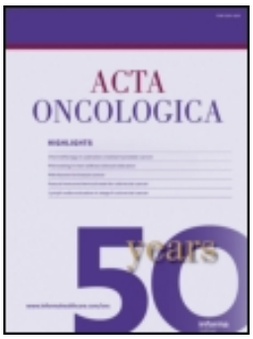

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ORIGINAL ARTICLE

A 25-year follow-up of a population screened with faecal occult blood test in Finland

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Abstract
The aim of the study was to assess the feasibility of and possible selection to attend in colorectal cancer screening. *Material and Methods.* During the years 1979–1980, 1 785 men and women (born in 1917–1929) were invited to a pilot screening project for colorectal cancer. The screening method used was a guaiac-based faecal occult blood test repeated once if the initial test was positive. *Results.* Compliance was 69% and the test was positive in 19% of those attending. In a record linkage with the Finnish Cancer Registry, 47 colorectal cancer cases and 24 deaths from colorectal cancer were observed by the end of 2004. In all, the particular test method was not regarded specific enough for population screening. There was, however, no difference in cancer incidence between those who complied and those who did not when compared to the general population of same age and gender. *Conclusion.* Compliance was found high enough to make screening feasible and there was no self selection of persons with low cancer risk to attend screening.

Colorectal cancers are common in Western countries with high standard of living. In the Nordic countries, Finland has earlier been among those with a low incidence rate but has reached the other Nordic countries during the 1990s [1]. Mortality from colorectal cancer in Finland has decreased in women since the 1970s and in men since the 1990s [2].

In the late 1970s the faecal occult blood (FOB) test was a recent invention and feasibility of colorectal cancer screening was tested at population level in Finland. The screening took place in 1979–1980. Since that the Finnish Cancer Registry (FCR) provided follow-up of over 20 years for colorectal cancers detected in the target population. This enabled comparison of colorectal cancer incidence and mortality during follow-up in those invited to screening and those actually screened and in those originally with a positive and a negative test.

The aim of the original project in 1979–80 was to evaluate whether testing for occult blood in feces could be used in colorectal cancer screening, and what the needs for clinical resources to confirm positive test results would be. The present analysis aimed at evaluating the feasibility of population based screening in terms of attendance and potential selection of low risk individuals to screening.

Material and methods

Altogether 1 801 men and women born in 1917–1929 (every second birth cohort) from three municipalities in south Finland (Järvenpää 569 persons, Kerava 832 persons, and Tampere 400 persons) were identified from the Central Population Register. Test-kits of a new guaiac test developed in Finland (the Fecatest®) [3] were sent to this target population between April and May 1979 (the first 100 invitees) and from January to June 1980 (the remaining 1 701 invitees). If the initial test was positive, the person received a second test-kit, and if still positive, further investigations with colongraphy or endoscopy were offered at the central hospital. In the present analysis, however, only the initial test was used to classify the population into screen negatives and screen positives. After excluding those who had moved or died before invitation, there were 1 785 men and women available for analysis.

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The personal identification codes of those invited were linked with the files of the population-based Finnish Cancer Registry (FCR), which was the source of information on incident cancer cases and cancer deaths providing almost 100% case coverage nation-wide [4,5]. The dates and causes of death were checked by linkage with files of Statistics Finland. Follow-up time for cancers started from population sampling and ended at death or on December 31, 2004, whichever occurred first.

The number of observed cancer cases, cancer deaths and person-years at risk were calculated for 5-year age-intervals and five calendar periods (1979–1984, 1985–1989, and 1990–1994, 1995–1999, 2000–2004), and for two different follow-up periods (<2 years and 2+ years after invitation) for men and women separately. The expected number of colorectal cancer cases was calculated by multiplying the number of person-years in each stratum by the corresponding average incidence or mortality rate in the entire country of Finland during the period of observation. To calculate the standardised incidence ratio (SIR) or standardised mortality ratio (SMR), the observed number of cases was divided by the expected number. The 95% confidence intervals (CI) were based on the assumption that the number of observed cases followed a Poisson distribution.

The permission to make the linkages for this follow-up study was granted by the National Research and Development Centre for Welfare and Health (STAKES).

Results

There were 35 599 person years of follow-up among the 1 785 invitees, 15 261 in men and 20 338 in women (Table I). Test-kits were received from 1 227 persons. Thus, compliance to screening was 69%, varying from 65% in the youngest age group (birth cohort 1929) to 71% in the oldest one (birth cohort 1917). Attendance was higher in women (73%) than in men (64%). Screen positivity was 19% in those that attended screening, somewhat higher in women (20%) than in men (17%).

During the follow-up, 47 colorectal cancers were diagnosed in those invited and the same number was expected (SIR 1.09, CI 0.80–1.44) according to the incidence rates in Finland (Table II). Non-attendees were not at high risk of colorectal cancer, in fact, the number of cases was slightly less than expected, 12 observed cases when the expected number was 12.8 (SIR 0.94, CI 0.48–1.63). The risk was high among the attendees during the two first years of follow-up (SIR 5.88, CI 2.16–12.8), and the risk was especially high (SIR 21.2, CI 5.76–54.2) in those with a positive test result (Table II).

Altogether 24 deaths from colorectal cancer occurred among those invited (SMR 1.17, CI 0.75–1.73) (Table II). There were minor differences in the SMR between test positives, test negatives and non-attendees, which could be accounted for by chance, because the numbers of deaths were small (Table II).

Discussion

The feasibility of a screening programme as to e.g. attendance and self selection by inherent risk should be derived from experience in the same population where a new programme is planned to be launched. The attendance to screening for colorectal cancer with FOB testing has varied. In the four randomised controlled screening trials the variation in attendance was from 60 to 78% [6–9], and was probably higher than if the test had been applied as a routine

Table I. Number (n) of men and women invited to screening and person years (pyrs) of follow-up by attendance to screening and screening results among those attending over different periods of follow-up (0–1: up to 2 years, 2+: more than 2 years).

Gender, follow-up time	Screen positives	Screen negatives	Non-attenders	All invited
Men (n)	93	445	299	837
Follow-up (pyrs)				
0–1	182	878	583	1 642
≥2	1 488	7 494	4 637	13 619
Total	1 670	8 371	5 220	15 261
Women (n)	137	552	259	948
Follow-up (pyrs)				
0–1	272	1 100	512	1 883
≥2	2 735	10 780	4 940	18 455
Total	3 008	11 879	5 451	20 338
Both sexes (n)	230	997	558	1 785
Follow-up (pyrs)				
0–1	454	1 977	1 095	3 526
≥2	4 223	18 274	9 576	32 073
Total	4 677	20 251	10 671	35 599

Table II. Observed number of cases (Obs) and standardised incidence (SIR) and mortality (SMR) ratios with 95% confidence intervals (CI) for colorectal cancer in 1979–2004 among 1 785 persons invited to screening. Expected rates are based on the reference rates from the entire country of Finland.

	Incidence			Mortality		
	Obs (N)	SIR	95% CI	Obs (N)	SMR	95% CI
Test positive						
0–1*	4	21.2	5.76–54.15	–	0.00	0.00–41.81
2+#	4	0.73	0.20–1.87	2	0.77	0.09–2.76
Total	8	1.41	0.61–2.78	2	0.74	0.09–2.67
Test negative						
0–1	2	2.4	0.29–8.66	1	2.57	0.07–14.34
2+	25	1.05	0.68–1.55	12	1.06	0.55–1.84
Total	27	1.1	0.72–1.59	13	1.11	0.59–1.89
Non-attendees						
0–1	–	0.00	0.00–7.93	–	0.00	0.00–17.16
2+	12	0.97	0.50–1.69	9	1.53	0.70–2.90
Total	12	0.94	0.48–1.63	9	1.48	0.67–2.80
All invited						
0–1	6	4.03	1.48–8.77	1	1.45	0.04–8.05
2+	41	0.98	0.71–1.33	23	1.16	0.73–1.73
Total	47	1.09	0.80–1.44	24	1.17	0.75–1.73

*0–1: Follow-up time up to 2 years.
#2+: Follow-up time more than 2 years.

health service. In a large feasibility study in the UK [10,11], compliance was 57%, higher in women (61%) than in men (52%). In the present study the attendance was high, 69%, which is consistent with high attendance in Finland in other population-based screening programmes for breast and cervix cancer, 85% and 72%, respectively [2]. This experience has been utilised in planning of the national screening programme in Finland 20 years later [12].

This was a long-term study of a register and the Finnish Cancer Registry statistics showed slightly elevated incidence and mortality rates (9 and 8% higher, respectively) in the participating municipalities compared with national rates from the entire country of Finland. The difference was small and to reduce random variation, the national rates were chosen as the reference when standardised incidence and mortality ratios were calculated.

In many screening programmes those attending screening are at a lower risk for cancer than those not attending [13]. In the present study there was no clear indication of self selection of those with low risk for colorectal cancer to attend screening. The high risk that was observed for colorectal cancer during the two first years of follow-up in those attending screening was probably an indication of high attendance among those having symptoms. There was one early death observed in those with a negative test result, but this was due to a cancer diagnosed before screening. This could also happen due to the inability of the test to respond on whole blood for example if the blood cells are intact or false negative tests because of prolonged storage of the samples [3].

The test was very sensitive, 19% of the test kits were positive. In other studies with other tests, positivity has varied from less than 1 to 10%, depending on the test and possible rehydration [3,7,14]. In the long run, over the total follow-up time there was no significant difference in the risk for colorectal cancer between test positives and test negatives. However, in those with a positive test cancers were diagnosed shortly (0–1 years) after the test (SIR 21.2) and the risk was low thereafter (SIR 0.73). In all, our results are consistent with the randomised controlled trials showing effectiveness given short screening intervals [6,8,9].

The pilot programme was stopped after the first period of screening in 1980. The low specificity made it impossible (i.e., too expensive) to continue the programme after the feasibility phase. Although the test was widely used in clinical practice it was not found feasible for screening purposes of unrecognised disease at population level. Because there was only one screening round, no mortality effect was expected. The standardised mortality ratios close to 1.0 confirmed this assumption. The project was useful in other ways; however, it showed that high attendance could be achieved in a routine screening setting and that there was no self selection of persons with low colorectal cancer risk to attend screening.

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