BREAST CANCER SCREENING

ANNUAL REVIEW 2018

MASS SCREENING REGISTRY 50 YEARS

The breast cancer screening programme has been underway for over 30 years and has proved to be effective. Altogether 315,000 women attended breast cancer screenings in 2016, and 2,000 cases of breast cancer were detected. Participation in screening reduces mortality by one third.

SUMMARY

The breast cancer screening programme has been underway in Finland for over thirty years and has proved both effective and cost-effective. On the basis of a wide-range evaluation, the benefits of the programme have exceeded its harms. However, in recent years attendance has been declining. For the first time ever, this annual review assesses social inequality between population groups according to mother tongue and socio-economic status. The preliminary results show significant differences in attendance between population groups. The lowest attendance was recorded for immigrants and the long-term unemployed. The Finnish Cancer Registry has already launched efforts to reach these groups.

1. INTRODUCTION

OVER THREE DECADES OF BREAST CANCER SCREENING

Finland started its national breast cancer screening programme in 1987, and was among the first countries to do so. Screening is used to detect breast cancers as early as possible, when the prognosis is good and the cancer can be treated by using breast conserving therapy. The ultimate goal of screening is to reduce breast cancer mortality.

The Mass Screening Registry was established in connection with the Finnish Cancer Registry fifty years ago, in 1968, to investigate the effectiveness of gynaecological mass screening (Moring et al. 1996). In the 1980s, the registry's activities were supplemented with the evaluation of breast cancer screening and research evidence based implementation. During the first five years of breast cancer screening, in 1987–1991, randomisation based on the birth year was carried out in the selected target population. At that time only some women in the target population were invited to screening, while others served as controls. The first results received from the randomised follow-up study indicated that the programme was as effective as had been expected on the basis of previous studies (Hakama et al. 1997).

Breast cancer screening became nationwide in 1992. Based on the Public Health Decree, all women between 50 and 59 years were invited to screening every two years. Once the Government Decree on screening entered into force in 2007, breast cancer screening was gradually expanded in 2007–2016 to cover the female population aged 60–69 years throughout Finland. However, some municipalities invited women aged 60–69 years to screening regularly, starting either at the beginning of the programme or from 2007 onwards.

As late as the 1980s, the prognosis for a person diagnosed with breast cancer was poor in Finland. Thereafter, the availability of early diagnostics services has improved markedly both through screening and as an increase in services outside the programme. The treatments for breast cancer have also developed and improved. At present, the prognosis of treatment for breast cancers is good, and the number of breast cancer deaths is very low when compared against the number of cases. During the five-year period 2011–2015, the age-adjusted breast cancer mortality in Finland was about 28 deaths for one hundred thousand woman-years, whereas in 1986–1990 the corresponding figure had been 35 deaths. Despite the constant rise in the incidence of breast cancer, the increase in breast cancer mortality levelled off in the late 1980s. Thereafter, breast cancer mortality among the female population of Finland has decreased by about one fifth. Breast cancer mortality has decreased both at the screening age and in younger age groups (Figure 1).

The quality and effectiveness of breast cancer screening have been evaluated using follow-up studies throughout its thirty year history. Both Finnish and international follow-up studies continue to corroborate the positive impact of breast cancer screening on both earlier diagnoses and reduced mortality (Heinävaara et al. 2014 and 2016, IARC 2016). In Finland, the breast cancer mortality of women attending screening is about one third less than in a situation where no screening would be organised (Heinävaara et al. 2016). In addition to the development of therapies and the increase in breast cancer awareness, screening has thus also had an independent effect reducing breast cancer mortality.

FIGURE 1 Incidence and mortality of breast cancer by age group in Finland, women, 1960–2015.

ANNUAL REVIEW

This annual review includes information on the outcomes of breast cancer screening nationally and in 21 hospital districts. Information is given for the year 2016 and the preceding four years. Comparisons concerning the implementation and quality of screenings are shown from 1992 onwards. For the first time, screening statistics are also presented for population groups illustrating social inequality. Information concerning population groups has been obtained for this purpose from the Population Register Centre and from Statistics Finland. Apart from screening statistics, the review describes topical research projects and discusses the benefits and harms of screening and other early diagnostics during the screening period of over 30 years.

2. BREAST CANCER SCREENING IN FINLAND

By virtue of the Government's Decree, all women 50–69 years of age are invited to breast cancer screening every two years. The screening protocol — the screening interval, the age groups screened and the test — has been selected on the basis of domestic and international scientific evidence.

Municipalities organise the screening. They select the body implementing the screening, which can be the municipality itself or a private operator. The screening takes place in specific screening units. The units send the invitations to screening and perform the mammography and further assessment, if needed. Diagnostic confirmation and surgery are conducted in specialised medical care. The mammography and the further assessment carried out in the screening units are free of charge for those invited. Treatments and examinations performed in specialised medical care are subject to patient fees, and

municipalities are required to pay the costs specified in the hospital's price list.

Individual data on all phases of screening are sent in electronic format to the Mass Screening Registry of the Finnish Cancer Registry for the evaluation of quality and effectiveness. Comprehensive data collection also enables the monitoring and correction of shortcomings and problems in the programme.

PROGRESSION OF SCREENING

Screening includes a personal invitation, mammography as the primary screening test and, if needed, further assessment (additional mammograms, ultrasound imaging, and needle biopsies) as well as surgery. Mammograms are taken from two directions for both breasts. The images are interpreted by two radiologists working independently. If cancerous growth is suspected in either breast, the radiologists do a consensus reading. The results of the screening are delivered by personal letter. If necessary, the letter includes an invitation to further assessment. Invitations to further assessment can also be delivered by phone.

MAIN FINDINGS IN 2016

All municipalities provided the 2016 screening data for the Mass Screening Registry. Altogether 379,000 invitations to screening were sent and 313,000 women participated in the programme (83%, Table 1). The screening invitations had a coverage of nearly 100% (Table 2). Approximately 97% of the women screened received a nor-mal screening result while about 3% were asked to come for further assessment in the screening centre. Around 2,500 women (0.8% of the screened) were referred to surgery and other further assessment performed in specialised medical care (Table 3). In all, the programme detected 1,988 invasive breast cancers or carcinomas in situ (0.6% of the screened), i.e. about six cases per one thousand women screened. About 5% of those referred to surgery lack the final, histologically confirmed diagnosis (n = 114). Most of these cases have been benign findings.

COMPARISON AGAINST EARLIER YEARS

Expansion of the target population for breast cancer screening to cover all women aged 50–69 years was realised in its entirety in 2016. Thus, invitational coverage increased until 2016, when virtually all members of the target population were invited to breast cancer screening every two years (Figure 2). In contrast, attendance at screening has declined slightly, falling from about 87% in 2005 to 83% in 2016 (Figure 2). The decrease in attendance has been similar in all age groups. The percentages of further assessments and cancerous findings for each person screened have remained roughly the same as in previous years. Expansion of the target age is also seen in the total number of breast cancers detected, which peaked in the statistics for 2015 and 2016.

3. BREAST CANCER SCREENING BY HOSPITAL DISTRICT

The invitational coverage and attendance vary by hospital district. In 2012–2016 the range of variation in attendance was 76–88% (Figure 3, Table 4). It is known that attendance in big cities is lower than elsewhere in Finland. As in previous years, the lowest attendance rate in 2016 was in Helsinki, where only 74% of those invited came for screening.

The results of screening have also varied depending on the hospital district (Figure 4, Figure 5, Table 5). In 2012–2016, the proportion of calls for further assessment ranged between 1.4 and 4.4%, the proportion of referrals to surgery between 0.6 and 1.1%

and the proportion of breast cancers detected between 0.5% and 0.8%. The regional differences stem from variation in the background risk as well as differences in practices and diagnostic criteria.den 0,5–0,8 %.

4. BREAST CANCER SCREENING BY POPULATION GROUP

The statistics for breast cancer screening in 2015–2016 were also produced for population groups. This annual review focuses on the mother tongue and the socio-economic status (Table 6, Table 7).

The women invited to breast cancer screening were divided into two categories, depending on their mother tongue. Finnish, Swedish and Sámi were counted as domestic languages. Missing information on the mother tongue was classified in the same category as other languages. People whose mother tongue was not one of the domestic languages were largely first and next generation immigrants. In most cases, the latest information on the socio-economic status was from 2014. Those whose socio-economic status could not be determined were classified as having an unknown socio-economic status.

The attendance at screening was clearly lower (65%) in the group of non-domestic languages than in the group of domestic mother tongues (83%). Women in this language group also had slightly fewer breast cancer findings (0.5% vs 0.7% of participants), which was probably caused by differences in the risk factors among population groups.

Differences giving cause for concern in terms of inequality were noted for attendance between women who were inactive (students, long-term unemployed, pensioners, socio-economic status unknown) and active (entrepreneurs, employees, workers) in working life. However, the probability of a breast cancer finding was roughly the same in all population groups except for pensioners, whose greater percentage of findings can probably be explained by higher age. It is important that population groups with a lower attendance rate would be better covered by screening.

5. BALANCE BETWEEN BENEFITS AND HARMS

The most notable benefits of breast cancer screening are associated with earlier cancer diagnoses enabling breast conserving therapies and the prevention of cancer deaths. Harmful effects include false positive and false negative test results, a longer life with breast cancer, and overdiagnosis. The last-mentioned means that screening also occasionally finds small, slowly growing tumours that would not have caused any symptoms or harm and would not have been detected without screening. Also, the ionising radiation used in mammography can, at least in calculations, have adverse effects in the target population (IARC 2016). The balance between the benefits and harms of screening depends essentially on the quality of activities and the age groups at which screening and early diagnosis are targeted. Despite these described harms, studies show that the benefits of breast cancer screening, for example for people aged 50–69 years, exceed its harms (IARC 2016).

PREVENTION OF BREAST CANCER DEATHS

Participation in breast cancer screening has been found to reduce breast cancer mortality by about 30–40% (Heinävaara et al. 2016, IARC 2016). The effect on breast cancer deaths at screening age (50–69 years) is about 40%. The smaller percentage (30%) also takes account of breast cancers and

breast cancer deaths for people older than 69 years. These estimates only consider the mortality from breast cancers detected after the first invitation to screening. Although most cancer deaths occur less than ten years after diagnosis, breast cancer deaths continue to accumulate for 20–25 years after the diagnosis. For lifelong benefit and harm estimates, it is therefore important to monitor breast cancers and breast cancer mortality among the population invited to screening for a long time after the end of the screening as well.

For people of screening age, screening for breast cancer reduces the incidence of breast cancers spread to the axillary lymph nodes or further by about 20% (Heinävaara et al. 2014, IARC 2016). However, their incidence returns to the pre-screening level within a couple of years after the last screening visit. Similarly, the benefit of screening to mortality decreases rapidly once screening has ended (Heinävaara et al. 2016).

As early as the 1990s, Hristova and Hakama (1997) predicted the age-group-specific effects that breast cancer screening targeted at women aged 50–69 years would have on mortality. In their predictions, they also took into account the breast cancers diagnosed before and after the screening age and among women who did not attend screening, as well as the subsequent deaths. According to these predictions, screening reduces breast cancer mortality by 8–30%, depending on the age group. The reduction is the smallest among women aged 50–54 years and the greatest among women aged 65–69 years. The predictions indicate that the current screening prevents about one hundred breast cancer deaths annually in Finland. Because all women aged 50–69 years in Finland have been within the scope of screening only since 2016, it has not yet been possible to make a more recent forecast.

Between 2011 and 2015, approximately 5,000 new cases of breast cancer were diagnosed in Finland, and about 40% of breast cancers were detected by means of screenings. During the same period, an average of 850 women died of breast cancer annually. Thus, the screening of women aged 50–69 years reduces breast cancer mortality by about ten per cent, when the impact of the benefit is proportioned to all breast cancer deaths in Finland. The lifelong probability of breast cancer incidence among women between 0 and 85 years of age was about 13%, and the probability of breast cancer death correspondingly was about 2.5% (Engholm et al. 2018).

SCREENING ALSO HAS HARMS

False positive and false negative screening results are harms caused by screening. The probability of false positive mammography findings among women attending screening is about 2.4% during one screening round. Similarly, when calculated for ten invitation rounds in the screening of women aged 50–69 years, about 18% of participants receive such a test result at least once during their lifetime (Singh et al. 2016).

A false negative screening result may appear as an interval cancer. Most interval cancers are caused by the fact that a rapidly growing tumour was not visible in the screening image. According to earlier studies, only in rare cases has a subsequent check revealed the cancer already in the screening image (Saarenmaa et al. 1999). Interval cancers are probably also detected in opportunistic testing.

Overdiagnosis is considered to be the most important harm of screening. It is estimated that breast cancer screening increases the incidence of breast cancer among those invited to screening in Finland by about

5–7% (Heinävaara et al. 2014). The estimate is based on a screening conducted in the Helsinki region, targeted at women aged 50–59 years. The study continued to monitor cancer mortality for 14 years after the end of screening, when the women invited to screening were 74 years old. On the basis of the result, it can be estimated that, owing to breast cancer screening, about 150–200 extra cases of breast cancer are detected annually in the whole of Finland. This is about 3–4% of all new cases of breast cancer. When seen against the breast cancer deaths prevented, this number of cases is about one and a half or two times higher. Since breast cancers associated with overdiagnosis have no underlying course of disease leading to death and the therapies are mostly light, the decrease in quality-adjusted life years is fairly small. It can thus be concluded that the benefits of breast cancer screening (impact on mortality) are clearly greater than the harms, also in terms of overdiagnosis (IARC 2016).

6.STUDY: ASSOCIATION BETWEEN SYMPTOMS AND THE RESULTS OF BREAST CANCER SCREENING

The Finnish Cancer Registry has studied the association between symptoms reported by those screened or the radiographer during the screening visit and the results of breast cancer screening and the breast cancer risk. The symptoms discussed in the studies are discharge from the breast, a lump, and retraction. Questions about these are on the screening form. The first article (Singh et al. 2015) focused on the association between symptoms and the breast cancer findings detected in the actual screening examinations among women aged 50–69 years who were screened in 2006–2010. Based on the study, especially a lump significantly increases the risk of breast cancer detected during that particular screening visit. The association between symptoms and the cancer finding at screening was emphasised further in women who had a large tumour, a poorly differentiated tumour type, or metastases in axillary lymph nodes.

The second article (Singh et al. 2016) focused on the association between symptoms and false and correct positive screening results among women aged 50–69 years who had been invited to screening in 1992–2012. When compared against symptomless women, the women who had reported symptoms had a higher cumulative probability for both false and correct positive screening results. However, in this study too, the risk varied greatly between various symptom types. Women who had reported several different symptoms had the greatest risk.

The third article (Singh et al. 2018) found that women who had reported symptoms had a significantly greater breast cancer risk also with respect to interval cancers and testing in the next screening round. For example, interval cancers were not generally local among women who had reported a lump, and also the risk of fatal screening and interval cancers had increased. The conclusion of the study was that women with symptoms should be referred more quickly to further assessment, including biopsy, and women with these symptoms should be examined at shorter intervals. Effort should also be made to improve knowledge of symptoms, and data on the principal symptoms indicating breast cancer should be collected more widely into the screening registry.

7. INTERNATIONAL COOPERATION PROJECT: EU-TOPIA

The Finnish Cancer Registry participates in the European research project EU-TOPIA (Towards improved screening for breast, cervical and colorectal cancer in all of

Europe). The aim of the project is to improve screening programmes for breast, cervical and colorectal cancer. The issues determined for this purpose include the scope, benefits, harms and cost-effectiveness of screenings. In the EU-TOPIA project, Finland's role is to define indicators describing benefits and harms, to determine the socio-economic and equity-related dimensions of screening, and to participate in the modelling of cost-effectiveness and the validation of models using the MISCAN software and Finnish materials.

The annual patient costs of breast cancers are about EUR 186 million (Torkki et al. 2018), whereas the estimated annual costs of the screening programme are about EUR 10 million. Thus, screening mammography only constitutes a relatively small item in the total costs of breast cancer. Owing to screening, the disease may be diagnosed earlier. This, in turn, may enable less aggressive and more conserving therapies. On the other hand, factors such as overdiagnosis may increase the costs of therapies slightly. As part of the EU-TOPIA project, a more detailed study on the harms, benefits and costs of breast cancer screening is underway in Finland. The main approach is the examination of lifetime effects instead of the previous cross-sectional surveys. History data on treating breast cancer have been collected for the examination, for instance, from Auria Biobank, located in connection with the Turku University Central Hospital. The material is used to estimate the costs of breast cancer in specialised medical care.

8. RECOMMENDATIONS AND CONCLUSIONS

The breast cancer screening programme has been in use in Finland for over thirty years, and has proved to be both effective and cost-effective. The programme has been subject to systematic, large-scale evaluation, and on the basis of the studies conducted it can be said that the benefits of activities have exceeded the harms. Despite this, assessment of benefits and harms is still needed in order to verify the effectiveness and potential problems of the programme in the future as well. Increasingly detailed information will also be needed, among other things, about the costs of treating breast cancer patients and about the benefits and harms of therapies so that the estimate of cost effectiveness can be specified. Evaluation of breast cancer screening also takes place in cooperation with international projects and networks. The evaluation practices used by Finland provide other countries with operating models, also for the utilisation of health economic models.

There have been marked differences in the quality of diagnostics, and apparently also in practices, between the actors of Finland's national programme. In consequence, the programme still shows great regional differences between hospital districts. Unification of the national programme requires the creation of a national and regional steering structure. One of the objectives of the steering structure must be to develop quality assurance for the screening programme. The regional ownership and service production structure of screening should be developed so that implementation decisions will be made in a population base that is large enough for the screening organisation. When women with symptoms participate in screening, effort must be made to improve the screening process so that their currently discovered clearly greater post-screening breast cancer risk can be brought under control.

In recent years, the attendance rate in the screening programme based on invitations has decreased from the previous level of nearly 90% to only about 83% in 2016. Effort must be made to improve attendance; the minimum target must be an attendance of at least 85%. A good attendance rate depends essentially on good invitational practices. The invitation letter should give a specific time and place for the imaging, and those who have not attended the screening should be sent a reminder letter. Compliance with good invitational practices should be included in monitoring of the screening programme quality, and the reasons for non-attendance should be determined through research. In addition, the mammograms and other images taken outside the screening programme, as well as the associated further assessment and treatments, should be encompassed by the evaluation system and quality assurance of screenings.

For the first time ever, this annual review assessed the connection between factors indicating social inequality and attendance at breast cancer screening and screening findings. Preliminary results show that screening still has significant problems indicating inequalities in health, including a lower attendance rate in population groups such as immigrants, the long-term unemployed, and people whose socio-economic status is unknown. In the future, inequality should also be reviewed from the perspective of the integrity of the screening process, treatment decisions, the effectiveness of screening, and the use of tests and services outside the programme. The provision of information concerning social and health inequalities must be included in the continuous evaluation and statistics production carried out in the Mass Screening Registry.

At the same time, indicators concerning inequality must be developed to meet present needs. The provision of information on the benefits and harms of screening must be intensified further among the target population. For instance, immigrants and other population groups with features of social inequality need varied and multichannel information about screenings, breast cancers and their symptoms, as well as preventive measures. This work has already started in the Finnish Cancer Registry and will continue actively in the years to come. Training on the benefits and harms of screening is also needed among health care actors and national, regional and local decision-makers. At present, there are many local and regional decision-makers, since the decisions concerning the implementation of screening are largely made by municipalities and joint municipal authorities.

AUTHORS

AHTI ANTTILA, Director of Research
MILLA LEHTINEN, Statistician
SIRPA HEINÄVAARA, Senior Researcher
DEEPENDRA SINGH, Researcher
MAIJU PANKAKOSKI, Researcher
TYTTI SARKEALA, Director of Screening

Mass Screening Registry, Finnish Cancer Registry, Helsinki

LINKS AND PUBLICATIONS

FINNISH CANCER REGISTRY

https://cancerregistry.fi/

INTERACTIVE SCREENING STATISTICS 1992–2016

https://cancerregistry.fi/statistics/

ANNUAL STATISTICS

https://cancerregistry.fi/statistics/screening-statistics/

Anttila A, Siljander I, Lönnberg S, Sarkeala T, Heinävaara S (2016) D2.3 Definition of equity. http://eu-topia.org/downloads/

Engholm, G. ym. (2018) Cancer Incidence, Mortality, Prevalence and Survival in the Nordic Countries, Version 8.1 (28.06.2018). Association of the Nordic Cancer Registries. Danish Cancer Society (viitattu 4.10.2018). Saatavilla internetissä: http://www.ancr.nu

Hakama M, Pukkala E, Heikkilä M, Kallio M (1997) Effectiveness of the public health policy for breast cancer screening in Finland: population based cohort study. BMJ 314(7084):864–7.

Heinävaara S, Sarkeala T, Anttila A (2014) Overdiagnosis due to breast cancer screening: updated estimates of the Helsinki service study in Finland. Br J Cancer 111(7): 1463–1468.

Heinävaara S, Sarkeala T, Anttila A (2016) Impact of organised mammography screening on breast cancer mortality in a case-control and cohort study. Br J Cancer 114(9): 1038–1044.

IARC (2016) Handbooks of Cancer Prevention: Breast Cancer Screening volume 15

Moring, B, Ramsay A, Turpeinen O (1996) Syöpä voidaan voittaa – 60 vuotta syöpätyötä. Suomen Syöpäyhdistys.

Saarenmaa I, Salminen T, Geiger U, Holli K, Isola J, Kärkkäinen A, Pakkanen J, Piironen A, Salo A, Hakama M (1999) The visibility of cancer on earlier mammograms in a population-based screening programme. Eur J Cancer 35(7):1118–22.

Siljander I, Lehtinen M, Makkonen P, Pankakoski M, Helander S, Sarkeala T, Heinävaara S, Anttila A (2016) D2.1 Definition of benefits and harms of cancer screening. http://eu-topia.org/downloads/

Siljander I, Heinävaara S, Sarkeala T, Pankakoski M, Anttila A (2016) D2.2 Definition of indicators. http://eu-topia.org/downloads/

Siljander I, Heinävaara S, Sarkeala T, Pankakoski M, Anttila A (2016) D2.4 Set of Benchmarks. http://eu-topia.org/downloads/

Singh D, Malila N, Pokhrel A, Anttila A (2015) Association of symptoms and breast cancer in population-based mammography screening in Finland. Int. J. Cancer 136(6): E630–E637.

Singh D, Pitkäniemi J, Malila N, Anttila A (2016) Cumulative risk of false positive test in relation to breast symptoms in mammography screening: a historical prospective cohort study. Breast Cancer Res Treat 159:305–313.

Singh D, Miettinen J, Duffy S, Malila N, Pitkäniemi J, Anttila A (2018) Association of symptoms and interval breast cancers in the mammography-screening programme: population-based matched cohort study. British Journal of Cancer.

TERMINOLOGY

BIOPSY
Tissue sample (core needle biopsy or open biopsy) or sampling of cells (fine needle aspiration biopsy). Histological confirmation of the diagnosis is always done on a tissue sample. Referral to surgery is generally based on a core needle biopsy, but the final diagnosis of breast cancer is usually made using an open biopsy.

CANCER INCIDENCE
The number of new cancer cases per population at risk during a given period.

FALSE POSTIVE SCREENING RESULT
A woman is called for further assessment or referred to surgery but the result is negative (no invasive breast cancer or carcinoma in situ of the breast).

FURTHER ASSESMENT
E.g. additional mammograms, ultrasound, pneumocystography, galactography, fine needle aspiration biopsy and core needle biopsy, or the combination of some of these.

MALIGNANT FINDING IN BREAST CANCER SCREENING

CARCINOMA *IN SITU*
A tumour where malignant cells have not penetrated deeper into the breast tissue but are present inside a duct or a gland lobule (ICD-10: D05).

INVASIVE BREAST CANCER
Breast cancer (ICD-10: C50).

MAMMOGRAPHY
X-ray imaging of breasts.

MORTALITY
The number of deaths per population at risk during a given period.

OPPORTUNISTIC TESTING
The testing of symptomless persons outside the organised screening programme in private or public health care services. Symptom-related testing and patient follow-up is also performed outside the screening programme. In most cases, the reason for outside testing is not known.

OVERDIAGNOSIS OF BREAST CANCER SCREENING
The diagnosis of a latent breast cancer or carcinoma in situ that would not affect the person's health during her lifetime.

SCREENING COVERAGE
Proportion of those invited to screening (invitational coverage) or attending screening (screening coverage) of the whole target population.

SCREENING PROCESS
Progression of screening from the definition of the target population and the sending of invitations all the way to testing, possibly further assessment, treatments and patient follow-up.

LIST OF FIGURES AND TABLES

FIGURE 2 **Attendance at breast cancer screening (%) and invitational coverage (%) in 1992–2016.**

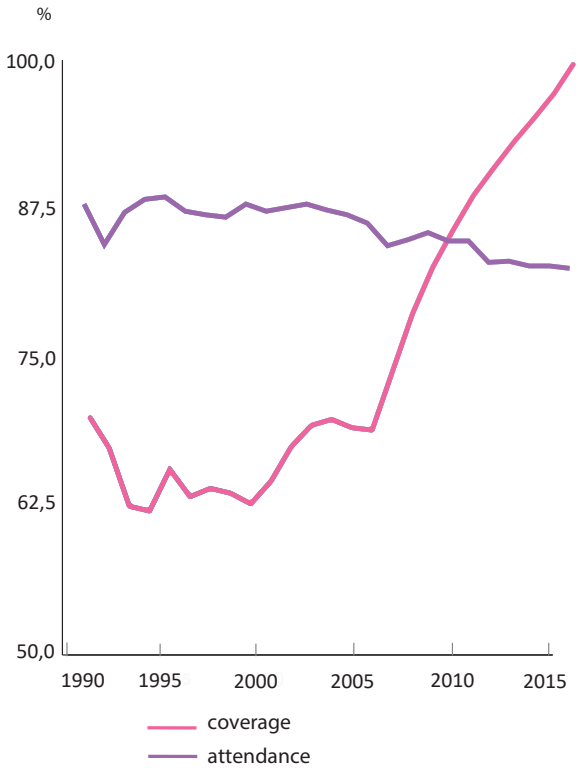

FIGURE 3 **Attendance at breast cancer screening (%) by hospital district in 2012–2016.**

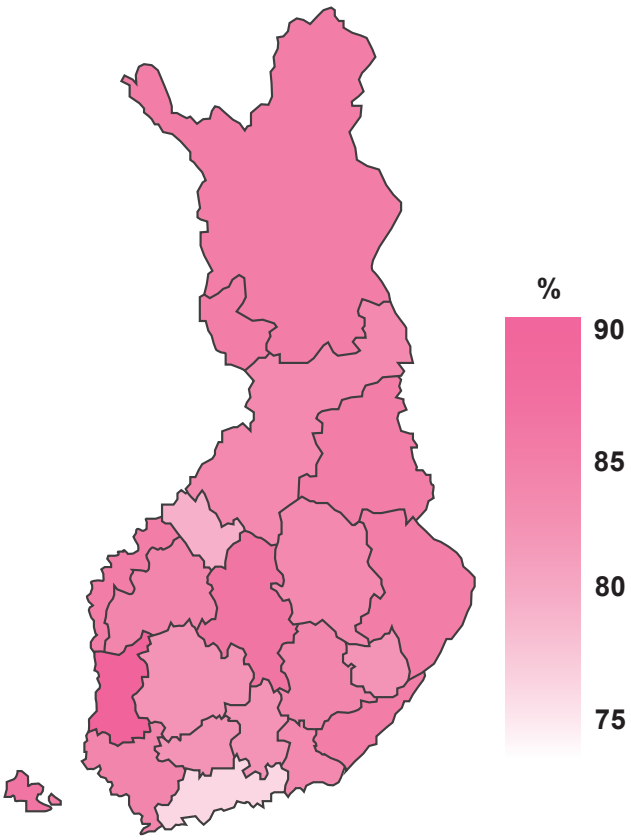

FIGURE 4 **Breast cancer screening recalls (%) by hospital district in 2012–2016.**

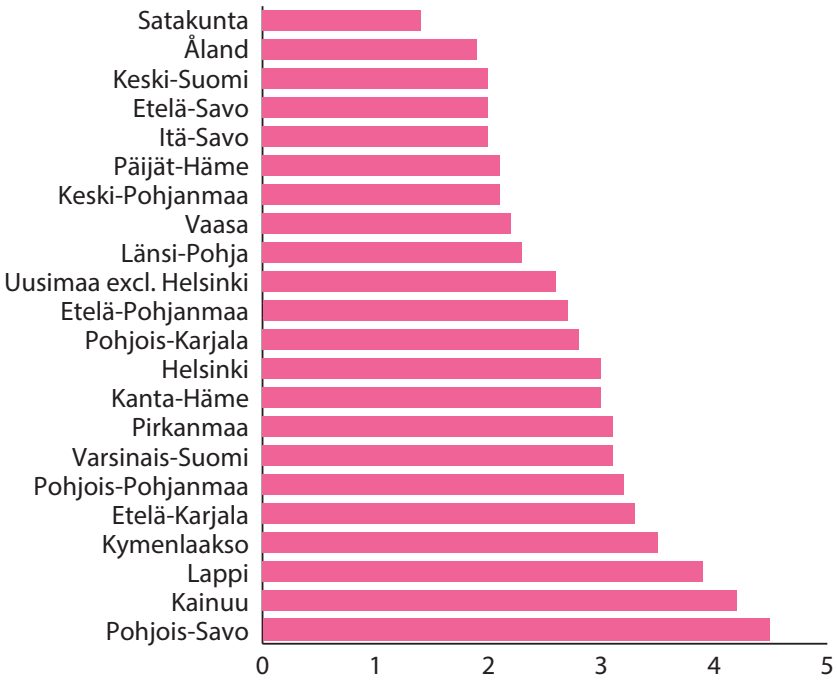

FIGURE 5 **Malignant findings in breast cancer screening (%) by hospital district in 2012–2016.**

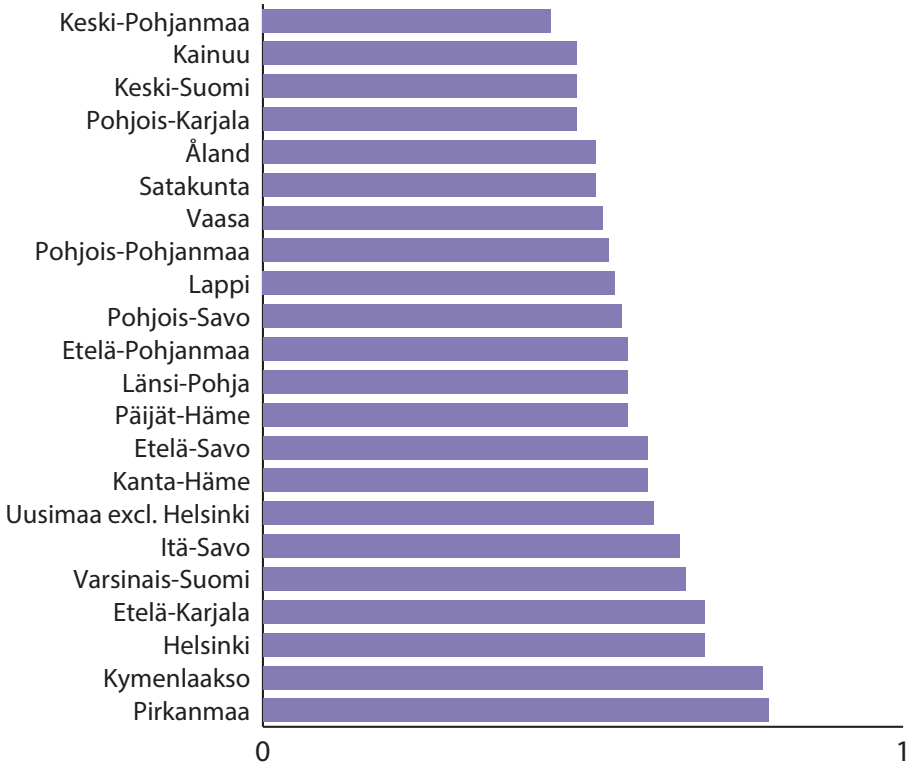

TABLE 1 Invitations and screenings within the breast cancer screening programme in 2016.

Age group	Invitations	Screenings	Attendance (%)
50–54	111 159	90 842	82
55–59	72 789	59 730	82
60–64	115 747	96 166	83
65–69	79 792	66 552	83
Total	379 487	313 290	83

TABLE 2 Invitational coverage of breast cancer screening in 2015–2016.

Age group	Target population	Invited during a-screening round	Invitational coverage (%)
50–54	185 565	184 932	100
55–59	184 657	184 232	100
60–64	191 263	191 018	100
65–69	196 248	195 954	100
Total	757 733	756 136	100

TABLE 3 Breast cancer screening results by age group in 2016.

Age group	Screenings	Recall		Core needle biopsy		Referral		Malignant finding	
		n	%	n	%	n	%	n	%
50–54	90 842	3 872	4,3	985	1,1	628	0,7	413	0,5
55–59	59 730	1 441	2,4	424	0,7	374	0,6	288	0,5
60–64	96 166	2 351	2,4	865	0,9	845	0,9	696	0,7
65–69	66 552	1 750	2,6	718	1,1	684	1,0	591	0,9
Total	313 290	9 414	3,0	2 992	1,0	2 531	0,8	1 988	0,6

TABLE 4 Invitations and screenings within the breast cancer screening programme by hospital district in 2012–2016.

Hospital district	Invitations	Screenings	Attendance (%)
Åland	10 584	9 306	88
Etelä-Karjala	46 503	39 897	86
Etelä-Pohjanmaa	58 158	49 611	85
Etelä-Savo	38 328	38 813	86
Helsinki	202 089	153 750	76
Itä-Savo	16 662	13 765	83
Kainuu	28 213	24 330	86
Kanta-Häme	52 360	43 572	83
Keski-Pohjanmaa	20 799	17 002	82
Keski-Suomi	79 040	68 165	86
Kymenlaakso	55 598	47 447	85
Lappi	43 608	36 895	85
Länsi-Pohja	22 825	19 185	84
Pirkanmaa	169 367	141 716	84
Pohjois-Karjala	60 406	51 901	86
Pohjois-Pohjanmaa	113 761	97 152	85
Pohjois-Savo	73 673	62 826	85
Päijät-Häme	79 654	66 498	84
Satakunta	77 042	67 324	87
Uusimaa excl. Helsinki	306 412	239 423	78
Vaasa	51 063	43 797	86
Varsinais-Suomi	162 650	138 046	85

TABLE 5 Breast cancer screening results by hospital district in 2012–2016.

Hospital district	Screenigs	Recall		Referral		Malignant finding	
		n	%	n	%	n	%
Åland	9 306	178	1,9	53	0,6	48	0,5
Etelä-Karjala	39 897	1 314	3,3	436	1,1	275	0,7
Etelä-Pohjanmaa	49 611	1 340	2,7	348	0,7	285	0,6
Etelä-Savo	32 813	663	2,0	297	0,9	198	0,6
Helsinki	153 750	4 581	3,0	1 174	0,8	1 055	0,7
Itä-Savo	13 765	281	2,0	111	0,8	89	0,7
Kainuu	24 330	1 024	4,2	163	0,7	119	0,5
Kanta-Häme	43 572	1 318	3,0	308	0,7	261	0,6
Keski-Pohjanmaa	17 002	363	2,1	115	0,7	77	0,5
Keski-Suomi	68 165	1 336	2,0	426	0,6	334	0,5
Kymenlaakso	47 447	1 660	3,5	510	1,1	369	0,8
Lappi	36 895	1 452	3,9	358	1,0	204	0,6
Länsi-Pohja	19 185	442	2,3	131	0,7	109	0,6
Pirkanmaa	141 716	4 355	3,1	1 330	0,9	1 126	0,8
Pohjois-Karjala	51 901	1 435	2,8	297	0,6	252	0,5
Pohjois-Pohjanmaa	97 152	3 114	3,2	700	0,7	524	0,5
Pohjois-Savo	62 826	2 779	4,4	512	0,8	350	0,6
Päijät-Häme	66 498	1 379	2,1	439	0,7	379	0,6
Satakunta	67 324	926	1,4	470	0,7	351	0,5
Uusimaa excl. Helsinki	239 423	6 135	2,6	1 831	0,8	1464	0,6
Vaasa	43 797	945	2,2	317	0,7	232	0,5
Varsinais-Suomi	138 046	4 304	3,1	1210	0,9	918	0,7

TABLE 6 Attendance at breast cancer screening and results by mother tongue in 2015–2016.

Mother tongue	Invited	Screenings		Recall		Referral		Malignant finding	
		n	%	n	%	n	%	n	%
Domestic	730 345	609 056	83,4	18 054	3,0	5 086	0,8	3 969	0,7
Other	29 275	18 973	64,8	628	3,3	137	0,7	87	0,5
Total	759 620	628 029	82,7	18 682	3,0	5 223	0,8	4 056	0,6

TABLE 7 Invitations and screenings within the breast cancer screening programme by socio-economic status in 2015–2016.

Sosioeconomic status	Invited	Screenings		Recall		Referral		Malignant finding	
		n	%	n	%	n	%	n	%
Entrepreneurs	40 662	33 510	82,4	1 018	3,0	250	0,7	184	0,5
Upper-level empl.	97 845	83 538	85,4	2 699	3,2	635	0,8	487	0,6
Lower-level empl.	229 040	200 143	87,4	6 093	3,0	1 539	0,8	1 160	0,6
Workers	81 122	67 808	83,6	1 991	2,9	501	0,7	374	0,6
Students	5 002	3 800	76,0	137	3,6	30	0,8	19	0,5
Pensioners	225 790	180 532	80,0	4 909	2,7	1 777	1,0	1 460	0,8
Long-term unempl.	63 106	48 027	76,1	1 460	3,0	400	0,8	303	0,6
Unknown	17 053	10 671	62,6	375	3,5	91	0,9	69	0,6
Total	759 620	628 029	82,7	18 682	3,0	5 223	0,8	4 056	0,6