# Changes in smoking during a community-based cardiovascular disease intervention programme

## The Coronary Risk Factor Study

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## Summary

**A prospective anti-smoking clinical trial was conducted as part of a coronary risk factor intervention study in three rural South African communities in the south-western Cape over a period of 4 years. The aim of this part of the study was to reduce smoking rates in two of the communities through application of high- and low-intensity intervention. The effect was evaluated by examining the net change in smoking habits, which was defined as the residual change in the intervention areas after allowing for change in the reference area. This paper presents the analyses of the estimated effect of the programme on the cohort aged 15 - 64 years at baseline who participated in the two surveys (4 087 subjects). The intervention programme among men in the high-intensity intervention area resulted in a reduction of 8,4% in smoking rates and 13,0% in the amount smoked per day. Among women in this area there was a reduction of 30,6% in smoking rates and 20,5% in amount smoked. Smoking and the amount smoked per day also decreased in the low-intensity intervention area, but less so than in the high-intensity intervention area. Smoking quit rates were strongly associated with initial smoking levels, with light smokers being significantly more successful quitters than heavy smokers. This study has proved that a community-based intervention programme can effectively reduce smoking.**

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Cigarette smokers have twice the overall death rate of non-smokers in most Western societies.[1,2] The evidence linking cigarette smoking to CHD is formidable and meets almost all the criteria for an aetiological relationship.[3,4] Persons predisposed to CHD because they have hypertension, hypercholesterolaemia or diabetes are at an even greater risk for CHD if they also smoke.

Since the US Surgeon General's Report in 1964,[5,6] sizeable reductions in cigarette smoking have occurred among adult men (but not among women) in developed countries. However, despite a massive accumulation of data demonstrating the multiple health hazards of cigarette smoking, millions of people all over the world still continue to smoke, and teenagers continue to take up the habit in large numbers.

Observational studies demonstrate that smokers who quit lower their CHD risk. Multifactorial trials such as the North Karelia Project,[7] the Multiple Risk Factor Intervention Trial (MRFIT),[8] the Oslo Primary Prevention Trial[9] and the European Factory-based Multifactorial Primary Prevention Trial,[10] and unifactorial trials such as the Whitehall Trial,[11] all concur in suggesting benefit in foregoing the smoking habit.

A prospective antismoking clinical trial was conducted as part of the Coronary Risk Factor Study (CORIS) in three rural South African communities in the south-western Cape over a period of 4 years. The aim of this part of the study was the reduction of smoking in two of the communities through the application of high- and low-intensity intervention.

## Subjects and methods

The study was designed as a quasi-experimental prospective clinical trial. It comprised cross-sectional surveys in three communities before and after a 4-year intervention programme of graded intensity in two communities, the third serving as a control. The specific aim of the intervention phase was initially to improve knowledge about coronary risk factors (including smoking) in the two communities, to influence attitudes, and finally to change behaviour in such a way that modified lifestyles would reduce the risk factor level of each community.

Three rural communities in the south-western Cape, Swellendam, Robertson and Riversdale, approximately similar in population, size, socio-economic status and cultural lifestyle, were treated as a single population during the cross-sectional baseline study in 1979. During this initial screening the prevalence of coronary risk factors was quantified in the three communities. Subsequently Robertson and Swellendam were subjected to high- and low-intensity multiple risk factor intervention respectively for 4 years, while Riversdale was used as the control area. All three communities were resurveyed in 1983 by means of a second cross-sectional study to evaluate the effectiveness of the intervention phase. In 1979, 3 357 men and 3 831 women aged 15 - 64 years were recruited by means of an intensive postal campaign. They represented 82% of the known target population between these age limits as ascertained from ratepayers' and electricity consumers' records and a postal census, and 68% of the 1980 census population aged 15 - 64 years. In 1983, 7 264 men and women aged 15 - 68 years were recruited. Of these individuals 4 087 (56,3%) were also surveyed in the 1979 study.

During the 4-year intervention period, the intervention areas were subjected to a coronary risk factor education programme, while further contact with the control area was avoided. Both the low-intensity intervention (LII) and high-intensity intervention (HII) areas received a mass media pro-

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gramme using the so-called small media, such as posters, billboards, mailings and local newspapers, which was aimed at the whole community and covered risk factors such as smoking, hyperlipidaemia, hypertension, inactivity and stress. In addition, the HII area also received interpersonal intervention to high-risk individuals, such as smokers. In both surveys, information on smoking habits was obtained by interview using the same general risk factor questionnaire. All interviewers were trained and standardised by the same core team before and during both surveys. Completed questionnaires were exchanged among interviewers and double-checked for completeness and accuracy.

A person was classified as a smoker if he or she smoked an average of at least 1 cigarette or 1 g tobacco per day. Occasional smokers, i.e. those who smoked less than 1 g per day, were categorised as non-smokers. People who had given up smoking at least 3 months before the study were regarded as ex-smokers. Regular cigar-only smokers were uncommon, and were either counted as smokers if they smoked pipe and/or cigarettes in addition to the cigars, or as non-smokers if they did not smoke anything else. Cigarette and pipe consumption was given in grams per day, where 1 cigarette = 1 g tobacco. Smokers were subdivided into light smokers (1 - 9 g tobacco daily), medium smokers (10 - 19 g per day) or heavy smokers ($\geqslant$ 20 g per day), regardless of inhalation habits and years of smoking.

This paper presents the analyses of the estimated effect of the programme on the cohort alone (4 087 subjects). The net change in smoking habits of the cohort was defined as the residual change in an intervention area after allowing for change in the control area. This is a measure of intervention effect, while the change within a community includes also secular trends and the effect of survey participation. Two-tailed $t$-tests were performed to test the net change and a probability of $P < 0{,}01$ was accepted as significant, in view of the large sample sizes. Quit rates were calculated as the percentage of smokers who stopped smoking during the intervention period. Differences in quit rates among the three areas and between heavy and light smokers were tested using the $\chi^2$ test.

## Results

Comparability of study areas at baseline (cohort only) is shown in Table I. The mean ages of the study populations were very similar. Although the HII area contained a higher percentage of smokers than the other areas, this, as well as the initial amount smoked among the three areas, did not differ significantly. The distribution of heavy smokers among the three communities was also very similar.

Table II shows the net change and net percentage change in smoking over 4 years in the two intervention communities relative to change in the control population. The net change in smoking, as well as the amount smoked, showed a favourable overall intervention effect. The most favourable net change was in the HII population, especially among the women (net change = −4,0; $P < 0{,}001$ for smoking). Although the net decreases recorded in smoking and tobacco consumption were often substantial, these frequently were not significant because of the large standard deviations of the smoking data.

The quit rates for smokers between 1979 and 1983 are shown in Table III. Among smokers of both sexes, the quit rates were highest in the HII area. Among women the quit rate in all smokers in the control area (15,5%) was significantly lower than in the HII area (31,4%; $P < 0{,}01$) and also significantly lower than in the LII area (28,3%; $P < 0{,}05$). The quit rates among all male smokers were not significantly

**TABLE I. BASELINE SMOKING PREVALENCES AND MEAN CONSUMPTION (± SD) OF THE COHORT IN THE THREE COMMUNITIES**

| | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | Controls | LII | HII | Controls | LII | HII |
| **No.** | **596** | **710** | **546** | **712** | **821** | **705** |
| **Age (yrs)** | **44,8 ± 12,8** | **43,2 ± 12,3** | **43,9 ± 12,6** | **44,2 ± 12,4** | **43,0 ± 12,3** | **43,4 ± 12,8** |
| **Tobacco (g/d)** | **9,1 ± 12,9** | **11,3 ± 14,9** | **10,6 ± 13,5** | **2,3 ± 6,9** | **2,1 ± 6,2** | **2,6 ± 7,0** |
| **Smokers (%)** | **44,4** | **46,6** | **49,2** | **14,5** | **14,7** | **17,0** |
| **Light smokers (1-9 g/d) (%)** | **7,4** | **4,6** | **6,9** | **3,9** | **3,6** | **4,9** |
| **Medium smokers (10-19 g/d) (%)** | **8,1** | **8,3** | **11,0** | **4,8** | **6,5** | **5,9** |
| **Heavy smokers ($\geqslant$20 g/d) (%)** | **28,9** | **33,7** | **31,3** | **5,8** | **4,6** | **6,2** |

**TABLE II. NET CHANGE (± SD) AND NET PERCENTAGE CHANGE IN SMOKING OVER 4 YEARS IN COHORT INTERVENTION POPULATIONS AGED 15-64 YEARS AT BASELINE, RELATIVE TO CHANGE IN CONTROL POPULATION**

| | Men | | | | Women | | | |
|---|---|---|---|---|---|---|---|---|
| | LII | | HII | | LII | | HII | |
| | Net change | Net % change | Net change | Net % change | Net change | Net % change | Net change | Net % change |
| **No.** | **710** | | **546** | | **821** | | **705** | |
| **Smokers (%)** | **+0,9±2,0** | **2,0** | **−3,7±2,0** | **−8,4** | **−3,0±0,1** | **−19,2** | **−4,0±1,0*** | **−30,6** |
| **Tobacco (g/d)†** | **−0,4±0,6** | **−4,6** | **−1,2±0,6** | **−13,0** | **−0,2±0,2** | **− 8,1** | **−0,5±0,2** | **−20,5** |

* $P < 0{,}001$; two-tailed $t$-tests, unadjusted data.
† In total cohort.

**TABLE III. QUIT RATES (%) BETWEEN 1979 AND 1983 IN SMOKERS FROM THE THREE COMMUNITIES**

| | Men | | | Women | | |
|---|---|---|---|---|---|---|
| | Controls | LII | HII | Controls | LII | HII |
| **All smokers** | **20,1** | **16,9** | **22,8** | **15,5** | **28,3*** | **31,4**** |
| **Light smokers** | **32,6***** | **26,5** | **40,5****** | **28,6***** | **44,4***** | **52,6******* |
| **Heavy smokers** | **17,7** | **15,8** | **19,9** | **10,7** | **23,7** | **21,7** |

* $P < 0,05$ compared with control population.
** $P < 0,01$ compared with control population.
*** $P < 0,05$ compared with heavy smokers.
**** $P < 0,01$ compared with heavy smokers.
***** $P < 0,001$ compared with heavy smokers.

different. The quit rates were strongly associated with the initial level of smoking. Light smokers (1 - 9 g tobacco per day) reported significantly higher quit rates than heavy smokers ($\geqslant$ 20 g/day) in all three areas, but especially in the HII area. It appears that light smokers were more successful at giving up smoking, and would therefore probably be more susceptible to intervention than heavy smokers.

## Discussion

The design of this study, namely a prospective clinical trial, is considered to be the most powerful technique for evaluating the effect of intervention. It is considered to be a quasi-experimental design, because the intervention and allocation of populations was under the control of the investigator; allocation is determined by the study goals and not by the study populations' needs or characteristics.[12] Also, the temporal sequence of the measured outcome is clear, because intervention always precedes the outcome. In a quasi-experimental design populations rather than individuals are the study units allocated to the experimental or control groups, there is an evaluation before and after intervention, and the results are expressed in relation to the control results.[13]

Participants lost to follow-up (drop-outs) may result in bias in a longitudinal study if they differ systematically from those who also participated in the follow-up study (stayers). Differences in tobacco smoking rates between drop-outs and stayers have been reported from several cross-sectional cardiovascular studies.[2,14] Such differences affect the internal validity of a prospective study, because the drop-outs may exhibit exposures or outcomes which differ from those of stayers. In the CORIS study only 56,7% of the original cohort remained in the follow-up study in 1983. Among the men who stayed in the study 46,4% were smokers compared with the 50,0% among those who dropped out. In women 21,4% of drop-outs were smokers, while only 15,4% of the stayers smoked. To avoid possible differences between the stayers and the drop-outs, it was therefore decided to use only the stayers (cohort) in the present study for evaluating the intervention effects. No correction for baseline differences in smoking rates was necessary, as these differences were not statistically significant and thus could not have influenced the intervention results significantly.

The main conclusion from this study is that a community-based intervention programme can reduce the mean tobacco consumption and prevalence of smoking among men and women. The difference in mean tobacco consumption between 1979 and 1983 among men in the HII area relative to the control area was 13%. This is exactly what was found in the North Karelia project.[7] The difference for women found in this study (20,5%) was, however, larger than the 8% difference found in the North Karelia project. The prevalence of smoking in the HII community decreased between 3% and 4% in the CORIS and by 1% in North Karelia[7] and in the Stanford Five-City Project.[15]

The difference in quit rates for men (2,7%) between the HII and control areas was lower than the 8% difference found in the Oslo trial,[9] which was aimed at high-risk groups only. The quit rates were, however, close to the 25% and 17% for the intervention and control groups in the Oslo trial. The difference of 15,9% for women in the present study indicated that intervention, especially HII, can be very effective in encouraging women to quit smoking. The quit rates in the present study were strongly associated with the initial level of smoking, with light smokers reporting higher quit rates than heavy smokers. This correlates well with findings in the MRFIT study.[8] Thus, light smokers were more successful at giving up smoking, and according to the MRFIT they would possibly be less likely than heavy smokers to start smoking again.

The better results for the HII area than for the LII area show that intensive instruction through interpersonal intervention can make a further contribution to a successful intervention programme. Cross-contamination between intervention populations was unlikely for the smokers in the cohort, since persons not resident in the HII community were not admitted to the personal anti-smoking counselling programme. The results of the present study also indicate that, in addition to the observed reduction in smoking in the intervention areas, there were favourable changes in the reference area. It is difficult to say whether these changes represented trends in natural history or whether they were the result of a national interest in the health hazards of smoking. Such changes were also observed in similar intervention studies, such as the North Karelia Study.[7]

Whether there will be further changes in the communities after this period, and whether this positive effect could be achieved elsewhere in the country, cannot at present be answered. However, this programme has proved that a community-based smoking intervention programme can effectively reduce smoking.

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