The number of smokers needed to screen and treat in a smoking cessation programme

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ABSTRACT

Objective: Smoking cessation is an important factor to reduce cardiovascular mortality, but considerable effort is needed to successfully persuade patients to quit smoking. We studied the efficiency of the Minimal Intervention Strategy (C-MIS) in addition to nicotine replacement therapy (NRT) for smoking cessation in cardiovascular outpatients in relation to the outcome of mortality.

Design: Prospective cohort data studying the C-MIS in three outpatient clinics: cardiology, vascular surgery and vascular medicine.

Methods: 2725 consecutive patients attending the clinics for first or routine follow-up visits were screened for atheroscleroses and smoking. The efficiency of the C-MIS was expressed as the number of smokers needed to screen (NNS) and needed to treat (NNT) in relation to the number of deaths prevented over a 5-year period. Mortality estimates were derived from the literature.

Results: 1431 patients were screened at first-time follow-up visits and 1294 at routine follow-up visits. With a rate of effectiveness of 4.3% for the C-MIS, the NNT was 240 (min-max: 64-∞) to prevent one death. The corresponding NNS was 687 (min-max: 141-∞) in the cardiology clinic, 574 (min-max: 134-∞) in the vascular surgery clinic and 444 (min-max: 90-∞) in the vascular medicine clinic. Within 5 years, 10 (min-max: 0-58) deaths could be prevented in all three clinics together. With the effectiveness for the C-MIS for first-time and routine follow-up attendees, only six (min-max: 0-36) and zero (min-max: 0-25) deaths could be prevented, respectively.

Conclusion: In terms of the efficiency of the C-MIS in addition to NRT, there is some benefit for first-time, and no benefit for routine follow-up attendees in preventing death.
INTRODUCTION
To reflect the effectiveness of an intervention from a clinical perspective, the number needed to treat (NNT) is generally used in clinical trials.\textsuperscript{1} NNT is defined as the number of patients that need to be treated to prevent one adverse event, and is the reciprocal of the absolute risk reduction.\textsuperscript{2} However, in screening programmes, the NNT may not reflect the total effort that is necessary to identify all patients who could potentially be treated. To quantify this effort, a new statistic has been developed: the number needed to screen (NNS).\textsuperscript{3} NNS is defined as the number of patients that need to be screened to prevent one adverse event. NNS can be one of the components used to evaluate and compare the usefulness, relevance, efficiency, cost-effectiveness and feasibility of screening programmes.\textsuperscript{4}

NNT and NNS are sensitive to baseline risk, patient characteristics, clinical setting\textsuperscript{5} and the effectiveness of an intervention. For example, as quitting smoking is important in preventing the recurrence of cardiovascular events, many smoking cessation programmes have been initiated. However, their limited effects on quit rates have resulted in moderate-to-high NNTs.\textsuperscript{6-11} It is necessary to realize that the NNT in these programmes represents the number of patients that quit smoking as a result of the intervention, and not the number of adverse events or deaths that were prevented. To prevent one adverse event or death, the number of patients that need to participate in the programme is much higher (Appendix 1A). Moreover, a considerable number of patients that were approached were not interested in participating in a smoking cessation programme. These elements comprise the NNS (Appendix 1B). However, repeated screening for smoking behaviour and motivating smokers to participate in the programme impose more time constraints on healthcare providers.

There is an increasing need to quantify the effort that health care providers need to make to engage patients in attempting to quit smoking in relation to clinically relevant outcomes. Using data from a recently published smoking cessation intervention trial in cardiovascular outpatients,\textsuperscript{11} we studied the efficiency of the additional effect of the intervention, expressed as NNT, NNS and number of deaths prevented over a 5-year period. In other words, we investigated the number of patients that has to be screened and treated to prevent one death as a result of a minimal smoking cessation intervention.

METHODS
To calculate the NNT and NNS to engage patients in a smoking cessation programme, we used mortality rates from the literature\textsuperscript{12} and data from the trial mentioned earlier.\textsuperscript{11} This trial studied the effectiveness of a minimal contact behavioural counselling smoking cessation intervention (the Minimal Intervention Strategy for Cardiology patients (C-MIS: Appendix 2)), in addition to nicotine replacement therapy among patients who attended the cardiology, vascular surgery and vascular medicine (department where patients are
assessed for integral vascular risk management) outpatient clinics for treatment of symptomatic atherosclerotic cardiovascular disease (CVD) at the Academic Medical Center in Amsterdam, The Netherlands. As there could be a difference in the prevalence of atherosclerotic disease and smokers, which might influence the NNS, data were studied separately for the three different outpatient clinics.

All patients aged over 17 years attending one of these outpatient clinics were eligible. From September 2001 to May 2002 all eligible first-time attendees of the clinics (e.g. the first 3 visits; Appendix 2) were recruited, until the target number of patients was reached (consecutive series of 500 cardiac, 500 vascular surgery and, for arbitrary logistical reasons, 250 vascular medicine patients). On the basis of the assumption that patients recently diagnosed with a smoking-related illness would be more motivated to participate in a smoking cessation programme than patients attending the outpatient clinic for a routine follow-up visit, we included an equivalent number of patients on a routine follow-up visit (e.g. more than 3 visits to the same clinic; Appendix 2). These patients were recruited from September 2002 to February 2003.

Patients were excluded if they did not attend their appointments. To compensate for these exclusions, more patients were recruited than the 2500 mentioned above ((500+500+250) * 2) patients. The patients were divided into six subgroups: three outpatient clinics stratified by two types of visit (first time and routine follow-up).

Outpatient clinic attendance for first-time or routine follow-up visits was identified by means of the Hospital Information System. The names of the patients identified were passed on to the clinicians, who were invited to verify the type of visit (first or routine), the presence of symptomatic atherosclerotic CVD (yes, no), the smoking status (yes, no), and the willingness to quit (yes, no). Missing data were completed after cross-checking with patients, clinicians and medical records.

The original trial was approved by the medical ethics committee of the hospital. The patients included in this trial were asked for written informed consent.\textsuperscript{11}

To calculate the NNT and NNS, we used mortality rates derived from the literature\textsuperscript{12} and the cohort data from the above-mentioned trial.\textsuperscript{11} For the purpose of this study, the lowest bound of the effectiveness of the C-MIS was set at 0.01% (point estimate 4.3% (95% confidence interval (CI): -3.2 to 11.7%), under the hypothesis that the C-MIS would not increase the number of smokers.

To extend the scope of the NNS and deaths prevented to a 5-year period, the number of all attending patients was retrieved from clinic admission data contained in the hospital’s annual report for 2003. At the cardiology outpatient clinic approximately 6700 patients (9500 consultations) were seen annually, of whom 2075 (22%) were first-time attendees; at the vascular surgery clinic of 1975 patients (3000 consultations), 700 (24%) were first-time attendees; at the vascular medicine clinic of 1225 patients (2150 consultations), 575 (26%) were first-time attendees.
Analysis

Patient characteristics (i.e., symptomatic atherosclerotic CVD and smoking status) were described separately for each subgroup. Patients with symptomatic atherosclerotic CVD were furthermore described by age, sex, smoking status and willingness to quit smoking.

To calculate the NNT to prevent one death, using the C-MIS programme, we divided 1 by the multiplication of the calculated risk difference of dying while still smoking or dying after having stopped smoking, by the estimated effectiveness of the C-MIS (Appendix 1A). These numbers were derived from the literature. The effectiveness of the C-MIS with regard to quitting smoking was based on the results of the original trial and additional analysis from our dataset.

To subsequently calculate the NNS, we divided the NNT by the percentage of patients willing to quit smoking (Appendix 1B), derived from the cohort data of the original trial.

To quantify the total effort required from all three outpatient clinics to prevent deaths over a 5-year period, the number of patients per year visiting the outpatient clinics was multiplied by 5, by the percentage of patients with symptomatic atherosclerotic CVD, and by the percentage of patients who smoked. The result was subsequently divided by the NNS (Appendix 1C).

Sensitivity analysis

To examine the variability of NNS, we performed a sensitivity analysis for each of the estimates of the variables mentioned (risk of dying, patient characteristics, and the effectiveness of the intervention). The sensitivity analysis was performed using the analysis of extremes. Simultaneously each variable was given the most optimistic or pessimistic value as derived from the 95% CIs. This analysis was performed separately for each subgroup.

RESULTS

Patient characteristics, prevalence of symptomatic atherosclerotic CVD, and smoking

A total of 2725 patients visited the three outpatient clinics during recruitment (Figure 1). Of these, 1431 patients were first-time attendees and 1294 routine follow-up attendees. Patients attending the cardiology and vascular surgery outpatient clinics were older (mean age 59.8 and 61.6, respectively) than patients attending the vascular medicine outpatient clinic (mean age 48.0).

The prevalence of symptomatic atherosclerotic CVD was significantly higher in patients attending the vascular surgery outpatient clinic. This was also true for routine follow-up attendees on comparison with first-time attendees (Figure 1).

The prevalence of smoking was significantly higher in patients at the vascular surgery outpatient clinic than at the other clinics, and this is also applicable to first-time attendees compared to routine follow-up attendees (Figure 1).
**Patients with symptomatic atherosclerotic CVD: characteristics, smoking prevalence and willingness to quit**

Patients with symptomatic atherosclerotic CVD attending the cardiology and vascular surgery outpatient clinic were, on average, 13 and 15 years older than those attending the vascular medicine outpatient clinic (Table 1). The number of smokers was highest among those attending the vascular surgery outpatient clinic (37.9%).

The percentages of patients who smoked and patients willing to quit smoking were lower in all three outpatient clinics in the routine follow-up attendees, but only reached statistical significance in the vascular surgery outpatient clinic (Table 1).
Effectiveness of C-MIS, and impact on NNT and NNS

With an overall estimated effectiveness of 4.3% (95% CI: -3.2 to 11.7) for the C-MIS,\textsuperscript{11} and a risk difference of dying while still smoking or after quitting smoking of 9.8% (95% CI: 6.4%-13.4%),\textsuperscript{12} the NNT with the C-MIS is 240 patients who smoke with symptomatic atherosclerotic CVD to prevent one death. The most optimistic calculation shows the NNT to be 64. In the most pessimistic calculation, the NNT reaches infinity. The NNS for the cardiology, vascular surgery and vascular medicine outpatient clinics is 687, 574 and 444, respectively. In the most optimistic calculation, the NNS is 141, 134 and 90, respectively; in the most pessimistic calculation, these numbers reach infinity (Table 2).

For first-time attendees, the estimated effectiveness of the C-MIS is 6.5% (95% CI: -3.3% to 16.3%)\textsuperscript{11} and the NNT is 158. For the cardiology, vascular surgery and vascular medicine outpatient clinics, the NNS is 399, 312 and 237, respectively (Table 2).

For routine follow-up attendees, the estimated effectiveness for the C-MIS is -0.9% (95% CI: -10.1% to 8.4%),\textsuperscript{11} and the NNT and NNS reach infinity for all outpatient clinics (Table 2).

The yield of the C-MIS over a period of 5 years

Using the overall estimated effectiveness of the C-MIS over a 5-year period, a small number of deaths can be prevented: 4.5 in the cardiology, 4.5 in the vascular surgery and 0.9 in the vascular medicine outpatient clinic (10 in total). In the most optimistic calculation, these numbers are 28.3, 24.0 and 6.2, respectively (58 in total). In the most pessimistic calculation, no deaths can be prevented (Table 2).

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Table 1. Characteristics of patients with symptomatic atherosclerotic CVD in outpatient clinic

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Patients (N)</th>
<th>Age, mean (SD) (years)</th>
<th>Male, N (%)</th>
<th>Smoking, N (%)</th>
<th>Willing to quit, N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>496</td>
<td>64.2 (12.9)*</td>
<td>337 (67.9)</td>
<td>100 (20.2)*</td>
<td>35 (35.0)</td>
</tr>
<tr>
<td>first visit</td>
<td>230</td>
<td>62.1 (13.8)†</td>
<td>141 (61.3)†</td>
<td>53 (23.0)</td>
<td>21 (39.6)</td>
</tr>
<tr>
<td>routine follow-up visit</td>
<td>266</td>
<td>65.9 (11.9)†</td>
<td>196 (73.7)†</td>
<td>47 (17.7)</td>
<td>14 (29.8)</td>
</tr>
<tr>
<td>Vascular Surgery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>749</td>
<td>66.1 (11.6)*</td>
<td>492 (65.7)</td>
<td>284 (37.9)*</td>
<td>119 (41.9)</td>
</tr>
<tr>
<td>first visit</td>
<td>357</td>
<td>65.8 (11.8)†</td>
<td>230 (64.4)</td>
<td>156 (43.7)†</td>
<td>79 (50.6)†</td>
</tr>
<tr>
<td>routine follow-up visit</td>
<td>392</td>
<td>66.4 (11.4)†</td>
<td>262 (66.8)</td>
<td>128 (32.7)†</td>
<td>40 (31.3)†</td>
</tr>
<tr>
<td>Vascular Medicine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>144</td>
<td>51.1 (9.3)*</td>
<td>105 (72.9)</td>
<td>37 (25.7)*</td>
<td>20 (54.1)</td>
</tr>
<tr>
<td>first visit</td>
<td>67</td>
<td>50.3 (10.4)</td>
<td>52 (77.6)</td>
<td>18 (26.9)</td>
<td>12 (66.7)</td>
</tr>
<tr>
<td>routine follow-up visit</td>
<td>77</td>
<td>51.8 (8.4)</td>
<td>53 (68.8)</td>
<td>19 (24.7)</td>
<td>8 (42.1)</td>
</tr>
</tbody>
</table>

CVD, cardiovascular disease. *p < 0.05 significant difference between the outpatient clinics. †p < 0.05 significant difference between the two types of visits.
When using the above-mentioned specific estimated effectiveness of the C-MIS for first-time and routine follow-up attendees, 6.3 (e.g. 2.6, 3.0, 0.7) and no deaths were prevented, respectively (Table 2).

Table 2. NNS of smoking patients with symptomatic atherosclerotic CVD to prevent one death when quit smoking by a C-MIS programme, and the total yield of the programme in 5 years in terms of prevented deaths

<table>
<thead>
<tr>
<th></th>
<th>Patients visits per year (N)</th>
<th>Symptomatic atherosclerotic CVD % (95% CI)</th>
<th>Smoking % (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cardiology</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>totala</td>
<td>6700</td>
<td>46.1 (43.1 - 49.1)</td>
<td>20.2 (16.6 - 23.7)</td>
</tr>
<tr>
<td>first visitb</td>
<td>2075</td>
<td>42.7 (38.6 - 46.9)</td>
<td>23.0 (17.6 - 28.5)</td>
</tr>
<tr>
<td>routine follow-up visitc</td>
<td>4625</td>
<td>49.4 (45.2 - 53.7)</td>
<td>17.7 (13.1 - 22.3)</td>
</tr>
<tr>
<td><strong>Vascular Surgery</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>totala</td>
<td>1975</td>
<td>68.7 (66.0 - 71.5)</td>
<td>37.9 (34.4 - 41.4)</td>
</tr>
<tr>
<td>first visitb</td>
<td>700</td>
<td>60.4 (56.5 - 64.3)</td>
<td>43.7 (38.6 - 48.8)</td>
</tr>
<tr>
<td>routine follow-up visitc</td>
<td>1275</td>
<td>78.6 (70.7 - 78.4)</td>
<td>32.7 (28.0 - 37.3)</td>
</tr>
<tr>
<td><strong>Vascular Medicine</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>totala</td>
<td>1225</td>
<td>25.8 (22.1 - 29.4)</td>
<td>25.7 (18.6 - 32.8)</td>
</tr>
<tr>
<td>first visitb</td>
<td>575</td>
<td>22.2 (17.5 - 26.9)</td>
<td>26.9 (16.8 - 39.1)</td>
</tr>
<tr>
<td>routine follow-up visitc</td>
<td>650</td>
<td>30.0 (24.4 - 35.6)</td>
<td>24.7 (15.6 - 35.8)</td>
</tr>
</tbody>
</table>

CI, Confidence Interval; C-MIS, Minimal Intervention Strategy for Cardiology patients; CVD, cardiovascular disease; NNS, number needed to screen; NNT, number needed to treat; RRR, relative risk reduction. Justification of used estimates and calculations. The calculations were based on the following assumptions:

1. number of patients visits per year: hospital annual report 2003
2. mean percentage of symptomatic atherosclerotic CVD for the cardiology, vascular surgery and vascular medicine outpatient clinics (Figure 1)
3. mean percentage of smokers and willingness to quit smoking for the cardiology, vascular surgery and vascular medicine outpatient clinics (Table 1)
   - Overall effectiveness of the C-MIS: 4.3% (95% CI: -3.2% to 11.7%)11
   - Effectiveness of the C-MIS for first-time attendees: 6.5% (95% CI: -3.3% to 16.3%)11; additional analysis
   - Effectiveness of the C-MIS for routine follow-up attendees: -0.9% (95% CI: -10.1% to 8.4%)11; additional analysis
   - Using the effectiveness of the C-MIS of 0.01% as lowest bound
4. Absolute risk of dying when smoking in coronary heart disease population: 27.1% (95% CI: 22% to 32%)12
5. RRR for deaths by abstained smoking and smoking: 36% (95% CI: 29.0% to 42.0%)12
6. Calculated risk difference (absolute risk multiplied with RRR) for deaths when abstained smoking and smoking: 9.8% (95% CI: 6.4% to 13.4%)12; To calculate the NNT and NNS and deaths prevented, see appendix 1A, 1B and 1C. NNT of smoking patients with symptomatic atherosclerotic CVD: 240 (upper and lower bound: 64-156 740). NNT of smoking patients with symptomatic atherosclerotic CVD for the first visit: 158 (upper and lower bound: 46-156 740). NNT of smoking patients with symptomatic atherosclerotic CVD for the routine follow-up visit: 102 383 (upper and lower bound: 86-156 740)

When using the above-mentioned specific estimated effectiveness of the C-MIS for first-time and routine follow-up attendees, 6.3 (e.g. 2.6, 3.0, 0.7) and no deaths were prevented, respectively (Table 2).
DISCUSSION

When compared with other screening programmes, fewer patients in our study needed to be screened and treated to reduce smoking-related mortality. However, the NNS was influenced heavily by a range of effectiveness estimates of the C-MIS. Ideally, the NNT and NNS should be interpreted in the context of a randomized clinical trial, as in our study. The NNS is one of the criteria used to determine the efficiency of a screening programme.\textsuperscript{14} The lower the NNT and NNS, the more efficient the treatment. In our study, the impact of the C-MIS in terms of number of deaths prevented over a period of 5 years, varied widely (0-58). In the most pessimistic calculation, no deaths could be prevented, although it is reasonable to assume that the programme will prevent six or more deaths given the actual effectiveness of the C-MIS for the two types of visit (Table 2).

The strength of our study is that no assumptions were made about patient and cohort characteristics such as smoking status, willingness to quit smoking, prevalence of symptomatic atherosclerotic CVD, or the effectiveness of the C-MIS. The actual numbers were all obtained from the original trial. Our only assumption was that the risk of dying was independent of the underlying type of cardiovascular disease. This assumption follows the Joint British recommendations\textsuperscript{15} on the prevention of coronary heart disease, which state that patients with peripheral arterial disease and those suffering from coronary arterial disease should be managed similarly, as the aetiology and the major risk factors of these conditions are similar.

To interpret the relative magnitude of the calculated NNS, we compared our result with the NNS in other studies of different diseases. Of the screening strategies evaluated

<table>
<thead>
<tr>
<th>Willing to quit % (95% CI)</th>
<th>Smoking patients to prevent one death, NNS (min-max)</th>
<th>Deaths prevented over 5 years, N (min-max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>35.0 (25.7 - 45.2)</td>
<td>687 (141 – 609 883)\textsuperscript{d}</td>
<td>4.5 (0.0 - 28.3)</td>
</tr>
<tr>
<td>39.6 (26.4 - 54.0)</td>
<td>399 (85 – 593 711)\textsuperscript{d}</td>
<td>2.6 (0.0 - 15.9)</td>
</tr>
<tr>
<td>29.8 (17.3 - 44.9)</td>
<td>343 566 (192 – 906 010)\textsuperscript{d}</td>
<td>0.0 (0.0 - 13.7)</td>
</tr>
<tr>
<td>41.9 (36.2 - 47.6)</td>
<td>574 (134 – 432 983)\textsuperscript{d}</td>
<td>4.5 (0.0 - 24.0)</td>
</tr>
<tr>
<td>50.6 (42.8 - 58.5)</td>
<td>312 (78 – 366 215)\textsuperscript{d}</td>
<td>3.0 (0.0 - 15.2)</td>
</tr>
<tr>
<td>31.3 (23.2 - 39.3)</td>
<td>328 149 (220 – 675 603)\textsuperscript{d}</td>
<td>0.0 (0.0 - 8.9)</td>
</tr>
<tr>
<td>54.1 (36.9 - 70.5)</td>
<td>444 (90 – 424 769)\textsuperscript{d}</td>
<td>0.9 (0.0 - 6.2)</td>
</tr>
<tr>
<td>66.7 (41.0 - 86.7)</td>
<td>237 (53 – 382 292)\textsuperscript{d}</td>
<td>0.7 (0.0 - 4.7)</td>
</tr>
<tr>
<td>42.1 (20.3 - 66.5)</td>
<td>243 189 (78 – 772 117)\textsuperscript{d}</td>
<td>0.0 (0.0 - 2.6)</td>
</tr>
</tbody>
</table>
by Rembold, the largest clinical benefit was found for dyslipidaemia, if detection was followed by pravastatin treatment for 5 years. To prevent one death, the estimated NNS was 418 (95% CI: 235 to 79 720). The NNS to prevent one death in Dutch general practice screening programmes is approximately 2560 for cervical cancer and approximately 2340 for the detection of hypertension in patients aged 55-75 years. This comparison suggests that the C-MIS for smoking cessation, assessed by the NNS and NNT, may be quite effective. Comparing only the NNS with other screening programmes leads to an incomplete assessment. Apart from the number of deaths prevented, other outcomes such as morbidity, balance of advantages and disadvantages, and cost-effectiveness need to be taken into account. In addition, smoking is a chronic ‘condition’ that requires repeated screening rather than a single approach.

Not only should the number of deaths prevented be counted as the benefit of an intervention, but also the prevention of morbidity. The literature shows a 32% relative risk reduction of nonfatal myocardial infarctions in cardiovascular patients who quit smoking. When repeating the same calculations for morbidity, as we did for the risk of death, a similar effect size is derived, doubling the overall effect of the intervention. Furthermore, the benefits of the intervention may increase over time. As follow-up of patients in the included trials ranged from 1 to 26 years, it is unlikely that our NNS will be influenced heavily when the timeframe is expanded. However, the effect size is likely influenced by the age of the participants.

When balancing advantages and disadvantages of the programme, screening for smoking behaviour and applying the C-MIS is not likely to have any disadvantages for the patient. Clinical practice guidelines on smoking cessation recommend that clinicians should identify, document and treat every smoker at each visit. However, in the Netherlands, smoking behaviour is only recorded in approximately 67% of the medical records of smokers. Furthermore, only 10% of Dutch physicians support the patient in their efforts to quit smoking. Lack of time, lack of incentive and lack of effective smoking cessation programmes in outpatient clinics are associated with these practices. Although the C-MIS is a structured and feasible programme and can be delivered by trained nurses, the clinician must still continue to verify and discuss the smoking habits of patients to motivate them to quit or to prevent relapses. In our original trial, we created optimal circumstances by identifying all patients who smoked, offering a personalized quit-smoking advice, delivering the C-MIS with the aid of trained nurses, and offering free NRT. These components may have increased patients’ willingness to quit smoking, resulting in an overly favourable NNT and NNS. Furthermore, we calculated the NNT and NNS as a single intervention for the additional effects of the C-MIS, which might also have resulted in optimistic estimates. Nevertheless, the calculations provide insight into the efforts clinicians have to make in screening and treating patients who smoke. However, comparisons with other screening programmes should be interpreted cautiously.
Finally, we did not calculate real costs, but helping smokers to quit is ranked among the top three most cost effective preventive services that clinicians can offer (asymptomatic) patients. Yet, we have insufficient knowledge about the cost-effectiveness in our population of older patients with smoking-related disease. The older the patient, the less likely it is that he or she is willing to quit, as older patients question the advantages of smoking cessation in view of their limited remaining life span. Although nurse-delivered interventions were found to be effective, especially in hospitalized cardiovascular patients, patients assigned to nurse-led clinics for secondary prevention of coronary heart disease did not show any improvement for smoking status at 1 year. Furthermore, evidence of effective cessation strategies in the cardiovascular (out)patient population is very limited. We showed that patients (even those who are older) with newly diagnosed cardiovascular disease are more receptive and willing to quit than routine follow-up attendees. However, the C-MIS was ineffective in the latter group. On the basis of our findings, the implementation of the C-MIS in outpatient clinics may be questioned. In our centre, we decided not to proceed with the C-MIS after the trial.
REFERENCES

1. Cook RJ, Sackett DL. The number needed to treat: a clinically useful measure of treatment effect. BMJ 1995; 310:452-4


APPENDIX 1A

**Formula used for calculating the NNT of smoking patients with symptomatic atherosclerotic CVD by using the C-MIS.**

\[
\text{NNT of patients who smoke with symptomatic atherosclerotic CVD} = \frac{1}{(\text{risk difference between dying while still smoking and dying after having quit smoking}) \times (\text{estimated effectiveness C-MIS})}
\]

Appendix 1B

**Formula used for calculating the NNS of smoking patients with symptomatic atherosclerotic CVD by using the C-MIS.**

\[
\text{NNS of patients who smoke with symptomatic atherosclerotic CVD} = \frac{\text{NNT of patients who smoke with symptomatic atherosclerotic CVD}}{\% \text{ willing to quit smoking}}
\]

Appendix 1C

**Formula used for calculating the number of deaths prevented over 5 years in a cardiovascular outpatient clinic.**

\[
\text{No. of deaths prevented per 5 year} = \frac{\text{(No. of patients visiting the outpatient clinic per year) \times (5) \times \% \text{ symptomatic atherosclerotic CVD) \times \% \text{ smoking}}}{\text{NNS of patients who smoke with symptomatic atherosclerotic CVD}}
\]
Appendix 2: Definitions used in this study

C-MIS: A minimal contact behavioural smoking cessation intervention: Minimal Intervention Strategy for Cardiology patients. The C-MIS consists of 6 steps and is delivered by nurses, after a advice to quit smoking by the clinician.

1. advice to quit smoking
2. pay attention to smoking behaviour during each visit at the outpatient clinic

Clinician
Nurse

1. assess smoke profile
2. assess and enhance motivation
3. discuss barriers
4. set a quit date
5. provide self-help materials
6. plan after-care by telephone

Symptomatic atherosclerotic CVD: Clinically diagnosed occlusive or aneurysmal disease of coronary or peripheral arteries, or a strong suggestion that this was the cause of the patient’s symptoms.

Smoking: Patients who smoke one or more cigarettes or cigars a day at the time of assessment.

Willing to quit: Number of patients who actually participate in the trial, and patients who want to quit on their own.

First visit: Three or less visits (or patients with a newly diagnosed cardiovascular event) to the outpatient clinic cardiology, vascular surgery or vascular medicine of the Academic Medical Center in Amsterdam.

Routine follow-up visit: After the third visit (four or more visits) to the same outpatient clinic, the patient was addressed as routine follow-up patient.

C-MIS, Minimal Intervention Strategy for Cardiology patients; CVD, cardiovascular disease.