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Cervical cancer screening programme in Finland

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Abstract

In Finland, the organised screening programme for the prevention of cervical cancer has been run for over 30 years and has contributed to a 70–80% decrease in the age-adjusted cervical cancer incidence, as well as a reduction in mortality rates. In this article, we describe the operational details of the organised programme — how the target population is defined, how the invitations are done, how smear tests are collected and analysed, how referrals to confirmation and treatment are conducted, and we also provide recent data on the extent and main screening results. The Finnish programme has led to net savings when assessed for its cost-effectiveness. The results encourage the continuation of the screening programme. By introducing modern screening technologies and more systematic quality control activities in the programme, and by expanding the coverage and compliance we expect to further increase the impact of the programme.

Keywords: Cervical cancer; Incidence; Mortality; Organised screening; Effectiveness; Quality assurance; Quality control

1. Introduction

In Finland (population 5 million) organised cervical screening was introduced in the early 1960s; piloting first within the area of three municipalities in 1963 and extending within a few years to most parts of the country. By 1970, the coverage of the invitational programme was already above 80% of women in the target age group. Furthermore, from the early 1970s onwards, the registered coverage has become almost complete in these target age groups.

During 1955–1964, the incidence of invasive cervical cancer in Finland was 15 cases per 100 000 woman-years; age-adjusted to the world standard population, with a slight increasing trend within that period. Mortality from cervical cancer was approximately 7 cases per 100 000 woman-years, respectively. Following the implementation of organised screening, there was a rapid decrease in the invasive cervical cancer incidence and mortality rates. During the years 1991–1995, when the screening programme had been running for 30 years, the incidence rates varied from 2.8 to 4.5 cases per 100 000 woman-years; indicating an overall decrease of approximately 70–80% in the age-adjusted rate [1,2]. The reduction was notable in the incidence of squamous cell carcinomas, whereas the incidence rate of cervical adenocarcinoma has been quite stable over the past decades. The relative reduction in the mortality rates has today even become slightly larger than the reduction in the incidence rate [2]. The age-adjusted mortality rate in 1995 was lower than ever, 0.8 cases per 100 000 woman-years. Due to Papanicolaou (Pap)-screening, each year more than 200 deaths from cervical cancer are avoided in our country [3]. The decrease in the cervical cancer rate is mainly attributable to the organised programme.

The screening activities are integrated in the health-care system. In the organised programme, the present coverage of invitations is 90% of the target age (including those ages included as a result of an extension in the target group definition in the late 1980s and early 1990s); the participation rate is higher than 70%. Historically, most of the screening activities have been administered by the Finnish Cancer Organisation (FCO). The cytological laboratories analysing smears within the FCO programme are under the supervision and control of the Central Cytological Laboratory of the FCO. Attending organised screening for women is

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free of charge. Sample taking is carried out by trained nurses (midwives) in the local healthcare centres and the sample quality is under continuous control and is assessed by the cytology laboratories. Confirmation and treatment is integrated into the normal healthcare routines. The invitations and screening results of the programme, including histologically confirmed diagnosis, are filed centrally at the Finnish Cancer Registry.

2. Population and methods

2.1. Invitation to screening

The target population is identified from the central population register of Finland. Invitational status is defined according to the year of birth and municipality. The mass screening registry identifies the women twice a year. A letter of invitation is sent to each woman individually. Those with a recent spontaneous smear or those who have had a hysterectomy are not excluded from the invitations. The invitation letter includes the place, date and time of smear taking. Historically, no reminders have been sent, but in 1998 a recommendation was given that a reminder should be sent to those women who have not contacted the sample taking unit. This is because we have observed that a low participation rate within a municipality correlates with a high level of invasive cervical cancer incidence and that non-participation in the programme appears to be the largest single problem resulting in a failure in prevention. Thus, we wish to further improve the compliance of the programme.

The screening organisation also negotiates annually with the municipality or national authorities on the invitations and other related details of the screening services. The screening programme, with its benefits as well as its problems and limitations, has recently been a focus of wide attention in the mass media and the scientific arenas.

3. Target population

According to a bylaw drawn up in 1992 the municipalities have to offer cervical cancer screening for a 30–60-year old women. A 5-year screening interval is based on a recommendation given by the Finnish Cancer Organisation since the start of the programme — in the present target age range this makes seven invitational rounds per lifetime for women with negative smears. In 1996, the invitations covered 95–99% of women who historically have been screened most widely (40, 45 and 50 years of age), whereas among those age groups which were included in the target age group in the late 1980s and early 1990s (55 and 60 years of age) the coverage is increasing, but is still somewhat lower, 88.1% and 73.5% respectively, in 1996 (Table 1). There were deficits within some municipalities in the coverage among 30 and 35-year-old women too (actual coverage of the programme invitations 72.4% and 92.1%, respectively in 1996). The coverage of invitations was 89.5% of the overall target population in 1996. According to information from an annual population survey, the proportion of all Pap smears, where the estimate includes also opportunistic and diagnostic smears, in addition to the

Table 1
Women in the target population, numbers of invitations and smears taken, as well as the coverage and compliance of the cervical cancer screening programme in Finland in 1996 (Mass Screening Registry, 1999)

Mode of invitation	Female population	Invitations sent		Smears taken		
Birth year (age, years)	31 Dec. 1995 *n*	*n*	% of the female population (coverage)	*n*	% of the invited (compliance)	% of the female population
With the regular 5-year interval						
1971 (25)	30 283	9003	29.7	5417	60.2	17.9
1966 (30)[a]	36 345	26 324	72.4	16 043	60.9	44.1
1961 (35)[a]	37 328	34 383	92.1	23 225	67.5	62.2
1956 (40)[a]	39 337	38 916	98.9	28 379	72.9	72.1
1951 (45)[a]	39 551	37 574	95.0	27 969	74.4	70.7
1946 (50)[a]	43 026	42 487	98.7	32 855	77.3	76.4
1941 (55)[a]	35 076	30 913	88.1	24 055	77.8	68.6
1936 (60)[a]	25 953	19 074	73.5	14 735	77.3	56.8
1931 (65)	25 819	3450	13.4	2638	76.5	10.2
Other age	x	2672	x	1025	38.4	x
1966..1936 (30..60)[a]	256 616	229 671	89.5	167 261	72.8	65.2
Sum of all above	x	244 796	x	176 341	72.0	x
Risk group screening	x	15 324	x	11 426	74.6	x
All	x	260 120	x	187 767	72.2	x

x, missing data.
[a] Ages included in the age range in the bylaw (1992).

programme smears taken during a 5-year period was approximately 93% for women in the target age group of the programme [4]; the coverage of any smears during a lifetime was 98%.

3.1. Local organisation and screening practices

The screening interval following a negative result is 5 years. The samples taken are VCE smears; i.e. samples from posterior vaginal fornix, cervix, and from the endocervical canal are taken separately, using an Ayre's spatula and an endocervical brush, and are placed on the same slide. The samples are stained with modified Pap staining and screened by cytotechnicians. The cytologist checks every abnormal smear and a percentage (usually 10–30%) of normal smears. In 1996, there were 19 cytology laboratories involved in reading approximately 188 000 smears in the programme.

Every woman is informed of the results individually by letter — including those with normal results — directly from the cytology laboratory, usually within 4 weeks of the visit. A longer interval may sometimes be applicable in busy weeks. For women with a suspicious smear (e.g. Papanicolaou group II), a control smear after 6 months is recommended. A visit to a gynaecologist is also recommended for those women who have reported bleeding symptoms. Moreover, women whose smear was classified as Papanicolaou group II (or Papanicolaou group III, IV or V, but for whom the histological confirmation was negative), as well as for those women who had reported bleeding symptoms, a new invitation — using the term 'risk-group' invitation — is usually sent after 12–24 months from the visit. This 'risk group' screening is maintained by most, but not all, the municipalities. For positive cytological results (Papanicolaou group III, IV or V) the referral for colposcopy and biopsy is carried out immediately by the cytology laboratory (by mail always, but the first contact is by phone whenever possible). Referral to colposcopy is recommended also after two repeated findings of suspicious infected or reactive cells; however, concerning the control or risk group smears, it is common practice for some laboratories to make the referral to colposcopy only after three successive suspicious findings. Yearly approximately 0.7–1.1% of the women participating in the screening programme are referred for colposcopy on the basis of cytological findings. The treatments are conducted as part of the normal healthcare activities, following their regulations.

Treatment is provided for women with relatively mild lesions cervical intra-epithelial neoplasia I (CIN I) or those with a more severe finding. All the data on the confirmation are included in the personal screening cards kept for every woman in the cytology laboratory; they are entered into a computerised format usually in the cytology laboratories with use of a centralised software and the national registry is maintained and adequacy of treatment is, also, followed by the mass screening registry as a part of the overall cancer registration system.

3.2. Cervical cancer screening programme personnel

Trained midwives take the screening samples. The smears are examined by trained cytotechnicians. Their workload is 40–55 samples per working day. The cytotechnicians get their training in nursing colleges and also in the laboratories where they work. Cytologists are medical doctors, either pathologists or gynaecologists with special training in gynaecological cytology. Colposcopies and treatments are done by gynaecologists, mainly with expertise in colposcopy and the treatment of premalignant lesions.

3.3. Quality assurance

Guidelines on technical details in screening have been traditionally given by the FCO, directly administering, or today, with agreements with most of the screening laboratories. In the mid-1990s, some of the municipalities started to use some new laboratories in the programme; it is not clear at the moment whether all their operational guidelines are the same as in the FCO programme. The target age range between 30 and 60 years is stated in a presidential bylaw made in 1992, prepared by the Ministry of Health. The National Board of Health and its successors are responsible for the general guidelines in healthcare. They have also provided detailed guidelines and instructions on which type of data is to be collected by the screening programme, as well as on the registration of that data. The registration of the mass screenings, as well as other cancer registry data, is done according to the law and bylaw on National Personal Records Kept under the Health Care System, effective since 1989.

In the normal screening practice of the organised programme there are a number of quality control activities, such as control of sample quality, re-readings, and cytopathological meetings. Presently, there is no systematic monitoring or publishing of their results.

3.4. Smear taking

All midwives involved in smear taking obtain a personal numerical code, which is marked on the clinical data in the screening card following each smear. Thus, the cytology laboratory in the programme can evaluate the quality of smears taken by a particular midwife, and directly give feedback and detailed instructions whenever needed. There is also a continuous training programme for smear takers. In cases of an unsatisfactory smear (e.g. too few cells, or broken glass), the woman is

invited by phone to have a new sample taken. There are very few unsatisfactory smears left thereafter in the programme. For example, in 1996 there were only eight unsatisfactory smears remaining, from among 188 000 women attending the programme (< 0.005%). Moreover, approximately 6–7% of the smears may be inadequate for full interpretation; however, almost all of these 'inadequate' smears are still considered 'satisfactory but limited' for cytological interpretation (e.g. due to lack of endocervical cells when a total hysterectomy had not been reported in the anamnestic data). There may be differences between cytology laboratories in inviting these women for a new sample; e.g. if there is a history of previous cytological abnormalities, the woman may be asked to give a new smear.

3.5. Re-reading of smears

The cytopathologists also examine 10–30% of normal smears to evaluate the quality of the work of their cytotechnicians. A study plan also exists to continuously evaluate the quality and diagnostic criteria by re-reading the smears in collaboration with the cancer registry, the screening laboratories involved, and a national reference laboratory. Important for developing the screening criteria within the programme, there are weekly sessions between cytology and pathology units/laboratories involved, where the results of cytological, histological and colposcopic assessments are evaluated. The FCO arranges yearly courses for cytotechnicians and cytopathologists, including comparison and reading of difficult cases. A systematic audit of the screening programme among cases of cervical cancer was conducted once in 1998, including data on invitations and attendance (obtained from the mass screening registry), a check-up of potentially misread cases, and follow-up of the adequacy of treatment of precancerous lesions. Continuation of the auditing activity has been designed to also include interviews of the cases at the hospitals. Then it is also possible to obtain data on opportunistic smears.

3.6. Data collection

The Finnish Cancer Registry provides complete data on cancer incidence and mortality, sorted individually with the help of the unique personal identifier. The mortality records are obtained from the files of the Cause-of-Death Registry at Statistics Finland. The cancer registry also has information for carcinoma *in situ* (cis) cases of the cervix uteri, as well as cases of dysplasia *gravis* (CIN III). The Mass Screening Registry — a sub-unit of the Finnish Cancer Registry — is responsible for maintaining the individual data on mass screenings including invitations, visits, personal history data (such as bleeding symptoms reported by the woman), smear findings and confirmation. The notification cards or computerised records have been available in the mass screening registry since 1963. The registry is also working to include the main data from the mass screening programme into the annual statistics on cancer as published by the Cancer Registry.

3.7. Results with the quantitative data on the exemplary year 1996

In 1996, 256 616 women in the target age group were eligible for cervical cancer screening, according to population statistics; 167 261 smears were taken after the 5-year invitations in the organised programme in the target age group, with a participation rate of 72.8%. Approximately 9000 smears were taken in other age groups, and some additional 11 426 risk group smears because of previous suspect findings (Table 1). Normal or negative results (Papanicolaou group I) were obtained in 93.1% of the screening tests; suspicious findings (Papanicolaou group II) were detected in 6.4% of the smears, and a positive cytological finding (Papanicolaou group III, IV or V) in 0.55%. After histological confirmation, more than 550 cases of CIN lesions or a more severe screening outcome were detected. The average detection rate was 3.1 cases per 1000 women screened. On average, 43% of the positive or suspicious cytological findings leading to a referral for colposcopy were confirmed histologically. The predictive value for a histologically confirmed finding following a positive Pap smear was 49% (488 CINI+ lesions out of 999 women with Papanicolaou group III, IV or V; Table 2).

4. Discussion

Historically, the overall incidence of invasive cervical cancer in Finland, as well as that of *in situ* carcinoma of the cervix uteri, has drastically decreased in those subject to organised screening activities. However, there is no decrease in the frequencies of CIN detection. Moreover, the detection rates of CIN grades II and III have even slightly increased [2], partly indicating a possibility that the biological background risk of developing cervical cancer may have increased among the Finnish population during the last few decades. In addition, the registered *in situ* carcinoma incidence of the cervix uteri has increased for those outside the age group that are included in the screening programme, for example, among women 15–29 years of age. On the other hand, the trends in the pre-invasive lesions detected in screening are subject to differences in diagnostic practices and criteria. Therefore, one can not draw any firm causal conclusions when interpreting them.

As demonstrated by age-period analyses of the cervical cancer incidence and mortality, the overall impact of the Finnish cervical cancer screening system has been

Table 2
Cervical cancer screening programme in Finland in 1996: the number and percentage distribution of smears in the screening programme, by final histological diagnosis, and Papanicolaou group (Mass Screening Registry, 1999)

Histological diagnosis	Papanicolaou group					
All	I[a] *n* (%)	II[a] *n* (%)	III *n* (%)	IV *n* (%)	V *n* (%)	*n* (%)
Normal	170 306 (93.7)	11 421 (6.3)	122 (0.07)	3 (0.002)	–	181 852 (100)
Condyloma	1 (0.2)	170 (30.7)	375 (67.8)	7 (1.3)	–	553 (100)
Dysplasia *levis* (CIN I)	–	42 (24.9)	125 (74.0)	2 (1.2)	–	169 (100)
Dysplasia *moderata* (CIN II)	1 (0.6)	17 (10.2)	134 (80.2)	15 (9.0)	–	167 (100)
Dysplasia *gravis*	–	9 (6.2)	102 (69.9)	35 (24.0)	–	146 (100)
In situ carcinoma	–	2 (3.5)	27 (47.4)	26 (45.6)	2 (3.5)	57 (100)
Micro-invasive carcinoma	–	–	2 (50.0)	2 (50.0)	–	4 (100)
Invasive carcinoma (cervix)	–	1 (5.9)	4 (23.5)	11 (64.7)	1 (5.9)	17 (100)
Squamous cell carcinoma	–	–	3 (30.0)	6 (60.0)	1 (10.0)	10 (100)
Adenocarcinoma	–	1 (14.3)	1 (14.3)	5 (71.4)	–	7 (100)
Other malignant (endometrium)	–	–	3 (75.0)	1 (25.0)	–	4 (100)
Sum of all above	170 308 (93.1)	11 662 (6.4)	894 (0.5)	102 (0.06)	3 (0.002)	182 969 (100)
Information missing	x x	x x	x x	x x	x x	4798[b] (100)
All	x x	x x	x x	x x	x x	187 767[b] (100)

x, missing data.
[a] Women having Papanicolaou group I or II are not sent to further examinations unless repeated cytology or other results are suggestive of cancer. Altogether 1302 women (0.7%) had been referred to colposcopy in 1996.
[b] Includes unsatisfactory smears ($n = 8$ in 1996).

uniquely high (see [3] and [5] for international comparisons). Using either the historical trends between countries with different screening systems [3,6] or data from a population-based case–control study using a questionnaire on screening history (ever versus never screened) [7], we have estimated that the overall effect in decreasing cervical cancer incidence with spontaneous smears is up to 30%, whereas the main effect in obtaining an up to 80% decrease in the historical rates has come from the well-organised screening programme. In Finland, only approximately one-third of the overall number of smears have been taken and analysed within the organised programme. This supports the possibility that the organised smears are spread quite evenly in the population, whereas the spontaneous smears may be more selectively distributed — with a large potential of over-consumption of smears. Moreover, potentially contributing to the effectiveness, most of the cytological laboratories of the organised programme have been subject to systematic control for their clinical work. The screening laboratories and confirmation units in the programme have been able to maintain rather strict diagnostic criteria. As it is typical that both the spontaneous and organised systems have at least equal effect at detecting pre-invasive lesions, it seems that overdiagnosis may be a more serious problem in the spontaneous system than in the organised programme in our country.

The direct screening cost for the municipalities, including the costs for invitational material and other printed material, mailing, sample-taking supplies, sample-staining and analysis, informing the women, and registration has been in the order of approximately 10 ECU per smear. The organised programme has been very cheap and has led to positive net savings when compared with its cost-effectiveness [3]. Because the organised programme has come close to its maximal effectiveness, we are planning options of modernising the screening systems with the help of new technologies available — such as human papilloma virus (HPV)-based controls, and introduction of automation-assisted methods in the cytological assessment. Pilot projects on implementing automation-assisted cytology are already running. Assessments of the possibilities to improve the impact of the screening programme with the help of new technologies may also be of importance as the biological background risk of developing cervical cancer — related, e.g. to sexual behaviour and smoking habits — may have increased during recent decades. All these results encourage the continuation of the pap-screening programme in its present form. As cervical cancer incidence among the rather young target ages has recently started to increase [2], it is necessary to expand the programme coverage further, particularly among the youngest women of the target age group.

5. Conclusions

Following the 30 years or so of its action, the cervical cancer screening programme in Finland has contributed to a large decrease in cervical cancer incidence and mortality rates. The results of the programme in reducing cervical cancer incidence and mortality encourage

its continuation in its present form. With the introduction of modern screening technologies and more systematic quality control activities in the programme, and moderate expansion of coverage and compliance — particularly at the youngest ages of the screening programme — we aim to further increase the effectiveness of screening for cervical cancer.

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