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# Keeping participants on board: increasing uptake by automated respondent reminders in an Internet-based Chlamydia Screening in the Netherlands

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## Summary

**Background:** A systematic Internet-based *Chlamydia* screening started in 2008 among respondents aged 16-29 years, aiming to reduce population prevalence of *Chlamydia* infections in the Netherlands. Automated respondent reminders by letter, email and SMS were used to encourage and optimise participation. The objective of this study was to examine the contribution of reminders on package request and sample return in relation to target population characteristics.

**Methods:** On average, 279.000 persons were annually invited by a personal letter. Individuals not responding to the invitation received a reminder letter after 1 month. Email- and SMS reminders were sent to test kit requesters who did not return their sample within 2 weeks. Effects of reminders on response (requesting a test package) and participation (returning a sample) rates were evaluated in two screening rounds (2008-2010). Logistic regression analyses were conducted to identify determinants of providing a cell phone (GSM) number, response after a reminder letter, and participation after email/SMS reminders.

**Results:** Of all 52.600 (round 1) and 41.700 (round 2) respondents, 99% provided an email address and 72% a GSM number. Factors associated with providing a GSM number were younger age (16-24 yrs), non-Dutch background, lower educational level, symptoms of an STI, and sexual risk behaviour in the past 6 months ( $p < 0.05$ ). Of all package requests 42% was performed after the reminder letter. The proportion invitees returning a sample increased from 10% to 14% after email/SMS reminders (round 2: from 7% to 10%). Determinants for requesting a test package after the reminder letter were male gender, young age (16-19 yrs), non-Dutch background, having a casual partner or  $\geq 2$  sex partners in the past 6 months. Email/SMS reminders resulted in more men and 25-29 year olds returning a sample.

**Conclusion:** Nearly all respondents were reachable by modern communication media. Factors associated with providing a GSM number were also related to *Chlamydia* positivity. Respondent reminders by letter almost doubled response (package requests) and resulted in reaching more people at higher risk. Email/SMS reminders contributed substantially to participation rates (sample returns). Incorporation of automated respondent reminders in systematic Internet-based (*Chlamydia*) screening programs is strongly recommended since they highly increase uptake.

**Key words:** *Chlamydia trachomatis*, screening, the Netherlands, Internet

## Introduction

In the Netherlands, a register- and Internet-based *Chlamydia* Screening Implementation (CSI) started in 2008 in three regions. The aim of this pilot implementation was to assess whether annual systematic and selective screening can reduce population prevalence of *Chlamydia trachomatis* (*Ct*) and prevent serious complications such as genital and pelvic inflammatory diseases (PID), sub- and infertility and ectopic pregnancies.<sup>1</sup> Additionally, the feasibility and cost-effectiveness of the program were evaluated in order to decide on a national roll-out.<sup>2-4</sup> Detailed descriptions and evaluations of the CSI program were described elsewhere.<sup>3-6</sup> In summary, the target population included 16-29 year old sexually active people. On average 279.000 people were invited by a personal letter in annual screening rounds. Invitees could request a home testing kit through the Internet.

In systematic screening programs, achieving adequate levels of participation and mobilising high risk groups are important though challenging. To encourage package request (response) and sample return (participation) in CSI, automated respondent reminders were embedded in the screening process. The reminders were sent automatically from a screening application. Reminders included a letter, two emails and – since the second screening round in 2009 – an additional SMS. The reminder letter was sent to invitees who did not (yet) respond to their invitation letter to request the testing package. Email- and SMS reminders were sent to respondents that requested the package, but did not (yet) return their sample to the laboratory.

Although the (combined) use of reminders has been described in other *Ct*-screening programs, reminders were either not sent by modern communication technologies like email and SMS, or were reported in screening settings other than systematic and population-based screenings, or their impact on screening uptake was not thoroughly evaluated.<sup>7-12</sup> Email reminders were only applied in opportunistic Internet-based *Ct*-screenings to remind on result checking and treatment.<sup>8-9</sup>

CSI is the first (systematic) population-based screening program using a combination of reminder letters, emails and SMS messages. As part of the process evaluation of the first two screening rounds of CSI, we investigated (1) determinants of providing a cell phone number by respondents, (2) whether respondent reminders enhanced the response rate (% of package requests) and participation rate (% of sample return), and (3) the determinants for response and participation after a reminder. The outcomes may contribute to the optimisation of screening adherence and the development of – tailored – future population-based screening programs.

# Methods

## Design and procedure CSI

CSI is a prospective, selective and systematic population-based *Chlamydia* screening program, using the Internet and home testing kits.<sup>3-5</sup> The target population included all inhabitants aged 16-29 years of the cities of Amsterdam and Rotterdam, and the more rural area of South-Limburg. People were invited in annual screening rounds and participation was voluntary. In the first round (started April 2008) 256.400 invitations were sent and in the second 301.600 (started April 2009). Response rates (testing kit requests) in the first and second round were 21% and 14% respectively. Participation rates (returned test samples by initial invitees) were 16% and 11.5%<sup>3,4</sup>

The CSI screening procedure was characterised by six steps: invitation, request of home testing kits, home sampling, sample return, and checking the test result (see Figure 1). Each step was automatically administrated and controlled by a central computer system. Invitees received a letter with a personal code to log in on [www.chlamydiatest.nl](http://www.chlamydiatest.nl). Online, invitees could order a free home testing kit or indicate not wanting to participate in the screening. Respondents were asked to voluntarily provide their email address and cell phone (GSM) number for communication purposes. Invitees who did not request a testing kit within 4 weeks after the invitation received a reminder letter by post. After home specimen collection, samples were posted to the regional laboratory. If no sample arrived at the lab within 2 or 3 weeks after package sending, the respondent automatically received 1 or, respectively, 2 email reminder(s). In the second round, the second email was coupled with an SMS. Text messages included demand for sample return. No reminders were sent if people responded within the predefined terms. After sample testing at the laboratory, test results were available online using the personal login code. *Ct*-positives were directed for treatment and automatically received a mailed re-screening test kit 6 months after their test result. All invitees and participants of the first round and re-screening were invited again in the second screening round (if they still fulfilled the age criteria). Screening procedures were similar in both rounds.

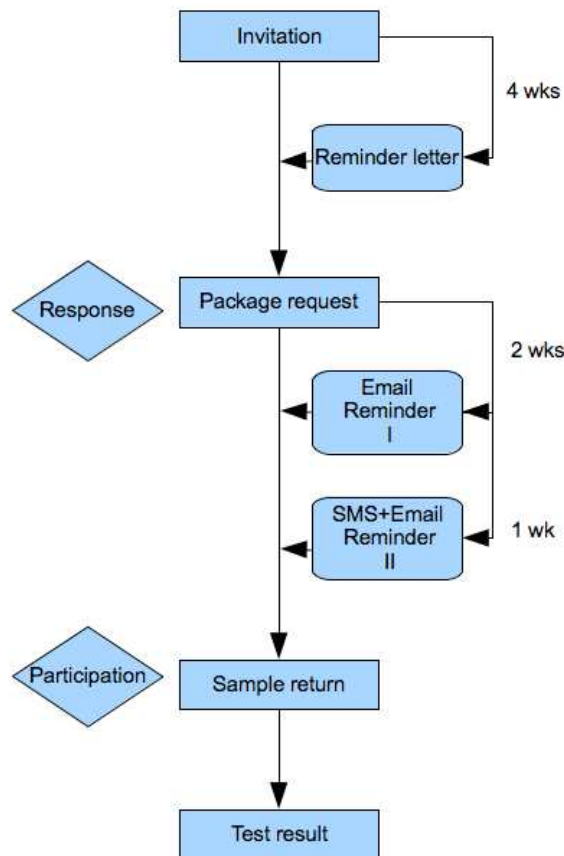


Figure 1. Flow-chart reminders in Chlamydia Screening Implementation

### Data collection

Socio-demographic data were available for all invitees from population registers. Sexual behavioural data were collected via online questionnaires (open and closed questions). Questionnaires were completed voluntarily after invitees replied whether or not to receive a test package. Additional questionnaires were sent to non-participants (see Figure 3, day 28).<sup>6,13</sup> Data collection included age, gender, educational level, sexual history, STI history and symptoms. Process data on invitation and reminder sending as well as lab results were automatically generated and were available from the screening application. ‘Response’ was defined as the online request of a *Ct*-self test kit by an invitee. ‘Participation’ included people’s return of a test sample to the laboratory. Participation rates were calculated by dividing the number of samples returned, by the number of invitations sent. Small differences in calculations could have occurred compared to previous research published<sup>2,4-6</sup> due to completeness of research data and different selection criteria for analysis. Excluded from the analyses were subjects with deviant screening procedures: lost packages and failed tests (3% of the participants in each round).

## Analyses

The first step of analysis was investigating numbers of respondents supplying their email address and/or cell phone number. This information provided insight into potential numbers of respondents reachable for screening communication – in particular for reminders. Subsequently, univariate and multivariate logistic regression analyses (backward stepwise,  $p < 0.05$ ) were conducted to identify determinants of providing a cell phone number by respondents, determinants for test package request after a reminder letter, and for sample return after email/SMS reminders. Determinants for providing an email address were not investigated since 99% of respondents provided their email address. Characteristics of respondents were described in detail by Op de Coul et al.<sup>2</sup> and were not included in this article. Variables were included in the multivariate models if  $p \leq 0.20$  (Wald test) in univariate analyses (SAS software, version 9.2). Socio-demographic and sexual risk behaviour variables were investigated (see Table 1 and 2). In the second round models an additional variable was included on repeated screening participation. Ethnic groups incorporated the main immigrant groups in the Netherlands, based on country of birth of the invitee and his/her parents from the population register (mother's background leading). Community risk level comprised a risk classification of geographic clusters based on age, ethnic and income profiles.<sup>4</sup> Computations of SES were also described elsewhere.<sup>6</sup>

The effects of all reminders were calculated in proportions, during the periods of time after people received the reminder. The effect of 'response after the reminder letter' was defined as package request  $\geq 31$  days after the invitation letter was sent (Figure 2). Proportions of response after the reminder ( $\geq 31$  days) were compared to response without the need of a reminder ( $\leq 30$  days). The effect of email- and SMS reminders on participation included sample return 15-30 days after package delivery (Figure 3). No distinction was made in number or type of reminder received, since reminders were sent in a short period of time. The cut off point of 30 days after package reception was chosen according to graphical patterns of sample return (Figure 3) and the defined period of time (one month). Proportions of sample return after the email/SMS reminders (15-30 days) were compared to proportions of sample return without needing a reminder ( $\leq 14$  days), and to sample return after a longer period of time after reminder reception ( $\geq 31$  days). Finally, positivity rates, also studied in relation to responses to email/SMS reminders, were calculated by dividing the number of *Ct*-positives by the number of tests performed. Proportions of positives were calculated during the period that people received email/SMS reminders and returned their sample (15-30 days after package delivery). Comparisons were made with positives that did not need any reminder ( $\leq 14$  days after package delivery) and people returning their sample after  $\geq 31$  days.

# Results

## **Providing an email address or cell phone number**

Although providing an email address and/or cell phone number was not obligatory in CSI, in both screening rounds 99% of all respondents (average >47.000, Table 1) gave their email address. Cell phone numbers were given by 71% of the respondents in the first round and 73% in the second round. Providing both an email address and a GSM number was 70% and 72% in the first, respectively second, round.

## ***Determinants of providing cell phone number***

Factors positively associated with providing a cell phone number in the multivariate models in both screening rounds, were younger age (16-24 yrs), non-Dutch background, lower educational level, young age at first sexual contact ( $\leq 15$  years), having a short-term steady partnership ( $\leq 1-2$  years), no condom use during last sexual contact with a casual partner, and having had an STI more than 6 months ago ( $p < 0.05$ ) (Table 1). Other determinants of providing a GSM number that were only significant in one of the two screening rounds, were female gender, living in a main city, being in a concordant non-Dutch/non-Dutch steady partnership, having  $\geq 2$  sexual partners in the past 6 months, no condom use during the last sex contact with a steady partner, and being *Ct*-positive in the first screening round. The odds ratios (ORs) were relatively small; the highest ORs (1.5-1.7) were observed in sub-Saharan Africans which provided their GSM number more often than the Dutch population.

**Table 1. Determinants of providing a cell phone number by package requesters, per screening round**

Package requests (N)	Multivariate logistic regression					
	Round 1 (N=52628)			Round 2 (N=41729)		
	n (%)	OR (95%CI)	p-value	n (%)	OR (95%CI)	p-value
Cell phone number providers (n)	37375			30510		
Gender	37375			30510		
Male	33.2	1.0		32.3	NA	NA
Female	68.8	<b>1.2</b> (1.0-1.4)	0.008	67.7		
Age	37374			30510		
16-19	14.7	1.0		15.1	1.0	
20-24	39.2	1.0 (1.0-1.1)	0.23	40.4	1.1 (1.0-1.2)	0.08
25-29	46.1	<b>0.8</b> (0.8-0.9)	<0.001	44.5	<b>0.8</b> (0.8-0.9)	<0.001
Ethnicity	37374			30510		
Dutch	61.2	1.0		60.1	1.0	
Surinam/Antillean	11.8	<b>1.3</b> (1.2-1.4)	<0.001	11.5	<b>1.3</b> (1.2-1.4)	<0.001
Turkish/Moroccan	6.4	<b>1.1</b> (1.0-1.2)	0.04	6.3	1.1 (1.0-1.2)	0.09
Sub Sahara African	3.4	<b>1.5</b> (1.3-1.8)	<0.001	4.1	<b>1.7</b> (1.5-2.0)	<0.001
Western, other	8.0	1.0 (0.9-1.1)	0.66	8.6	1.0 (0.9-1.1)	0.87
Non-Western, other	9.2	<b>1.1</b> (1.1-1.2)	0.002	9.4	<b>1.2</b> (1.1-1.3)	<0.001
Region	37375			30510		
Rotterdam	57.4	ns	ns	55.0	1.0	
Amsterdam	39.3			38.3	1.0 (0.9-1.0)	0.35
South-Limburg	3.3			6.7	<b>0.8</b> (0.7-0.9)	<0.001
Community risk level	37375			30510		
Low	34.9	1.0		34.4	1.0	
Medium	50.1	<b>0.9</b> (0.8-0.9)	<0.001	49.0	<b>0.9</b> (0.9-1.0)	0.006
High	15.0	1.0 (0.9-1.0)	0.24	16.6	0.9 (0.9-1.1)	0.82
Educational level	23229			17172		
Low	5.0	1.0		4.9	1.0	
Medium	28.7	0.9 (0.8-1.0)	0.17	28.8	1.0 (0.8-1.2)	0.74
High	66.3	<b>0.8</b> (0.7-0.9)	0.007	66.3	<b>0.8</b> (0.7-1.0)	0.05
Ethnicity SP	13998			9638		
Concordant(NL/NL)	54.8	1.0		54.1	ns	ns
Discordant (NL/non-NL)	26.9	1.0 (0.9-1.1)	0.55	26.7		
Concordant (non-NL/non-NL)	18.3	<b>1.4</b> (1.2-1.5)	<0.001	19.2		
Age at first sexual contact	22728			16752		
≤ 15	29.3	1.0		30.6	1.0	
16-18	52.6	<b>0.8</b> (0.8-0.9)	<0.001	52.9	<b>0.8</b> (0.8-0.9)	<0.001
≥ 19	18.1	<b>0.7</b> (0.6-0.8)	<0.001	16.5	<b>0.6</b> (0.6-0.7)	<0.001
Number of sexual partners < 6 months	22459			16612		
No partner(s)	8.5	1.0		7.9	ns	ns
1 steady partner	49.4	1.2 (1.0-1.5)	0.12	44.5		
1 casual partner	11.7	1.2 (1.0-1.5)	0.16	13.0		
≥ 2 partners (incl. steady partner)	30.4	<b>1.5</b> (1.1-1.9)	0.003	34.6		
Duration steady partnership	22812			16841		
< 1 year	15.9	1.0		17.7	1.0	
1-2 years	20.9	1.0 (0.9-1.1)	0.62	19.5	1.0 (0.9-1.1)	0.18
3-5 years	15.0	<b>0.8</b> (0.7-0.9)	<0.001	12.7	<b>0.9</b> (0.8-1.0)	0.01
≥ 6 years	9.1	<b>0.8</b> (0.7-0.8)	<0.001	6.9	<b>0.7</b> (0.6-0.8)	<0.001
No steady partner	39.1	1.5 (0.9-2.4)	0.13	43.2	<b>0.8</b> (0.7-0.9)	0.001
Condom use last contact CP	8124			6926		
Yes	47.7	1.0		44.0	1.0	
No	52.3	<b>1.2</b> (1.1-1.3)	<0.001	56.0	<b>1.1</b> (1.1-1.3)	0.02
Condom use last contact SP	13876			9547		
Yes	15.8	1.0		16.0	NA	NA
No	84.2	<b>1.2</b> (1.1-1.3)	<0.001	84.0		
History of STI	3175			8442		

No STI ever	68.1	1.0		68.8	1.0	
Yes, < 6 months	4.0	1.2 (0.8-2.0)	0.38	4.0	1.2 (0.9-1.5)	0.25
Yes, ≥ 6 months	27.9	1.2 (1.0-1.5)	0.03	27.2	1.2 (1.1-1.3)	0.002
Symptoms of an STI	5649			13284		
Yes	38.1	ns	ns	40.1	1.0	
No	61.9			59.9	0.7 (0.8-0.9)	<0.001
Test result (after participation)	29845			25059		
Ct-neg	95.5	ns	ns	95.5	1.0	
Ct-pos	4.5			4.5	1.3 (1.2-1.5)	<0.001

OR, odds ratio; CI, confidence interval; NA, not applicable ( $p \geq 0.2$  in univariate analysis); ns, not significant ( $p > 0.05$  in multivariate analysis); MSM, men having sex with men, STI, sexually transmitted infection(s); SP, steady partner; CP, casual partner. Ethnicity 'Western other' included Oceania, North America, Canada, Europe (excluding the Netherlands and Turkey); 'Non Western other' included Central and South America, Middle East, South and South-East Asia (excluding Surinam, Antilles, Aruba, Morocco and North Africa). Variables that were non significant in the multivariate models in both screening rounds were not shown: SES-score, Living situation, Concurrent partners yes/no, Sexual preference, History of STI testing.

## Effects of automated reminders on response and participation

### Response rates after reminder letter

Of all invitees, 87% (223.700/256.400) and 91% (275.000/301.600) received a reminder letter in the first, respectively second, screening round. When people requested a test package (circa 52.600 in round 1 and 41.700 in round 2), 41% and 43% of the respondents did their request after the reminder letter. The overall response rate (package request rate) in the first round (R1) increased from 12% to 20% after the reminder letter and in round 2 (R2) from 8% to 14% (Figure 2). Request patterns were similar in both screening rounds (R2 not shown).

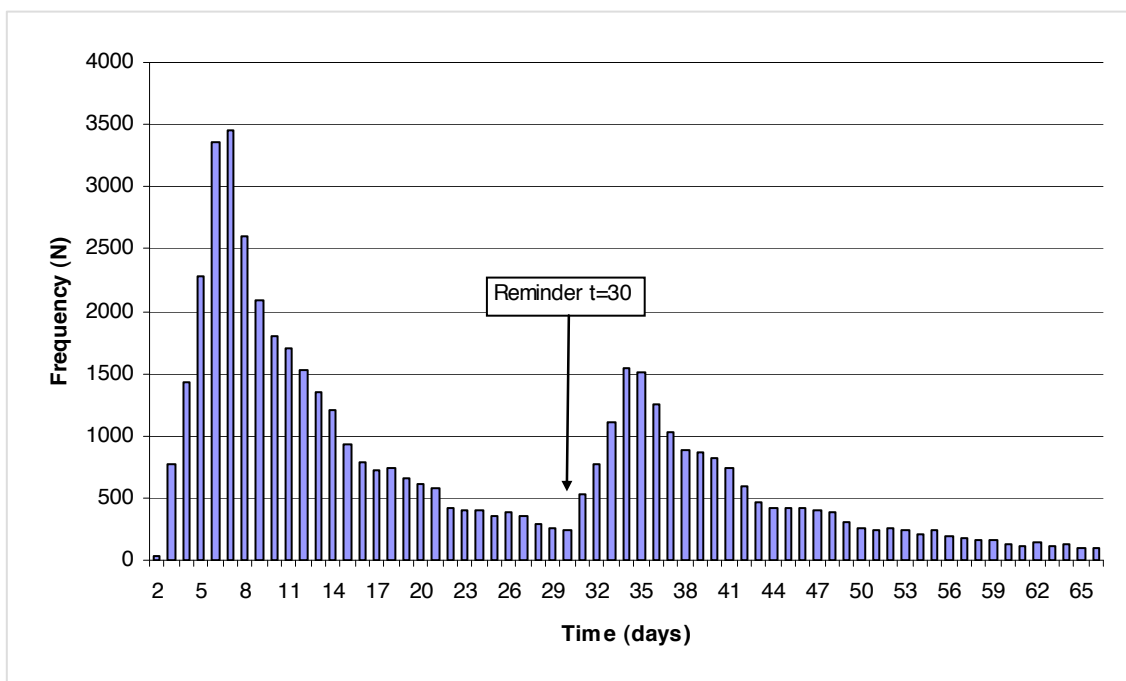


Figure 2. Time (days) from invitation to test package request in first screening round

### ***Determinants of package request after reminder letter***

In the multivariate models for both screening rounds, the most significant determinants for requesting a test package after receiving a reminder letter, were male gender, non-Dutch background, having a long-term steady relationship and having used a condom with a casual sex partner (Table 2). In R1, responding after the reminder letter was also associated with young age (16-19 yrs), having had a casual partner or  $\geq 2$  sex partners in the past 6 months, and being a man with a heterosexual preference. Furthermore, people in R2 who tested *Ct*-positive in R1 and did not return the re-screening test kit, were more likely to respond after the reminder letter compared to first round *Ct*-negatives and those who did return the re-screening test.

**Table 2. Determinants of package request after the reminder letter, per screening round**

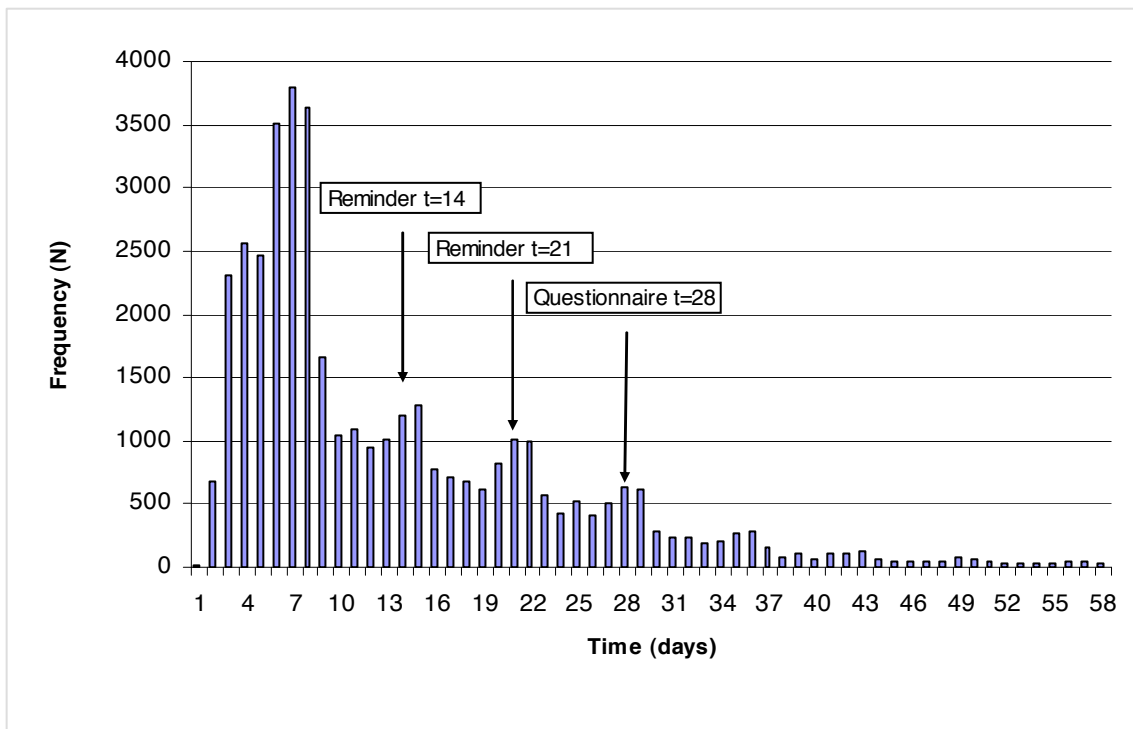
	Multivariate logistic regression			
	Round 1 (n=20926)		Round 2 (n=17267)	
	OR (95%CI)	p-value	OR (95%CI)	p-value
Gender				
Male	1.0		1.0	
Female	<b>0.9</b> (0.8-0.9)	<0.001	<b>0.9</b> (0.8-0.9)	<0.0001
Age				
16-19	1.0		ns	ns
20-24	<b>0.9</b> (0.9-1.0)	<0.001		
25-29	<b>0.9</b> (0.8-0.9)	<0.001		
Ethnicity				
Dutch	1.0		1.0	
Surinam/Antillean	<b>1.3</b> (1.2-1.4)	<0.001	<b>1.2</b> (1.1-1.3)	<0.001
Turkish/Moroccan	<b>1.4</b> (1.3-1.5)	<0.001	<b>1.4</b> (1.2-1.5)	<0.001
Sub Sahara African	<b>1.4</b> (1.2-1.5)	<0.001	<b>1.4</b> (1.2-1.5)	<0.001
Western, other	<b>1.2</b> (1.1-1.3)	<0.001	<b>1.1</b> (1.0-1.2)	0.02
Non-Western, other	<b>1.2</b> (1.1-1.2)	<0.001	<b>1.2</b> (1.1-1.3)	<0.001
Region				
Rotterdam	1.0		1.0	
Amsterdam	<b>1.3</b> (1.2-1.3)	<0.001	<b>1.2</b> (1.1-1.2)	<0.001
South-Limburg	<b>1.3</b> (1.1-1.4)	<0.001	1.0 (0.9-1.1)	0.61
Number of sexual partners < 6 months				
No partner(s)	1.0		ns	ns
1 steady partner	<b>1.8</b> (1.4-2.3)	<0.001		
1 casual partner	<b>2.2</b> (1.7-2.8)	<0.001		
≥ 2 partners (steady partner included)	<b>2.0</b> (1.6-2.6)	<0.001		
Duration steady partnership				
< 1 year	1.0		1.0	
1-2 years	1.0 (1.0-1.1)	0.27	1.1 (1.0-1.2)	0.05
3-5 years	1.0 (0.9-1.1)	0.87	<b>1.3</b> (1.1-1.4)	<0.001
≥ 6 years	<b>1.2</b> (1.1-1.3)	0.009	<b>1.3</b> (1.2-1.5)	<0.001
No steady partnership	1.0 (0.9-1.1)	0.92	<b>1.2</b> (1.1-1.3)	0.001
Condom use last contact CP				
Yes	1.0		1.0	
No	<b>0.9</b> (0.8-1.0)	0.004	<b>0.9</b> (0.8-1.0)	0.004
Sexual preference				
Heterosexual men	1.0		ns	ns
MSM	<b>0.8</b> (0.6-0.9)	0.003		
Test result first screening round				
Ct-neg	NA	NA	1.0	
Ct-pos, no rescreening			<b>1.9</b> (1.2-3.1)	0.01
Ct-pos, rescreened Ct-neg			1.1 (0.9-1.4)	0.19
Ct-pos, rescreened Ct-pos			0.6 (0.3-1.5)	0.30

OR, odds ratio; CI, confidence interval; NA, not applicable ( $p \geq 0.2$  in univariate analysis); ns, not significant ( $p > 0.05$  in multivariate analysis); MSM, men having sex with men, STI, sexually transmitted infection(s); SP, steady partner; CP, casual partner. 'Western other' included Oceania, North America, Canada, Europe (excluding the Netherlands and Turkey); 'Non Western other' included Central and South America, Middle East, South and South-East Asia (excluding Surinam, Antilles, Aruba, Morocco and North Africa). Variables that were non significant in the multivariate models in both screening rounds were not shown: SES-score, educational level, living situation, ethnicity SP, age at first sex contact, concurrent partners, condom use with SP, variables on STI history. Non significant variables in second round only: gender, age, number of sexual partners <6 months, sexual preference.

### **Participation rates after email- and SMS reminders**

Of all package requesters, 79% (41.700/52.600) in R1 and 82% (34.200/41.700) in R2 returned their sample to the laboratory. Two weeks after package delivery, reminder emails were sent to half of the requesters (R1: 49% and R2: 48%), because they did not return their sample. After another week a second reminder was sent to 41% (R1) and 35% (R2) of the requesters.

Sample return increased after the reminder email(s) and SMS (Figure 3). Of all samples returned, 65% and 64% was returned before any reminder; an additional 26% and 27% after  $\geq 1$  reminders (Figure 3, day 15-30). After  $\geq 31$  days, another 9% returned their sample. On day 28 a questionnaire was sent to package requesters that did not return their sample to ask for their reasons. In total, participation rates (proportion of initial invitees returning a sample) increased from 10% to 14% after the email/SMS reminders in round 1 and in round 2 from 7% to 10%. Similar patterns were seen in sample return in both screening rounds (round 2 not shown).



**Figure 3. Time (days) to return test sample after package reception in first screening round**

### ***Determinants of sample return after email- and SMS reminders***

Significant socio-demographic determinants of sample return after email/SMS reminders included male gender and the age group 25-29 yrs. No significant associations were found with sexual behavioural factors; effects were either small or not present in both screening rounds (not shown).

### ***Chlamydia-positivity***

Van den Broek et al. reported positivity rates of 4.2% and 4.1% in the first two CSI screening rounds.<sup>4</sup> Of all *Ct*-positives detected in CSI, 67% returned their sample without receiving any reminder and 23% after an email/SMS reminder. Positivity rates detected before a reminder were 4.5% (R1) and 4.1% (R2) and after having received email/SMS reminders 3.6% (in both rounds). Another 4.3% and 4.6% were detected  $\geq 31$  days after package delivery. In absolute numbers, 562 and 474 positives would have been missed if no email/SMS reminders were sent for sample return.

## Discussion

Effects of automated respondent reminders on response- and participation rates were evaluated in two screening rounds of the Chlamydia Screening Implementation (CSI) in the Netherlands. Respondents' willingness to provide an email address or cell phone number for communication during the screening procedure was high. Furthermore, automated letter-, email- and SMS reminders contributed substantially to response- and participation rates.

The reminder letter not only resulted in reaching more invitees requesting a test package (in round 1 from 12% to 20%), but also resulted in reaching more people at higher risk of *Chlamydia*.<sup>2,6</sup> Package request rates after the reminder letter were higher in non-Dutch than in Dutch invitees. Various underlying reasons may have played a role, though we cannot exclude the possibility that non-Dutch invitees needed more time to respond due to a linguistic barrier. Response rates after the reminder letter were also higher in people with a casual partner or  $\geq 2$  sex partners. Fear for the test result may have played a role in being reluctant to request a package; the reminder letter could have raised awareness on their sexual risk. In contrast, people with a long-term steady relationship also reacted more often after the reminder letter. Possibly, this group decided not to participate at first, due to a perceived lower risk. However, a reminder letter addressing the relevance of screening, may have made them decide differently.

Compared to first round *Ct*-negatives and re-screening participants, *Ct*-positives who did not participate in the re-screening needed more stimuli to respond again in the second screening round. Prosperously, this high risk group was ultimately persuaded to request a package. Compared to heterosexual men, men having sex with men (MSM) more often applied for a test package directly after the invitation, which can be related to a certain familiarity with other Internet-based interventions targeted to MSM in the Netherlands.<sup>13</sup>

Participation rates increased after email/SMS reminders from 10% to 14% and 7% to 10% in the two screening rounds. Still, every 1 in 5 packages requested was unreturned, even after any reminder. Reasons for non participation (no sample return after package request) were described elsewhere.<sup>2,14</sup> Briefly, most important reasons were lack of time, loss of package, forgetfulness and being *Ct*-tested and -treated elsewhere.

The email/SMS reminders resulted in more men and 25-29 year olds returning a sample. In contrast to package request, sample return after reminders was not related to (sexual) risk factors of *Ct*-positivity. However, 23% of all *Ct*-positives identified in CSI, returned their sample after receiving a reminder. This illustrates the usefulness of sending reminders to encourage sample return and, subsequently, getting more people treated for their infection. Although these findings are encouraging, a direct effect of the email/SMS reminders remains uncertain due to not knowing what proportions of people would have returned their sample, without receiving any reminder.

In CSI, men were more likely to react after reminders than women. Although the differences were small, this can be explained by the fact that participation in population-based *Ct*-screening programs, in general, is higher in women than in men.<sup>7,8,11,15,16</sup> In contrast, in France, women's reaction to reminders (phone call and letters) was little higher than men's, but also in this screening program women participated more often than men.<sup>11</sup> Additionally, in the UK, young women (16-24 yrs) with the highest *Ct*-prevalence participated only after repeated reminders (by postcard, letter or phone call). In this study, again, more women participated than men.<sup>7,17</sup> Concluding, reaching men with reminders is encouraging, because they are less likely to engage in *Ct*-screenings.

Nearly all respondents were reachable by modern communication media (99% by email; 72% by cell phone). Although associations were not very strong (ORs between 0.7–1.7), most determinants of providing a cell phone number were the same as for *Ct*-positivity.<sup>2,6</sup> Menon-Johansson et al. reported similar socio-demographic characteristics of people being both at higher risk of STI, and more often making use of mobile phones (young aged, migrants, poorer socio-economic background).<sup>18</sup> These findings illustrate the value of using cell phones and text messaging (SMS) for communication to high risk groups.

To our knowledge, CSI is the first among both systematic, and population-based *Ct*-screening programs, using respondent reminders aimed to both optimise response- and participation rates. Generally, the only systematic<sup>7</sup> and seven other opportunistic population-based *Ct*-screenings implemented reminders for similar, but also other purposes than in CSI. Reminders were used to confirm package receipt,<sup>7,11,17</sup> encourage sample return,<sup>7,10,11,16,17</sup> checking test results<sup>8,9</sup> or reminding going for treatment.<sup>8</sup> Although reminders were reported in those *Ct*-screenings, comparison was impeded due to differences in program design and reminder implementation. Moreover, effects of reminders were not thoroughly reported and determinants of reaction after reminders were not evaluated in detail. Few screening programs reported using modern technologies like email and SMS for their reminders. Emails were used to remind to result checking and going for treatment.<sup>8,9</sup> SMS reminding was reported only once, in a small research group.<sup>16</sup> More frequently, SMS was used for partner- and result notification, but not in systematic screening settings.<sup>15,16,18,19</sup>

A great advantage of this research was the availability of socio-demographic data for all invitees from population registers. Further, all data on package request, sample return and reminders were automatically monitored and administrated, which enabled thorough process evaluations. A limitation of this study was that it remained unclear to what degree response and participation patterns were influenced by reminders or by natural processes. Due to the program design (implementation), no control group was embedded of persons who did not receive any reminder. Though cut off points of 'no reminder needed' and 'after reminder' were defined differently for the reminder letter and email/SMS, choices will be plausible since emails and SMSs are, unlike letters, read shortly after receipt.<sup>20</sup> This could have shortened reaction time to reminders. Analyses were corrected for availability of email addresses and cell phone numbers,

but people could have missed reminder messages due to changes in email addresses and/or phone numbers. However, precautions were taken by program designers to avoid marking emails as spam.

In conclusion, the results of this process evaluation illustrated that implementation of respondent reminders is effective in increasing response- and participation rates in (systematic) population-based *Chlamydia* screening programs. In particular, reminder letters are effective devices to stimulate package request with eligible, initially not involved, target groups. In CSI, the reminder letter nearly doubled response (package requests) and resulted in reaching more people at higher risk. Additionally, using email- and SMS reminders in *Ct*-screenings is recommended to encourage participation, and easily reach young, high risk, target populations. This research demonstrated that after email/SMS reminders participation rates (sample returns) raised and additional *Ct*-positives were detected. Moreover, nearly all respondents were reachable by email and cell phone. Those providing a cell phone number, were also of higher *Ct*-risk, which suggests the tailored usability of cell phones – for instance by SMS – for screening communication to high risk groups. In CSI, continuation of using respondent reminders is recommended and implementation of a third reminder for sample return should be considered, since sample return raised and extra *Ct*-positives were found after receiving a questionnaire. Further exploration is suggested on the effect of repeated invitation and participation in subsequent screening rounds.

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