia positive reduced the number of partners and increased condom use over time, which was in line with previous studies (Soetens et al., 2015; Sznitman et al., 2010). However, this is in contrast with the high percentage of repeat

Table 3

Generalized estimating equation models of behavioral and psychological characteristics over time in participants with and without treatment consultation/positive test result.

	With treatment consultation				Without treatment consultation				GEE difference in % change	
	Baseline		3-week	6-month	Baseline		3-week	6-month	3-week	6-month
	N	%	% change compared to baseline ^e	% change compared to baseline ^e	N	%	% change compared to baseline ^e	% change compared to baseline ^e	p-Value	p-Value
Total	75				497					
Condom use										
Never/sometimes	56	75			323	65				
Usually/always	19	25	+16%	+6%	174	35	-1%	-6%	0.02	0.15
Number of partners in past 6 months										
0–2 partners	19	25			185	37				
3+ partners	56	75	-	-34%	312	63	-	-15%	-	0.03
Sex frequency in past 4 weeks										
0–2 times	31	41			228	46				
3+ times	44	59	-	-7%	269	54	-	-6%	-	0.90
Health goals										
Low (score < 4.00)	45	60			216	44				
High (score ≥ 4.00)	30	40	+21%	+17%	281	56	0%	+7%	0.002	0.13
Attitudes ^a										
Low (score < 4.25)	30	40			193	39				
High (score ≥ 4.25)	45	60	+7%	+6%	304	61	-2%	+1%	0.25	0.44
Anticipated shame										
Low (score < 3.75)	37	49			193	39				
High (score ≥ 3.75)	38	51	-14%	+1%	304	61	-9%	+3%	0.46	0.82
Impulsiveness										
Low (score < 2.63)	35	47			239	48				
High (score ≥ 2.63)	40	53	-12%	+7%	258	52	+3%	+1%	0.04	0.28
Knowledge ^b										
Low (score < 6)	31	41			224	45				
High (score ≥ 6)	44	59	+8%	+14%	273	55	+5%	+11%	0.62	0.45
Self-efficacy										
Low (score < 3)	39	52			241	49				
High (score ≥ 3)	36	48	+8%	+9%	256	51	+3%	+6%	0.28	0.62
Social norms and support										
Low (score < 3.2)	24	32			174	35				
High (score ≥ 3.2)	51	68	+10%	+4%	323	65	+4%	+3%	0.42	0.91
Self-esteem										
Low (score < 4)	24	32			159	32				
High (score ≥ 4)	51	68	-5%	-5%	338	68	+3%	+6%	0.11	0.01
Risk perception ^c										
Low (score < 27.50)	26	35			255	51				
High (score ≥ 27.50)	49	65	-11%	-15%	242	49	-8%	-14%	0.61	0.76
Intentions ^d										
Low (score < 2.67)	34	45			195	39				
High (score ≥ 2.67)	41	55	+22%	+19%	302	61	+6%	+6%	0.02	0.04
Anticipated stigma										
Low (score < 2.17)	31	41			231	47				
High (score ≥ 2.17)	44	59	-24%	-4%	266	53	-3%	+2%	0.005	0.57

Numbers of each variable do not all add up to the total number of testers, as missing values are not shown.

Statistical associations are shown in bold when the p-value is smaller than 0.05.

Abbreviations: GEE = generalized estimating equation.

^a Attitudes regarding prevention of chlamydia.^b Knowledge regarding sexual health, prevention of chlamydia and consequences of chlamydia diagnosis.^c Own risk perception for chlamydia.^d Intentions regarding condom use and STI testing.^e Change expressed in percentage point.

infections found in individuals diagnosed with chlamydia in previous studies (Hosenfeld et al., 2009). A possible explanation for this paradox might be that even though people reduced the number of partners, they might be re-infected by an untreated regular partner (Batteiger et al., 2010). Other explanations for repeat infections might include treatment failure (Batteiger et al., 2010; Dukers-Muijters et al., 2019), or auto-inoculation (Heijne et al., 2016) (i.e., spread of infection between anatomic sites of the body), which are not related to behavior change.

We found that changes in behavioral and psychological characteristics did not differ between participants with and without a test consultation. On the one hand, this suggests that there was little impact of a

test consultation on subsequent behavior and psychological characteristics. A possible explanation for this could be that behavior change techniques, such as motivational interviewing, were not consistently used during the consultation. Furthermore, even if these techniques were used consistently, reappraisal of chlamydia risk could have overpowered the impact of the test consultation, leading to decreased perceived importance of condom use after receiving negative test results (Martin Braunstein et al., 2014). On the other hand, all participants, including participants without any face-to-face counselling, reported decreased number of partners, increased knowledge, and increased intentions and self-efficacy regarding condom use and STI

testing. Thus, testing itself, irrespective of test results or consultation, might have a risk-reducing impact on sexual behavior. Furthermore, the test consultation may have prevented the participants from increasing their already high-risk behavior (Soetens et al., 2015).

We showed that condom use decreased in participants without a treatment consultation/positive test result, even though knowledge, intentions and self-efficacy regarding condom use increased after testing. A possible explanation might be that people engaged in more steady partnerships where condoms are less often used (Fortenberry et al., 2002). However, this hypothesis was not supported by the data, because the proportion of steady partnerships in each group was constant over time (data not shown). Another explanation might be that changes in the psychological characteristics were not sufficient to achieve increased condom use. An effective strategy to reduce the gap between intended and actual condom use might be to use implementation intentions (Ajzen et al., 2009; de Vet et al., 2011). Implementation intentions involve formulating simple plans, such as “If I encounter situation X, then I will perform behavior Y”. This strategy could be used at SHC during a face-to-face consultation.

Since the treatment consultation/positive test result had a risk-reducing impact on behavioral and psychological characteristics, it might be interesting to offer risk reduction counselling after receiving negative test results. However, resources for elaborative face-to-face counselling after negative test results are not always available (LeFevre, 2014; Robin et al., 2004; Roy et al., 2019). Upscaling the use of online interventions, including social media, as an alternative to face-to-face counselling could be useful. Digital behavioral interventions have been found to effectively change sexual behavior, and increase testing uptake (Long et al., 2016), when they were based on multiple behavior change techniques, including improving attitudes, self-efficacy, social norms and intentions towards condom use. Furthermore, psychological characteristics could be assessed to tailor the digital interventions to individual-level characteristics, which may be more effective (van Wees et al., 2020). Online (interactive) behavioral interventions might also be an effective approach to reach individuals ordering internet-based self-sampling test kits (Bailey et al., 2015). Future research should examine the impact of risk reduction counselling, face-to-face and especially online alternatives, after receiving negative test results on subsequent behavior and psychological characteristics.

5. Conclusions

A treatment consultation/positive test result had a risk-reducing impact on subsequent sexual behavior and psychological characteristics. The impact of a test consultation was limited, but testing itself, might have a risk-reducing impact on sexual behavior and psychological characteristics. Since the majority of young heterosexuals test negative for chlamydia, alternative interventions achieving risk-reducing behavior change, such as online interventions, tailored to psychological characteristics of individuals who tested negative are needed.

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CRedit authorship contribution statement

Daphne A. van Wees: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Software, Visualization, Writing - original draft, Writing - review & editing. **Meggie M.C.M. Drissen:** Conceptualization, Data curation, Formal

analysis, Investigation, Resources, Software, Visualization, Writing - original draft, Writing - review & editing. **Chantal den Daas:** Conceptualization, Funding acquisition, Investigation, Methodology, Resources, Supervision, Validation, Visualization, Writing - review & editing. **Titia Heijman:** Conceptualization, Writing - review & editing. **Mirjam E.E. Kretzschmar:** Conceptualization, Methodology, Supervision, Writing - review & editing. **Janneke C.M. Heijne:** Conceptualization, Data curation, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing - review & editing.

Declaration of competing interest

None.

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Appendix A. Supplementary data

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