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## **How to encourage smokers to participate in web-based computer-tailored smoking cessation programs: a comparison of different recruitment strategies**

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## **Abstract**

**Objective:** The reach, retention, and costs of four strategies aimed to recruit smokers for participation in a computer-tailored smoking cessation intervention was explored.

**Methods:** The study was part of a randomized controlled trial whereby 832 respondents were randomised to 3 conditions. Smokers were invited by general practitioners (GP), newspapers, Internet and other strategies (i.e, mailing organizations) to take part. ANOVA's /Chi-square tests explored sample differences. Logistic regression analyses investigated differences between the samples regarding retention and smoking behaviour.

**Results:** Smokers recruited via GPs (N=144) had a lower educational level and suffered more from chronic obstructive pulmonary disease compared to respondents recruited via Internet (N=307) ( $\chi^2=11.554$ ,  $df=3$ ,  $p=.009$ ). Less motivated respondents, recruited by GPs were more likely to return to study compared to the less motivated respondents recruited by 'other recruitment' strategies ( $\chi^2=6.416$ ,  $df=3$ ,  $p=.093$ ). Highly addicted respondents recruited from newspapers (N=213) were less likely to make a quit attempt compared to highly addicted respondents recruited by GPs (OR=.334,  $p=.035$ ). Females from newspapers were less likely to remain abstinent compared to the GP sample (OR=.337,  $p=.005$ ). Recruitment via GPs showed highest costs.

**Conclusion:** Recruitment strategy influenced the type of smokers. Group differences were associated with different patterns of quitting.

**Word count:** 198

## **Introduction**

Although web-based computer-tailored (CT) interventions have been developed to aid smokers in quitting [1-5], reaching and recruiting smokers to participate and adhere to these interventions is a challenge [6]. It might become especially challenging to reach the remaining segment of the smoking population, namely those who are least ready to quit [7-9]. Although past research indicates that web-based smoking cessation interventions are potentially effective [10-14], less is known about strategies to encourage smokers to enrol in these programs and about their adherence to these programs [15].

Even though web-based interventions are believed to be able to reach a large number of people [16, 17], research has shown that only a small part of the smoking population is actually reached by these interventions [18]. Mostly higher educated respondents with a healthy lifestyle pattern make use of web-based lifestyle interventions [19-21]. Moreover, people with a lower education level may be less likely to be reached by online interventions [22, 23]. As lower educated smokers show high addiction levels and experience the most problems in quitting [24-27], it is important to obtain more insight in how different educational groups and especially lower educated smokers can be best recruited to participate in these interventions. Past research has already indicated that CT smoking cessation interventions have the potential to positively influence lower educated groups [28]. Investigating user's characteristics and their reach for participation in smoking cessation interventions can therefore, be helpful in optimizing ways of disseminating smoking cessation interventions among different educational groups.

Strategies to recruit smokers into smoking cessation programs often include face-to-face referral (e.g., by general practitioners (GPs)), media campaigns, Internet campaigns and other methods, like postal or e-mail invitations. Past research has already distinguished between those seeking information regarding quitting, who are often highly motivated to quit versus a cold-contacted group, recruited via an unsolicited form, who are on average often less motivated to quit [29]. A recent study has already indicated that large media

campaigns were an effective recruitment tool, but are associated with high costs [30]. Internet campaigns, in contrast, have the potential to reach a large audience against low costs, but its actual reach among different educational groups is not yet clear [31]. In contrast, recruitment via mass media channels has shown to be effective in recruiting numerous smokers from different educational levels [32], and is also associated with lower retention and success rates compared to recruitment via GPs [33]. Recruitment via GPs, on the other hand, was assumed to be successful in reaching lower educated smokers in particular, although the net effect in quitters was still in favour of the mass media approach [33, 34]. To optimize the public health impact of smoking cessation interventions, it is therefore, important to examine which recruitment strategy is most effective, and to further explore effects of additional strategies and whether or not these effects differ depending on the educational level of respondents.

The present study explored the reach, retention and costs of four different strategies aimed to recruit smokers for participation in a web-based CT smoking cessation intervention. Firstly, we examined how many smokers were reached with each strategy and whether the recruitment strategies (recruitment via GPs, newspapers, Internet and other strategies (e.g. e-mailing to companies, referrals) resulted in samples consisting of different types of smokers. Secondly, we investigated whether possible differences existed between the recruited samples regarding retention, quit attempts and smoking abstinence, measured 6 months after baseline. With respect to the first two goals, we were especially interested in smokers with lower educations since they are most 'in need' and hard to reach [24, 25]. Lastly, different costs of the recruitment strategies were examined in relation to recruitment success to determine the costs per recruited respondent, per respondent who made a quit attempt and per abstinent respondent.

## **Methods**

### **Study design**

The study was part of a randomized controlled trial (Dutch Trial Register (NTR3102)) [35] in which three conditions were compared. Respondents were randomized to one of the two experimental conditions (video or text-based CT intervention) or the control condition (respondents received a short general text advice after baseline on smoking cessation). Respondents were not informed which group they had been allocated and had no information about the content of the other experimental conditions. In the text condition, participants were presented multiple text-based CT messages on smoking cessation. In the video condition, the same tailored messages were used but were translated into video-driven messages (without graphics/ animations). The current study was submitted for approval to the Medical Research Ethics Committee (MREC) of Atrium Medical Centre Heerlen. The MREC decided that no MREC approval was necessary because respondents were not obliged to engage in medical acts. The study was conducted according to the APA principles [36].

### **Target population and inclusion criteria**

Respondents were recruited in the Netherlands from December 2010 until November 2011. Daily smokers of 18 years and older, who were motivated to quit within the following six months and had access to the Internet were eligible for study participation.

### **Recruitment methods and related costs**

Respondents were recruited by several strategies. The goal of the recruitment was to encourage smokers to visit the Dutch Intervention website:

[www.steunbijstoppen.nl](http://www.steunbijstoppen.nl) [37] and to register for participation.

*GP practice:* Respondents were recruited through GPs. About 2,000 GPs in the Netherlands were invited by mail, whereof about 150 GP practices agreed to refer a minimum of 20 smoking patients, who met the inclusion criteria, to the

intervention website. In the Netherlands, smoking cessation treatment recommendations for GPs are to ask patients with smoking related illnesses about their smoking behaviour, to give stop smoking advice and to refer the patient to stop smoking treatment programs [38]. During our study, GP practices received recruitment materials, including a description of the project, business cards and flyers that they could give to eligible patients visiting their practice (instead of referring them to the usual channels). Their only task was to refer patients to the intervention website. GPs were not compensated for their time spent on recruiting smokers for our study. Since the GP practices often have a limited amount of time to ask patients about their smoking and do not reach all potential smokers, a mix of recruitment strategies was used. In this way, we assumed to reach a broader group of potential quitters and we were able to investigate whether different strategies attract similar or different samples of smokers.

*Newspaper advertisement:* Respondents were therefore also recruited by several paid advertising campaigns in national newspapers and different free insertions in local newspapers. Advertisings directly referred smokers to the intervention website, where they could receive information about the intervention and participation in the study.

*Internet advertisement:* Recruitment via the Internet consisted of paid advertisings on newspaper websites and free insertions on websites of national health funds (e.g., the Dutch Diabetes foundation). These insertions were directly linked with the intervention website. This procedure enabled people to visit our intervention website for further information.

*Companies:* Several companies recruited respondents. Targeted mailings were sent to approximately 33 different companies; companies were asked to bring the intervention to the attention of their employees by means of advertisements or announcements. The same as with the other recruitment strategies, advertisings referred employees to the intervention website.

*Local free media:* Respondents were also recruited through local free media (e.g., TV- interviews and information on teletext).



*Referral:* It was also registered whether respondents received a referral of a friend or family member to visit the intervention website.

### **Procedure**

Respondents were randomized into one of the three groups regardless of method of recruitment. After giving online informed consent to participate, respondents were invited to fill out the baseline questionnaire, assessing their' demographics, smoking behaviour, beliefs about quitting, occurrence of different diseases and mode of recruitment. Depending on their readiness to quit, participants in the two experimental conditions received tailored feedback over a period of one to three months whereas respondents in the control condition received general text advice about smoking cessation after baseline. Six months after baseline, all respondents were asked to complete the follow-up measurement. Several strategies were also applied to prevent attrition at follow-up (see Figure 1).

### **Figure 1**

### **Intervention**

The web-based multiple CT smoking cessation intervention was based on the I-Change model (ICM), a model integrating various social cognition models to explain and change health behaviours [39]. The model recognizes three phases for behavioural change: awareness, motivation and action. This implies that in order to motivate people to develop intentions to quit smoking, they need to become convinced of the pros and cons of the health behaviour (i.e. smoking cessation), need to perceive social support, and feel self-efficacious. In order to facilitate the translation of intentions into action, an individual is encouraged to make a specific action plan to prepare the new behavior, to cope with challenges to prevent relapse, and to act on these plans [40]. The content of our intervention was partly based on earlier effective CT smoking cessation interventions [1, 3, 41]. Depending on smokers' readiness to quit smoking within one month or not, respondents in the two experimental conditions (video vs. text CT) received

personalized feedback during multiple CT sessions, using two separate routings. In routing 1, respondents motivated to quit within one month were asked to set a quit date and received support in preparing quitting and staying abstinent during the following 3 months. In routing 2, respondents who were not motivated to quit within one month were invited to follow the next session one month after baseline. They then received feedback on advantages and disadvantages of smoking and quitting smoking, and were encouraged to set a quit date. Smokers who were motivated to quit were directed to routing 1, if not, smokers were invited to the next session (one month later) to again reassess their smoking behavior (see Figure 2). The feedback sessions each took about 20-30 minutes. A detailed description of the intervention and its components is reported elsewhere [35].

## **Figure 2**

### **Questionnaire**

#### *Baseline measures*

The following demographic variables were measured at baseline: gender (0=male; 1= female), educational level (3= high (higher vocational school or university level); 2= intermediate (higher general secondary education, preparatory academic education, medium vocational school; 1=low (primary, basic vocational, lower general school)) [42], nationality (0= other nationality; 1= Dutch nationality) and age.

*Addiction level* was assessed by six items using the Fagerström Test for Nicotine Dependence (FTND), asking respondents how many cigarettes they smoked per day, at which time points and whether they had difficulties not to smoke in smoke-free places. The answers were converted into an overall sum score (0=not addicted; 10= highly addicted) [43].

*Readiness to quit smoking* was measured by one item asking respondents when they intended to quit smoking, resulting in 5 categories (5=yes, within the following month; 4= yes, within 1 to 3 months, 3= yes, within four to six months;

2= yes, within one year; 1= yes, though not within a year, but within one and five years or later) [44].

*The occurrence of chronic obstructive pulmonary disease (COPD), cardiovascular disease, cancer, diabetes and asthma* were assessed by four questions, asking respondents whether they suffered from these diseases (0= no; 1=yes).

*Mode of recruitment* was measured by one item asking respondents how they learned about the intervention website, resulting in several categories; 1= via GP, 2= via newspaper; 3= via Internet; 4= via companies; 5= local free media and 6= via a referral of a family member or friend. Recruitment categories 4 (N=81), 5 (N=14) and 6 (N=73) were combined into one single category mentioned in the following part as 'other' strategies due to the fact that there were insufficient cases to analyze them separately.

*Retention* was defined as still being in the study after 6 months, measured by whether or not the respondent returned to fill out the 6 month follow-up measurement (0= not filled out; 1=filled out).

#### *Outcome measures at six-month follow-up*

At the 6 month follow-up questionnaire, 7-day point prevalence abstinence (PPA) was assessed by asking respondents whether they had smoked one or more cigarettes during the last 7 days (0=yes; 1=no) [45]. Respondents were also asked whether they had undertaken a serious quit attempt (defined as having refrained from smoking more than 24hours) since baseline (1=yes; 0=no).

#### **Analyses**

First, descriptive analyses were used to investigate baseline differences of the four samples. Analyses of variance were used to assess differences in continuous baseline variables. If the F-test showed a  $p < .05$ , the Tukey-HSD method was used for post-hoc pairwise comparisons. Chi-square tests were used to assess differences in categorical baseline variables. If the Chi-square test showed a  $p < .05$ , post-hoc pairwise comparisons with Bonferroni correction

$\alpha = .05/3 = .017$  were used. Baseline differences were included as potential covariates in all analyses.

Next, logistic regression analyses using complete cases were conducted to assess whether the recruitment samples differed with regard to retention. Lastly, logistic regression analyses were conducted to investigate whether mode of recruitment had an effect on the outcome measures. A top down procedure was used, beginning with the most extensive regression model, including recruitment mode, covariates (gender, education, level of addiction, age, occurrence of diseases, experimental condition, and motivation to quit) and possible interactions between mode of recruitment and covariates. We first used the GP sample as the reference group and afterwards reran the same analyses, this time with the other three strategies, respectively, as the reference group to investigate possible differences between the other three strategies. Non-significant interaction effects were removed from the regression model. Interaction effects were regarded to be significant when  $p < .10$ ; this was done in an effort to lower the risk of mistakenly overlooking a 'true' interaction effect [46]. In the case of a significant interaction effect, subgroup analyses were done. Main effects were considered to be significant when  $p < .05$ . To test the robustness of the results, a sensitivity analysis was conducted regarding all drop-outs as smokers.

All analyses were conducted with SPSS 19.0 (SPSS, Inc., Chicago, IL, USA).

## **Results**

### **Sample characteristics related to recruitment strategy**

Figure 3 displays the flow of respondents. From the 1,016 potential respondents, 20 did not meet the inclusion criteria, 31 declined participation and 133 did not finish the baseline questionnaire and were therefore excluded from all further analysis. Thus, 832 respondents were randomized into the video condition (N=270), the text condition (N=290) and the control condition (N=272). The

baseline differences between the recruitment samples are presented in Table I. The four recruitment strategies attracted somewhat different samples of smokers.

### **Figure 3**

### **Table I**

We found differences in educational level ( $\chi^2=24.409$ ,  $df= 6$ ,  $p=.000$ ) between the samples, such that the GP recruitment yielded a larger proportion of lower educated respondents compared with the other three recruitment strategies. Furthermore, differences were found in the samples with regard to gender ( $\chi^2=14.041$ ,  $df=3$ ,  $p=.003$ ). Internet advertisements yielded a larger proportion of female smokers compared with respondents recruited via 'other' strategies. In addition, there were differences in age ( $F(3,828)=8.209$ ,  $p=.000$ ), such that those recruited from newspapers and GPs were older compared to the other two strategies. Differences were also found in the level of addiction ( $F(3,828)=6.476$ ,  $p=.000$ ). Those recruited from newspapers were less nicotine dependent than those recruited by the other three recruitment strategies. Moreover, there were differences in the samples with regard to the occurrence of COPD ( $\chi^2=11.554$ ,  $df=3$ ,  $p=.009$ ). The GP sample consisted of more smokers who indicated to have COPD compared to recruitment via Internet. Finally, we found a significant difference between the samples regarding readiness to quit ( $\chi^2=15.127$ ,  $df=3$ ,  $p=.002$ ). Those recruited via 'other' strategies were less motivated to stop smoking compared to respondents recruited via GPs and the Internet.

### **Retention analysis**

Of the 144 eligible respondents who were recruited via GP practices, 99 (68.8%) returned to the study after 6 months. Of the 213 eligible respondents who were recruited via newspaper advertisements 151 (70.9%) came back to fill out the follow-up. For the sample recruited via Internet advertisements ( $N=307$ ), 200 (65.1%) came back to fill out the follow-up questionnaire, whereas 88 (52.4%) of

the 168 eligible respondents recruited via other recruitment strategies returned to fill out the follow-up questionnaire. Possible predictors of retention for respondents who returned to the follow-up are presented in Table II.

No interaction effect was found between educational level and mode of recruitment regarding retention ( $\chi^2=2.970$ ,  $df=6$ ,  $p=.813$ ). Furthermore, no significant influence on retention was found for any of the three experimental conditions ( $\chi^2=1.859$ ,  $df=6$ ,  $p=.932$ ). However, retention was significantly predicted by older age (OR 1.022;  $p=0.001$ ) and a significant interaction effect was found between mode of recruitment and readiness to quit smoking ( $\chi^2=6.416$ ,  $df=3$ ,  $p=.093$ ). Subsequent subgroup analysis revealed that for respondents who were less motivated to quit, those who were recruited by 'other' strategies were significantly less likely to return to the study compared to respondents recruited by GPs.

To test all possible combinations of each parameter pair, the same subgroup analysis were run again but newspaper, Internet and 'other recruitment' strategies were used as the reference group respectively (not presented in table). We found that respondents, within the group of less motivated respondents (1 month to 5 years), and who were recruited via the Internet were significantly less likely to return to the study compared to respondents recruited via newspapers (OR=.907;  $p=.014$ ). The same was true for 'other' strategies; respondents within the group of less motivated (1 month to 5 years) and recruited from 'other' strategies were less likely to return to the study compared to respondents recruited via newspapers (OR=.337;  $p=.001$ ). Lastly, we found that respondents within the group of highly motivated respondents (those wanting to quit "within the next month") and recruited by 'other' strategies were less likely to return to the study compared to those recruited via the Internet (OR=.526;  $p=.019$ ).

### ***Table II***

#### **Differences in smoking behaviour: Quit attempts and 7-day point prevalence abstinence**

At follow-up, 72 (73.5%) respondents recruited via GP practices indicated having made a serious attempt to quit smoking during the last 6 months, whereas 95 (65.1%) respondents in the newspaper sample, 150 (77.7%) respondents within the Internet advertisement sample and 55 (67.1%) respondents within the 'other' strategies sample reported so. The differences in quit attempts between the recruitment groups were borderline significant ( $\chi^2=7.624$ ,  $df=3$ ,  $p=.054$ ).

Predictors of having made a quit attempt in the previous 6 months are presented in Table III.

### ***Table III***

No interaction effect was found between educational level and mode of recruitment regarding quit attempts ( $\chi^2=3.662$ ,  $df=6$ ,  $p=.722$ ). Again, no differences in quit attempts were found between the three experimental condition ( $\chi^2=1.767$ ,  $df=6$ ,  $p=.940$ ). Though, our analysis showed that a higher motivation to quit at baseline significantly predicted a made quit attempt 6 months after baseline. The analyses also revealed a significant interaction effect between mode of recruitment and addiction level regarding quit attempts ( $\chi^2=6.672$ ,  $df=3$ ,  $p=.083$ ). Subgroup analysis among respondents with lower (FTND score < 5) and higher (FTND score >5) levels of addiction showed that highly addicted respondents, recruited via newspapers, were significantly less likely to have made a quit attempt compared to the GP sample.

To test all possible combinations of each parameter pair, the same subgroup analyses were run again but the newspaper, Internet and 'other' recruitment strategies, respectively, were used as the reference group (not presented in table). In the group of highly addicted smokers, respondents who were recruited via the Internet were more likely to make a quit attempt compared to those recruited via newspapers (OR=.2.856;  $p=.017$ ). In table IV, descriptive data of the differently recruited samples is shown, stratified by level of addiction. The GP sample included especially higher addicted older women. When drop-

outs were regarded as smokers, interaction effects between addiction level and mode of recruitment were no longer detected ( $\chi^2=4.654$  df=3,  $p=.199$ ).

At follow-up, 36 (36.4%) respondents recruited via GP practices reported being abstinent during the last 7 days. For the sample recruited via newspapers, 40 (26.5%) respondents reported 7-day PPA abstinence, 64 (32.0%) respondents recruited via Internet advertisements and 20 (22.7%) respondents recruited via other recruitment strategies reported so. Though abstinence rates did not differ significantly between the different recruitment groups ( $\chi^2=5.402$ , df=3,  $p=.145$ ).

Logistic regression analysis regarding 7-day PPA did not reveal an interaction between educational level and mode of recruitment ( $\chi^2=1.787$ , df=6,  $p=.938$ ) nor an interaction between addiction level and mode of recruitment ( $\chi^2=2.595$  df=3,  $p=.458$ ). Furthermore, no differences were found with regard to 7-day PPA between the three experimental conditions ( $\chi^2=1.889$  df=6,  $p=.930$ ). However, there was a significant interaction effect between mode of recruitment and gender ( $\chi^2=8.078$ , df=3,  $p=.044$ ). Subsequent subgroup analysis among gender revealed that women, recruited via newspapers were significantly less likely to report being abstinent compared to women, recruited via GPs (see Table V). Next, women in the video condition were more likely to report being abstinent compared to women in the control condition.

To test all possible combinations of each parameter pair, the same subgroup analysis were run but newspaper, Internet and 'other' strategies were used respectively as the reference group (not presented in table). It was shown that men recruited via 'other' strategies were less likely to quit compared to men recruited via newspapers (OR=.320;  $p=.025$ ) and compared to men recruited via the Internet (OR=.344;  $p=.035$ ). When drop-outs were regarded as smokers, no significant differences were found between gender ( $\chi^2=5.122$  df=3,  $p=.163$ ).

**Table IV**

**Table V**



### **Costs per smoker reached**

On average, €4,643.81 was spent on the recruitment via GPs for recruitment materials (e.g., addresses of general practitioners and flyers). Time, that the research team as well as the general practitioners spent on the inclusion and preparation (e.g., GPs had to get informed about the intervention) were not included in the calculation. Furthermore, €1,792.42 was spent on the advertisements in the newspapers, €750.00 was spent on the recruitment via Internet advertisements and €378.03 was spent on the recruitment via companies. Investments in terms of the research team were again not taken into account. One hundred and forty-four eligible smokers were recruited through GPs. The costs per eligible respondent to initiate the intervention were thus €32.24 (€4,642.81/144). Two hundred and thirteen eligible smokers were recruited via newspaper advertisements, resulting in €8.42 (€1792.42/213) spent per recruited smoker. Three hundred and seven smokers were recruited via the Internet, resulting in €2.44 (€750.00/307) spent per recruited smoker whereas 168 eligible smokers were recruited by 'other' strategies, resulting in €2.25 (€378.03/168) spent per recruited smoker.

For every respondent having made a serious quit attempt approximately, €64.48 (GPs), €18.87 (newspaper), €5 (Internet) and €6.87 ('other' strategies) were spent. For every respondent who reported being abstinent during the 7-day PPA prior to the measurement, €128.96 (GPs), €44.81 (newspaper), € 11.72 (Internet) and €18.90 ('other' strategies) were spent on recruitment.

### **Discussion**

#### *Main findings*

The aim of this study was to investigate whether different recruitment strategies resulted in different samples of smokers participating in the CT smoking cessation intervention with emphasis on differences between lower and higher educated smokers.

First, our results revealed that the GP recruitment attracted a larger proportion of lower educated smokers and more smokers suffering from COPD compared to the other recruitment strategies. Second, smokers recruited via newspapers were shown to be less nicotine dependent compared to smokers recruited via other methods. Additionally, the results showed that older respondents were more likely to return to the study at follow-up. The effect of recruitment strategy also depended on the readiness of the respondent to quit smoking. Retention rates among people with a lower readiness to quit were higher among those recruited by GPs compared to those recruited via 'other strategies'. Third, our results furthermore suggested that highly addicted respondents recruited via newspapers were less likely to make a quit attempt compared to highly addicted respondents recruited via GPs or the Internet. With regard to 7-day PPA, women recruited via newspapers were less likely to be abstinent compared to women recruited via GPs. None of the variables were predictive for men. No significant differences were found between the three conditions regarding retention, quit attempts and 7-day PPA. Fourth, our study findings clearly demonstrate that costs when using GPs, recruitment and quitting behaviours were much higher than for any other modality. No significant differences were found between lower and higher educated smokers regarding retention and smoking behaviour.

Supporting findings of previous national and international studies, the recruitment via GPs resulted in a relatively larger population of lower educated smokers and smokers with smoking related diseases that participated and made more quit attempts compared to recruitment via other strategies [33, 34, 47]. It is conceivable that lower educated smokers with smoking related diseases visit a GP more often than other educational groups, thus resulting in the fact that recruitment via GPs reaches relatively more lower educated smokers. However, when absolute numbers are used, the results show that recruitment via the other three strategies was more successful in reaching more smokers of a lower educated level. Hence, from a public health impact point of view [32], this would favour approaches other than recruitment via GPs. If the target group of smokers

is not limited to lower educated smokers, recruitment via the Internet and newspaper advertisements may possibly be a better and cheaper strategy to recruit a high number of smokers, something also found in previous research [33]. Furthermore, our results showed that the more traditional recruitment approaches (e.g., the recruitment via newspapers) seemed to attract a lower percentage of nicotine dependent smokers compared to recruitment via the Internet [32]. A possible explanation could be that the less addicted smokers, which could be also categorized into the cold-contacted group [29], might have become by chance attentive of the newspaper advertisement compared to higher addicted respondents who might be more proactive in seeking cessation guidance (e.g., asking GPs for advice or searching on the Internet).

In line with previous research [33], we furthermore found that retention rates among people with a lower readiness to quit were higher among those recruited by GPs compared to recruitment via 'other strategies'. Next, our results revealed that highly addicted smokers recruited by the GPs and the Internet, were more likely to make a quit attempt compared to highly addicted people recruited by newspapers. A possible reason could be that respondents recruited via the GPs received more smoking cessation support, were more motivated to quit and more interested in quitting compared to the sample recruited via newspapers [48]. Again perhaps, respondents recruited via the Internet or GPs might have actively searched for quit programs and were more involved in quitting compared to the more 'cold-contacted' groups, such as the newspaper sample [29]. Furthermore, the three conditions to which respondents were assigned showed no impact on retention and smoking related outcomes. Although this was not our main research question in the current study, we would have expected respondents in the experimental conditions to be more likely to return to the study and quit smoking compared to respondents in the control condition. In line with past research, the costs per recruited smokers, per quit attempt made and per abstinent respondent were the highest among the GP sample compared to the other strategies [33]. We were not able to replicate our findings when drop-outs were regarded as smokers. However, since we had no

information about why respondents did not return to the follow-up measurements, treating all missing cases as treatment failures may be too conservative.

In sum, the recruitment via GPs might be an effective, but also expensive, way of recruiting lower educated smokers and respondents with more smoking related diseases, whereas recruitment via mass media channels resulted in a larger absolute number of smokers, and also lower educated smokers. The present study therefore suggests that future trials might use the support of mass media channels in order to recruit respondents since many more smokers were recruited with this strategy.

### *Limitations*

Several limitations should be noted. First, it was only known how many smokers enrolled in the intervention but not known how many smokers were actually invited per strategy (e.g. by GPs) and how many respondents visited the website. Therefore, it was not possible to calculate the intervention's public health impact [49], which might be valuable to include in future studies. Second, GP recruitment resulted in relatively few smokers. Since the procedure might have been unclear to them, future research should include face-to-face meetings, in order to avoid indistinctness. In addition, the changes in financial compensation for smoking cessation pharmacotherapy in the Netherlands (2011) might have also influenced the enrolment of smokers. Third, the evaluation of the recruitment strategy mainly relied on one question, asking respondents how they learned about the intervention. Because several recruitment strategies were used simultaneously, and respondents may have become aware of the intervention via different channels, this could have caused errors in recall. Fourth, given the fact that socioeconomic status (SES) is a multidimensional construct, it might be that educational level alone was not sufficient to accurately assess SES and therefore limited our results. However, past research has already indicated educational level to be a good indicator of SES [50, 51]. Fifth, due to financial reasons, we were not able to conduct biochemical validation to confirm self-reported smoking status. Quit rates may therefore have been overestimated. It is however unlikely

that misreports of smoking status varied between the recruitment channels and is therefore not expected to bias the results on our main research questions [52]. Sixth, referring respondents to a web-based Internet intervention might have influenced the sample being studied. However, since the Internet in the Netherlands is highly accessible to smokers with different educational levels, we do not think this could have biased our results. Additionally, we measured retention after 6 months, however it might be also valuable to investigate how respondents adhere to the CT program during the intervention period itself (e.g., which sessions they followed, whether there are differences in adherence between routing 1 and 2) and to assess long-term effects. Finally, smokers were recruited to participate for a smoking cessation trial, however the results might be different when recruiting smokers for interventions.

## **Conclusion**

The purpose of this study was to obtain a better understanding of which recruitment strategies are most effective when inviting smokers for a smoking cessation intervention. We can conclude that mode of recruitment influenced the type of smokers, participating in the CT smoking cessation intervention. The results of our study showed that GPs recruited a higher percentage of lower educated smokers that participated and made a quit attempt, compared to the other strategies. However, when using absolute numbers, our results showed that recruitment via other strategies resulted in a larger absolute number of (lower educated) smokers who participated and made a quit attempt. Lastly, our findings clearly show that the costs when using GPs recruitment were much higher than for any other recruitment strategy.

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**Conflict of interest statement**

Hein de Vries is scientific director of Vision2-Health, a company that licenses evidence-based computer-tailored health communication tools.

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## Tables

Table 1: Baseline sample characteristics for the four differently recruited (recruited from December 2010 to October 2011) samples participating in a Dutch web-based multiple CT intervention

	GP(G) (N=144)	Newspaper(N) (N=213)	Internet (I) (N=307)	Other strategies(O) (N=168)	F	X <sup>2</sup>	Df	p-value	Turkey HSD/ Bonferroni
<b>Gender</b>									
[% female (N)]	60.4(87)	60.1(128)	69.7(214)	53.0(89)		14.041	3	.003**	I>O
<b>Educational level</b>									
Low	54.2(78)	35.2(75)	31.3(96)	37.5(63)		24.409	6	.000**	G<N, I, O
Medium	27.1(39)	35.7(76)	38.8(119)	31.0(52)					
High	18.8(27)	29.1(62)	30.0(92)	31.5(53)					
<b>Delivery strategy</b>									
[% (N)]						1.403	6	.966	
Video	32.6(47)	31.5(67)	32.2(99)	33.9(57)					
Text	34.7(50)	33.8(72)	34.5(106)	36.9(62)					
Control	32.6(47)	34.7(74)	33.2(102)	29.2(49)					
<b>Age [M (SD)]</b>	48.35(11.90)	49.02(13.42)	44.36(12.07)	44.73(11.78)	8.209		3/829	.000**	N, G>I, O
<b>FTND score (1-10)</b>	5.12(1.84)	4.38(2.02)	5.08(1.88)	5.02(2.18)	6.476		3/829	.000**	G>N
<b>Readiness to quit</b>						15.127	3	.002**	O<G, I
[% (N)]									
Within 1 month	65.7(94)	55.4(118)	65.8(202)	50.0(84)					
Between 1 month -5 years or later	34.3(49)	44.6(95)	34.2(105)	50.0(84)					
<b>With COPD</b>	25.0(36)	16.0(34)	12.4(38)	17.9(30)					
[% (N)]						11.554	3	.009**	GP>I
<b>With cancer or diabetes</b>	11.1(16)	6.6(14)	7.5(23)	10(6.0)					
[% (N)]						3.513	3	.319	
<b>With cardiovascular diseases</b>	16.0(23)	11.7(25)	9.8(30)	11.3(19)					
[% (N)]						3.684	3	.298	
<b>With asthma</b>	9.0(13)	4.2(9)	5.5(17)	4.8(8)					
[% (N)]						4.150	3	.246	

**[% (N)]**

FTND, Fagerström Test for Nicotine Dependence; Occurrence of diseases, cancer and diabetes were merged into one category due to insufficient cases  
Readiness to quit, category 4,3,2 & 1 were merged into one category due to insufficient cases; \* Chi-square of F significant at  $p < .05$  level;  
\*\* Chi-square of F significant at  $p < .01$  level.

Table II: Predictors of retention in Dutch adults recruited from December 2010 to October 2011 - final regression model and subgroup analysis based on readiness to quit smoking

After 6 months follow up					
Final regression model	X <sup>2</sup>	df	OR	95%CI	P
Newspaper recruitment <sup>a</sup>			1.126	.511-2.482	.769
Internet recruitment <sup>a</sup>			.539	.256-1.138	.105
Other recruitment <sup>a</sup>			.380	.176-.817	<b>.013</b>
Gender <sup>b</sup>			1.211	.888-1.652	.227
Low educational level <sup>c</sup>			.859	.587-1.258	.435
Medium educational level <sup>c</sup>			.957	.657-1.394	.820
Age			1.022	1.009-1.035	<b>.001</b>
FTND score (addiction level)			1.030	.954-1.111	.451
Experimental group (text) <sup>d</sup>			.883	.618-1.263	.496
Experimental group (video) <sup>d</sup>			.956	.664-1.377	.810
COPD <sup>e</sup>			1.039	.687-1.572	.856
Readiness to quit (within next month) <sup>f</sup>			.780	.363-1.677	.524
Readiness to quit <sup>a</sup> recruitment	6.416	3			<b>.093</b>
<b>Subgroup analyses</b>					
<b>Readiness to quit (within next month) (N=498)</b>					
			<b>OR</b>	<b>95%CI</b>	<b>P</b>
Newspaper recruitment <sup>a</sup>			1.033	.570-1.870	.915
Internet recruitment <sup>a</sup>			1.272	.739-2.189	.385
Other recruitment <sup>a</sup>			.668	.358-1.280	.207
Gender <sup>b</sup>			1.447	.957-2.189	.080
Low educational level <sup>c</sup>			.956	.586-1.559	.855
Medium educational level <sup>c</sup>			1.059	.655-1.714	.815
Age			1.021	1.003-1.039	<b>.019</b>
FTND score (addiction level)			1.008	.910-1.116	.882
Experimental group (text) <sup>d</sup>			.685	.427-1.098	1.16
Experimental group (video) <sup>d</sup>			.804	.493-1.312	.383
COPD <sup>e</sup>			.862	.490-1.515	.605
<b>Readiness to quit (1 month to 5 years) (N=333)</b>					
			<b>OR</b>	<b>95%CI</b>	<b>P</b>
Newspaper recruitment <sup>a</sup>			1.103	.494-2.459	.811
Internet recruitment <sup>a</sup>			.507	.237-1.084	.080
Other recruitment <sup>a</sup>			.372	.171-.807	<b>.012</b>
Gender <sup>b</sup>			.975	.603-1.577	.919
Low educational level <sup>c</sup>			.744	.397-1.394	.356
Medium educational level <sup>c</sup>			.806	.434-1.498	.495
Age			1.021	1.002-1.041	<b>.028</b>
FTND score (addiction level)			1.058	.941-1.189	.345
Experimental group (text) <sup>d</sup>			1.259	.716-2.212	.424
Experimental group (video) <sup>d</sup>			1.159	.661-2.033	.606

COPD<sup>a</sup> 1.296 695-2.415 .414

<sup>a</sup> General practitioner is the reference group (score=0); <sup>b</sup> Female is the reference group (score=0); <sup>c</sup> High educational level is the reference group (score=0); <sup>d</sup> Control group is the reference group (score=0); <sup>e</sup> Suffering from the disease is the reference group (score=0); <sup>f</sup> Readiness to quit after 1 month to 5 years of later is the reference group (score=0).



Table III: Predictors of quit attempts in Dutch adults recruited from December 2010 to October 2011 - final regression model and subgroup analysis based on addiction level

After 6 months follow up					
Final regression model					
	$\chi^2$	df	OR	95%CI	P
Newspaper recruitment <sup>a</sup>			2.009	.375-10.763	.415
Internet recruitment <sup>a</sup>			.671	.121-3.727	.649
Other recruitment <sup>a</sup>			.596	.092-3.862	.588
Gender <sup>b</sup>			.775	.508-1.181	.235
Low educational level <sup>c</sup>			.665	.392-1.127	.665
Medium educational level <sup>c</sup>			.770	.452-1.312	.337
Age			.996	.979-1.013	.650
FTND score (addiction level)			1.063	.821-1.377	.642
Experimental group (text) <sup>d</sup>			1.118	.678-1.845	.661
Experimental group (video) <sup>d</sup>			.955	.583-1.565	.856
COPD <sup>e</sup>			1.063	.821-1.377	.642
Readiness to quit (within next month) <sup>f</sup>			.3419	2.265-5.160	.000
Recruitment * FTND score	6.672	3			.083
<b>Subgroup analyses</b>					
<b>FTND score 1-5 (N=312)</b>					
			OR	95%CI	P
Newspaper recruitment <sup>a</sup>			1.181	.547-2.549	.672
Internet recruitment <sup>a</sup>			1.271	.580-2.788	.549
Other recruitment <sup>a</sup>			1.195	.502-2.845	.687
Gender <sup>b</sup>			.872	.506-1.503	.622
Low educational level <sup>c</sup>			.832	.426-1.624	.589
Medium educational level <sup>c</sup>			.918	.478-1.763	.797
Age			.996	.974-1.018	.700
Experimental group (text) <sup>d</sup>			1.298	.695-2.426	.414
Experimental group (video) <sup>d</sup>			.902	.484-1.679	.745
COPD <sup>e</sup>			.857	.398-1.845	.694
Readiness to quit (within next month) <sup>f</sup>			3.029	1.806-5.081	.000
<b>FTND score 6-10 (N=205)</b>					
			OR	95%CI	P
Newspaper recruitment <sup>a</sup>			.334	.120-.924	.035
Internet recruitment <sup>a</sup>			.953	.360-2.524	.923
Other recruitment <sup>a</sup>			.528	.168-1.662	.275
Gender <sup>b</sup>			.749	.373-1.502	.416
Low educational level <sup>c</sup>			.522	.206-1.323	.171
Medium educational level <sup>c</sup>			.568	.214-1.509	.256
Age			.997	.967-1.028	.853
Experimental group (text) <sup>d</sup>			.898	.386-2.085	.802
Experimental group (video) <sup>d</sup>			1.027	.454-2.324	.949
COPD <sup>e</sup>			.928	.398-2.162	.863

Readiness to quit (within next month) <sup>f</sup> 3.939 1.984-7.823 **.000**

<sup>a</sup> General practitioner is the reference group (score=0); <sup>b</sup> Female is the reference group (score=0); <sup>c</sup> High educational level is the reference group (score=0); <sup>d</sup> Control group is the reference group (score=0); <sup>e</sup> Suffering from the disease is the reference group (score=0); <sup>f</sup> Readiness to quit after 1 month to 5 years of later is the reference group (score=0).

Table IV : Descriptive data for the four differently recruited samples stratified by addiction level

	GP (G) (N=144)	Newspaper (N) (N=213)	Internet (I) (N=307)	Other strategies (O) (N=168)	F	X <sup>2</sup>	Df	p-value
<b>FTND score 1-5</b>								
<b>Gender</b>	52.9(45)	61.8(94)	71.3(122)	54.1(53)		11.9	3	<b>.008*</b>
% female (N)]						16.3	6	<b>.012*</b>
<b>Educational level</b>								
% (N)]								
Low	49.4(42)	32.2(49)	26.9(46)	28.6(28)				
Medium	29.4(25)	35.5(54)	37.4(64)	31.6(31)				
High	21.2(918)	32.2(49)	35.7(61)	39.8(39)				
Age [M.(SD)]	48.56(13.1)	49.31(13.9)	44.59(12.3)	44.34(11.7)	8.2		3/502	<b>.001**</b>
<b>FTND score 6-10</b>								
<b>Gender</b>	71.2(42)	55.7(34)	67.6(92)	51.4(36)	8.3		3	<b>.040*</b>
% female (N)]					10.9		6	<b>.092*</b>
<b>Educational level</b>								
% (N)]								
Low	61.0(36)	42.6(26)	36.8(50)	23.8(35)				
Medium	23.7(14)	36.1(22)	40.4(55)	30.0(21)				
High	15.3(9)	21.3(13)	22.8(31)	20.0(14)				
Age [M.(SD)]	48.03(9.9)	48.31(12.0)	44.07(11.8)	45.27(11.9)	2.8		3/322	<b>.043*</b>

FTND, Fagerström Test for Nicotine Dependence; \* Chi-square of F significant at p< .05 level; \*\* Chi-square of F significant at p<.01 level.

Table V: Predictors of 7 day point prevalence abstinence in Dutch adults recruited from December 2010 to October 2011 - final regression model and subgroup analysis based on gender

After 6 months follow up					
Final regression model	$\chi^2$	df	OR	95%CI	P
Newspaper recruitment <sup>a</sup>			.347	.165-.731	<b>.005</b>
Internet recruitment <sup>a</sup>			.585	.302-1.134	.113
Other recruitment <sup>a</sup>			.596	.255-1.395	.233
Gender <sup>b</sup>			.548	.231-1.302	.173
Low educational level <sup>c</sup>			.971	.597-1.579	.905
Medium educational level <sup>c</sup>			1.123	.692-1.824	.639
Age			1.009	.992-1.025	.314
FTND score (addiction level)			.984	.893-1.084	.744
Experimental group (text) <sup>d</sup>			1.026	.639-1.648	.917
Experimental group (video) <sup>d</sup>			1.305	.817-2.084	.265
COPD <sup>e</sup>			1.117	.659-1.894	.682
Readiness to quit (within next month) <sup>f</sup>			1.285	.861-1.920	.220
Recruitment * Gender	8.078	3			<b>.044</b>
<b>Subgroup analyses</b>					
<b>Men (N=212)</b>					
			<b>OR</b>	<b>95%CI</b>	<b>P</b>
Newspaper recruitment <sup>a</sup>			1.496	.603-3.715	.385
Internet recruitment <sup>a</sup>			1.390	.575-3.357	.464
Other recruitment <sup>a</sup>			.478	.160-1.433	.188
Low educational level <sup>c</sup>			1.137	.514-2.512	.751
Medium educational level <sup>c</sup>			1.095	.500-2.396	.821
Age			1.003	.978-1.028	.844
FTND score (addiction level)			1.014	.875-1.175	.853
Experimental group (text) <sup>d</sup>			.937	.455-1.930	.859
Experimental group (video) <sup>d</sup>			.682	.318-1.465	.327
COPD <sup>e</sup>			1.036	.421-2.552	.938
Readiness to quit (within next month) <sup>f</sup>			1.152	.607-2.188	.665
<b>Women (N=325)</b>					
			<b>OR</b>	<b>95%CI</b>	<b>P</b>
Newspaper recruitment <sup>a</sup>			.337	.158-.721	<b>.005</b>
Internet recruitment <sup>a</sup>			.590	.299-1.168	.130
Other recruitment <sup>a</sup>			.576	.242-1.373	.213
Low educational level <sup>c</sup>			.894	.473-1.688	.729
Medium educational level <sup>c</sup>			1.260	.666-2.385	.477
Age			1.016	.993-1.040	.167
FTND score (addiction level)			.935	.818-1.069	.326
Experimental group (text) <sup>d</sup>			1.226	.642-2.341	.538
Experimental group (video) <sup>d</sup>			2.134	1.135-4.013	<b>.019</b>

COPD <sup>a</sup>	1.213	622-2.365	.572
Readiness to quit (within next month) <sup>f</sup>	1.344	.798-2.267	.267

<sup>a</sup> General practitioner is the reference group (score=0); <sup>b</sup> Female is the reference group (score=0); <sup>c</sup> High educational level is the reference group (score=0); <sup>d</sup> Control group is the reference group (score=0); <sup>e</sup> Suffering from the disease is the reference group (score=0); <sup>f</sup> Readiness to quit after 1 month to 5 years of later is the reference group (score=0)

## Figures

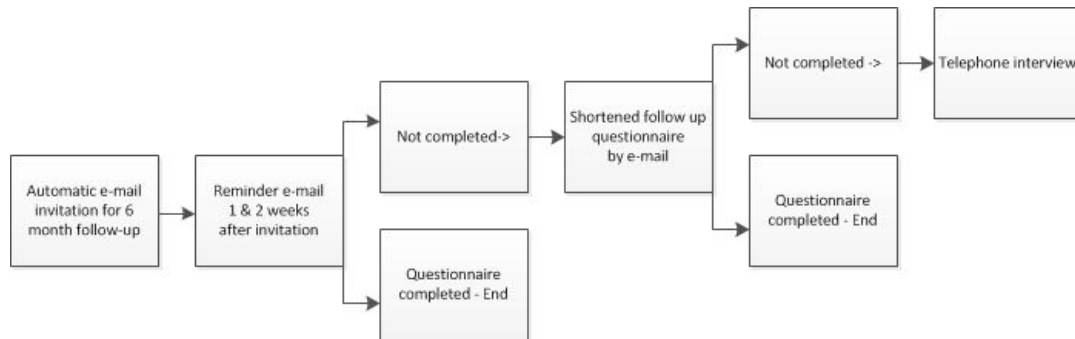


Fig. 1. Procedure of reminder e-mails

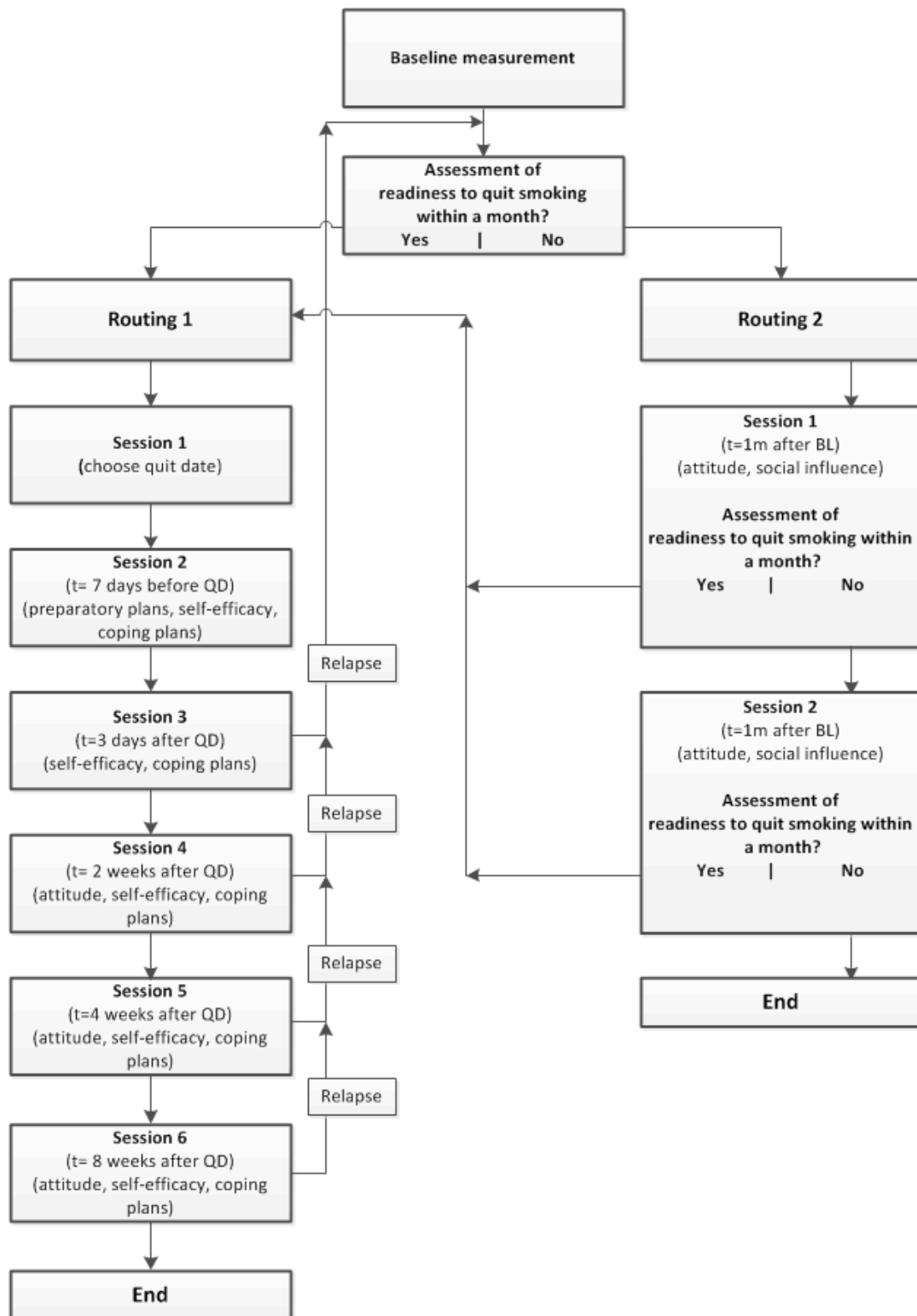
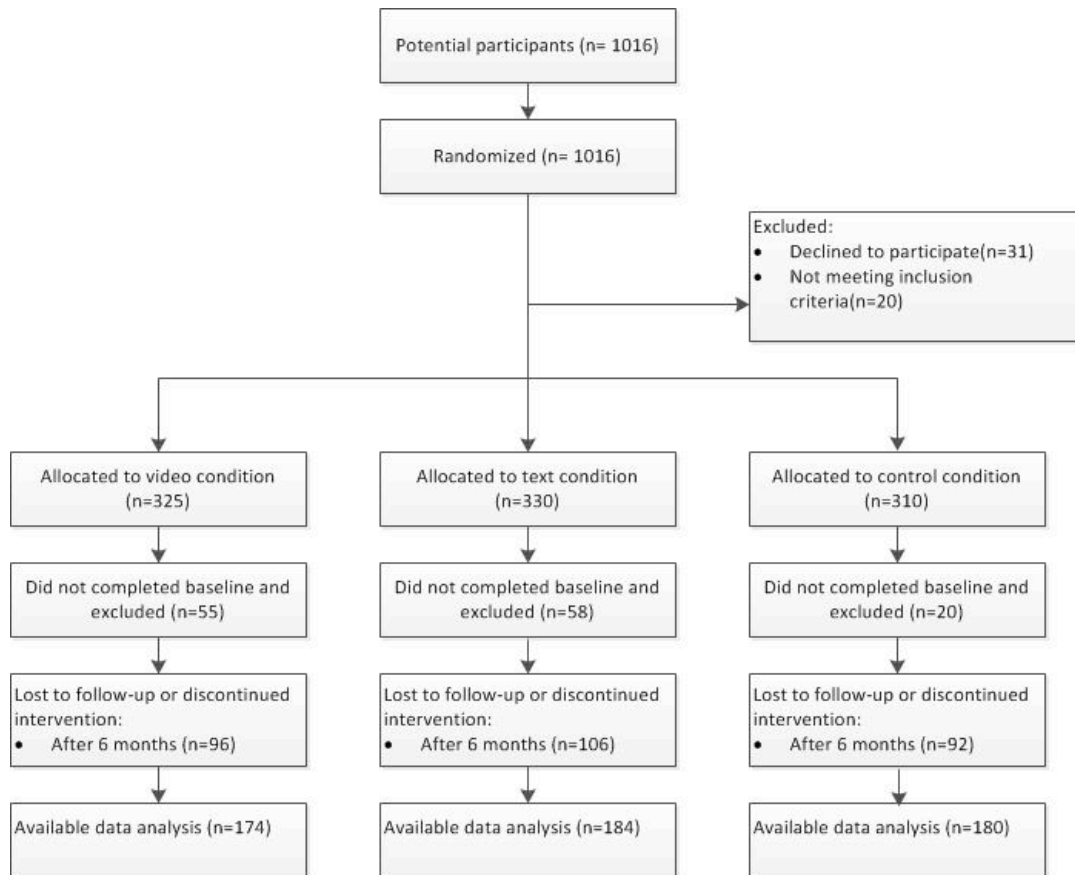


Fig. 2. Intervention design



**Fig. 3. Flow diagram of Dutch adults (N 1/4 1016) randomized to three different conditions**