

REPORT

2026

BreastScreen Norway 30 years, 1996-2025

Early performance measures and recent developments

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Foreword

Over the past 30 years, BreastScreen Norway has developed from a pilot project into a nationwide public health program. We are proud of its contribution to reducing breast cancer mortality and of the extensive knowledge it has generated on early detection, screening performance, communication, and early indicators of program effectiveness. These achievements have been possible only through the sustained commitment of multidisciplinary professional communities across Norway. We are deeply grateful to the radiographers, radiologists, pathologists, surgeons, oncologists, medical physicists, researchers, technical personnel, and administrative staff whose expertise and collaboration have shaped the program. We also extend our sincere appreciation to the women who have participated and placed their trust in BreastScreen Norway.

Looking ahead, artificial intelligence and more personalized screening strategies offer important opportunities to increase benefits, reduce harms, and use healthcare resources more effectively. Realizing this potential will require careful evaluation of the evidence, planning and establishment of robust quality assurance systems, in addition to continued multidisciplinary collaboration. It will also require modernization of the program's information technology infrastructure. Although the existing systems have supported BreastScreen Norway reliably for three decades, substantial upgrades are now essential to ensure that the program can remain safe, efficient, and responsive to future needs.

Oslo, October 2026

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Key messages

BreastScreen Norway has evolved from a pilot project in 1995/96 into a nationwide screening program that has invited 1.3 million women and detected more than 31,000 ductal carcinoma in situ (DCIS) and invasive breast cancers.

The results demonstrate a mature and high-performing screening program. BreastScreen Norway continues to detect breast cancers with favorable prognostic characteristics, including a high proportion of early-stage disease. This is consistent with the program's goal of reducing breast cancer mortality.

Attendance has increased in recent years and is now about 80%, reflecting public trust and strong engagement among women targeted by the program. Regular attendance is associated with more favorable early performance measures than irregular attendance.

A major strength of the program is its comprehensive quality assurance system, built on close collaboration with the breast centers, systematic monitoring and a unique national infrastructure for data collection, evaluation and research. These elements have been used to generate substantial knowledge on early detection of breast cancer and mammographic screening through more than 400 publications originating from the program. This knowledge provides a strong basis for the continuous improvement of BreastScreen Norway.

Executive summary

BreastScreen Norway was introduced in four counties in 1995/96 and became nationwide in 2005. The program currently targets approximately 700,000 women aged 50–69, who are offered mammographic screening every two years. Since its introduction, BreastScreen Norway has sent more than 7 million invitations and performed 5.4 million screening examinations among 1.1 million women.

Overall, this report shows stable and robust results over the program's 30-year history, which provide a solid foundation for further development, including implementation of new technologies and more personalized screening strategies.

Attendance

Among women who have received ten invitations to BreastScreen Norway, 93% have attended at least once. Annual attendance has increased from an average of 76% during the first 25 years to 78% during the period 2021–2025. In 2025, attendance reached almost 80%, the highest rate since the program became nationwide. Introduction of SMS reminders probably contributed to this increase. During 2021–2025, Fonna, Nordland, Rogaland and Sogn og Fjordane had the highest attendance rates, all exceeding 81%.

Attendance remained substantially lower among immigrant women than among non-immigrant women. During 2021–2025, 58% of immigrant women attended, compared to 81% of non-immigrants. The introduction of SMS reminders increased attendance rates in 2025 also among immigrant groups.

Recall for further assessment

The recall rate due to mammographic findings remained stable at 3–4% throughout the program's 30-year history. During 2021–2025, the rate was 3.1%, ranging from 1.6% in Telemark to 3.9% in Oslo. For prevalently screened women, the rate was 7.0%, while it was 2.4% among subsequently screened women. For regularly screened women, the rate was 2.2% while it was 3.4% for irregularly screened.

Among women who underwent further assessment, 56% had additional imaging only, while the remaining women also underwent needle biopsy.

Breast cancer detection

More than 31,400 breast cancers were detected in BreastScreen Norway, including 5,500 (18%) ductal carcinoma in situ (DCIS).

The detection rate was at its lowest (5.3 per 1000 screening examinations) in the years after the nationwide implementation and reached 6.4 during 2021–2025. For the last 5-year period, the detection rate was 7.7 for prevalently screened and 6.1 for subsequently screened. The rate was 5.7 for women who attended regularly and 9.7 for those who attended irregularly.

Approximately 8,400 interval cancers were diagnosed, accounting for nearly one quarter of all breast cancers detected. More than 65% of the interval cancers were diagnosed in the second year of the screening interval. The interval cancer rate has remained stable since the program started at approximately 1.8 per 1,000 screened women. For women screened 2019–2023, the rate was 1.9.

Histopathologic tumor characteristics

Screen-detected cancers generally had more favorable prognostic characteristics than interval cancers. They had smaller median tumor diameter (12.7 vs. 17 mm) and were less likely to involve lymph nodes (16 vs. 25%).

These findings indicate that breast cancers detected through screening are generally identified earlier and before the disease has progressed into symptomatic cancers. This is associated with more favorable prognosis, which is confirmed by studies showing reduced breast cancer mortality among women invited and women who actually attended BreastScreen Norway.

Hovedbudskap (norsk)

Mammografiprogrammet har utviklet seg fra et pilotprosjekt i 1995/96 til et landsdekkende screeningprogram. Siden oppstarten har 1,3 millioner kvinner i alderen 50-69 år blitt invitert og over 31 000 tilfeller av brystkreft og forstadier (duktalt karsinoma in situ) er påvist.

Resultatene viser at Mammografiprogrammet er et modent og velfungerende screeningprogram med høy kvalitet. Programmet fortsetter å påvise brystkreft, der en høy andel tilfeller er oppdaget i et tidlig stadium og svulstene har kjennetegn som gir grunnlag for god prognose. Dette er også i tråd med programmets mål om å redusere dødeligheten av brystkreft.

Deltakelsen har økt de siste årene og ligger nå på rundt 80%. Den høye oppslutningen tyder på at programmet har stor tillit i befolkningen og blant kvinnene som inviteres. Kvalitetsindikatorene viser at kvinner som møter regelmessig har større gevinst av screeningen enn de som møter uregelmessig.

En sentral styrke ved Mammografiprogrammet er den omfattende kvalitetssikringen, som bygger på tett samarbeid med brystsentrene, systematisk overvåking og en unik nasjonal infrastruktur for datainnsamling, evaluering og forskning. Disse elementene er grunnlaget for at programmet har kunnet bidra med betydelig kunnskap om tidlig oppdagelse av brystkreft og mammografiscreening, dokumentert gjennom mer enn 400 publikasjoner. Kunnskapen danner også et solid grunnlag for videre forbedringer av Mammografiprogrammet.

Sammendrag (norsk)

Mammografiprogrammet ble innført i fire fylker i 1995/96 og ble landsdekkende i 2005. Programmet omfatter i dag om lag 700 000 kvinner i alderen 50–69 år, som tilbys mammografiscreeing annethvert år. Siden oppstarten har programmet sendt ut mer enn 7 millioner invitasjoner og utført 5,4 millioner undersøkelser av 1,1 millioner kvinner.

Samlet viser rapporten stabile og solide resultater gjennom programmets 30-årige historie. Dette danner et godt grunnlag for videreutvikling av programmet, inkludert innføring av ny teknologi og mer persontilpassede strategier.

Oppmøte

Blant kvinnene som har fått ti invitasjoner til Mammografiprogrammet, har 93% møtt minst én gang. Årlig oppmøte har økt fra et gjennomsnitt på 76% de første 25 årene til 78% i perioden 2021–2025. I 2025 var oppmøtet nær 80%, som er det høyeste siden programmet ble landsdekkende. Innføringen av SMS-påminnelser har trolig bidratt til økningen. I perioden 2021–2025 hadde Fonna, Nordland, Rogaland og Sogn og Fjordane alle et oppmøte på over 81%.

Oppmøtet var betydelig lavere blant innvandrerkvinner enn blant norskfødte. I perioden 2021–2025 møtte 58% av innvandrerkvinnene til screening, sammenlignet med 81% av de norskfødte. Innføringen av SMS-påminnelser førte til økt oppmøte i 2025, også blant innvandrergrupper.

Tilleggsundersøkelser

Andelen kvinner som ble kalt tilbake for tilleggsundersøkelser på grunn av funn på mammografibildene har holdt seg stabil på 3–4% siden oppstart. I perioden 2021–2025 ble 3,1% av kvinnene tilbakekalt, med variasjoner fra 1,6% i Telemark til 3,9% i Oslo. Blant kvinner som møtte for første gang, var andelen 7,0%, mens den var 2,4% blant de som møtte i påfølgende screeningrunder. For kvinner med regelmessig oppmøte var andelen 2,2%, mot 3,4% for de som møtte uregelmessig.

Blant kvinner som fikk utført tilleggsundersøkelser, var det 56% som kun trengte tilleggsbilder, mens de øvrige også fikk utført nålebiopsi.

Deteksjon av brystkreft

Det ble påvist mer enn 31 400 tilfeller av brystkreft i Mammografiprogrammet, inkludert 5 500 (18%) tilfeller av duktalt karsinom in situ (DCIS).

Andel påviste brystkrefttilfeller var lavest (5,3 per 1000 undersøkelser) i årene etter at programmet ble landsdekkende, og nådde 6,4 i perioden 2021–2025. For den siste femårsperioden var deteksjonsraten 7,7 for kvinner som møtte for første gang og 6,1 for kvinner med påfølgende oppmøter. Raten var 5,7 for kvinner som møtte regelmessig, og 9,7 for kvinner som møtte uregelmessig.

Det ble diagnostisert 8 400 intervallkrefttilfeller, noe som utgjorde nesten en fjerdedel av all påvist brystkreft i programmet. Over 65% av intervallkrefttilfellene ble diagnostisert i det andre året av screeningintervallet. Forekomsten har holdt seg stabil siden programmet startet, på omtrent 1,8 per 1 000 screenede kvinner. For kvinner screenet i perioden 2019–2023, var raten 1,9.

Histopatologisk tumorkarakteristikk

Kvinner med screeningoppdaget brystkreft hadde generelt bedre prognose enn de som var diagnostisert med intervallkreft. Svulstene hadde mindre median diameter (12,7 mot 17 mm), og sjeldnere spredning til lymfeknuter i armhulen (16 mot 25%).

Funnene tyder på at brystkreft som oppdages ved screening, generelt blir identifisert tidligere og før sykdommen har utviklet seg til symptomatisk kreft. Dette er forbundet med en mer gunstig prognose, noe som bekreftes av studier som viser redusert dødelighet av brystkreft blant kvinner som har blitt invitert, og kvinner som faktisk har møtt, i Mammografiprogrammet.

Abbreviations, Terms and Definitions

Consensus If either of the two radiologists assigns a score of 2 or higher on an interpretation scale ranging from 1 to 5 for the screening mammograms, a consensus meeting is held to decide whether the woman should be recalled for further assessment.

Concordant interpretation A screening examination for which both radiologists assign an interpretation score of 1 or both have assigned a score of 2 or higher.

Discordant interpretation A screening examination for which one radiologist assigns an interpretation score of 2 or higher and the other assigns a score of 1.

DCIS (Ductal Carcinoma In Situ) The presence of abnormal cells inside a milk duct in the breast.

False-positive screening result Findings on the screening mammograms that lead to further assessment, but do not result in a breast cancer diagnosis.

IC (Interval Cancer) Breast cancer diagnosed within 2 years after screening following either a negative screening result or more than 6 months after a false-positive screening result.

Invasive breast cancer Breast cancers that has invaded the surrounding breast tissue.

NAT (NeoAdjuvant Treatment) Systemic treatment given before surgery to reduce tumor burden and improve treatment outcome.

Negative screening examination A screening examination assigned a score of 1 by both radiologists, or

dismissed after consensus, resulting in no recall for further assessment.

PACS (Picture Archiving and Communication System) A system for image storage and communication technology.

Positive screening examination A screening examination that results in a recall for further assessment.

Prevalent invitation/attendance A woman's first invitation to or attendance in BreastScreen Norway.

Recall Women are recalled for further assessment because of findings on the mammogram, clinical symptoms or unsatisfactory image quality.

SDC (Screen-Detected Cancer) DCIS or invasive breast cancer diagnosed as a result of recall assessment, and diagnosed within 6 months following a screening examination.

Subsequent invitation/attendance A woman's invitation to or attendance in BreastScreen Norway after her prevalent invitation or attendance.

Subsequent irregular attendance Attendance after missing one or more screening examinations since the previous attendance.

Subsequent regular attendance Attendance without missing any screening examinations since the previous attendance.

1. BreastScreen Norway

Thirty years ago, organized mammographic screening was introduced in Norway. Today, BreastScreen Norway is one of the country's largest and most extensively evaluated cancer prevention initiatives and constitutes a cornerstone in early detection of breast cancer in Norway. What began as a pilot project in four counties in 1995/1996 has evolved into a nationwide public health program (1–3). Over three decades, more than 7 million invitations have been dispatched, over 5 million screening examinations have been performed, and approximately 1.1 million women have participated in the program. Through this, approximately 31,400 ductal carcinomas in situ (DCIS) and invasive breast cancers have been detected through the program (4).

Beyond these numbers lies the program's most important achievement: contributing to fewer deaths from breast cancer. Studies have shown that invitation to BreastScreen Norway is associated with a 20% reduction in breast cancer mortality (5, 6), while the reduction is about 40% among those who have attended compared to non-attenders (7, 8).

BreastScreen Norway now targets about 700,000 women aged 50 to 69 years for biennial mammographic screening and is an integral part of the Norwegian public healthcare system. Implementation was staggered, with the program becoming nationwide in 2005. In addition to providing equitable access to high-quality mammographic screening, the program has established a robust and comprehensive infrastructure for quality assurance, evaluation, and research, contributing substantially to national and international knowledge on breast cancer screening (1, 2).

The organization, implementation, and early performance measures and outcomes of BreastScreen Norway have been described in several reports, where the most recent are "The Norwegian Breast Cancer Screening Program, 1996-2016: Celebrating 20 years of organised mammographic screening" (3), and "BreastScreen Norway: 25 years of organized screening" (1). Building on these reports, the present publication marks 30 years of organized mammographic screening in Norway and presents updated results on early performance measures and recent developments in these parameters.

At the time of publication, Norwegian health authorities are evaluating a potential expansion of the target population to include women aged 45–49 years and/or 70–74 years. This ongoing assessment reflects the maturity of mammographic screening as an established public health service and the increased body of evidence supporting the benefits of screening across age groups (9–11). Several other Eu-

ropean countries are considering age extensions of their breast cancer screening programs as well.

1.1 Organization of the screening program

Since the launch of organized mammographic screening in Norway, the Cancer Registry of Norway has served as the national coordinating center for BreastScreen Norway.

On 1 January 2024, the Cancer Registry became part of the Norwegian Institute of Public Health (NIPH) as part of a major reorganization of the Norwegian health administration. The Cancer Registry is now one of six divisions within NIPH. Through this organizational transition, the Cancer Registry has retained its established expertise and national responsibilities within BreastScreen Norway, while also benefiting from the broader resources and support functions of NIPH.

The Cancer Registry continues to serve as the national coordinating unit of BreastScreen Norway. Among its responsibilities is program administration and development, including invitation systems, information and communication activities, data collection and management, information technology solutions, quality assurance and improvements, program evaluation, and research. These activities are carried out in accordance with the Regulations on the collection and processing of personal health data at the Cancer Registry of Norway (the Cancer Registry Regulations) (12).

Throughout this report, the national coordinating unit of BreastScreen Norway is referred to as the Cancer Registry or the Cancer Registry of Norway.

Breast centers and regional health authorities

BreastScreen Norway is delivered in close collaboration between the Cancer Registry and the breast centers, which are administered by the regional health authorities. The regional health authorities have the overall responsibility for providing screening and follow-up services through the breast centers, which are part of the local health trusts. This includes mammographic screening, interpretation of screening mammograms, further assessment as well as diagnostics, treatment and follow-up when needed.

The breast centers play a key role in ensuring equitable access to high quality screening services across the country. Based on the framework provided by the regional health authorities and local health trusts, they are responsible for maintaining the facilities, equipment, and personnel

required to provide timely screening and assessment for women participating in the program (2, 13).

Today, women invited to BreastScreen Norway are offered screening at 31 screening units, including 27 stationary and 4 mobile units, organized within 16 screening areas and their corresponding breast centers (Table 1.1). The screening areas largely follow current and former county borders. To reduce travel burden and improve accessibility, some women are invited to attend screening in a neighboring screening area when this results in a shorter travel distance (14).

The health authorities, steering and advisory groups

The Ministry of Health and Care Services holds the overall responsibility for ensuring health and care services for the Norwegian population, including BreastScreen Norway. The Ministry is responsible for major policy decisions concerning the program. The Norwegian Directorate of Health has an important role in the national governance of the cancer screening programs and provides advice to the Ministry on the program's organization and development.

In 2022, the Directorate established a new governance structure for the three national cancer screening programs. A joint steering group, chaired by the Directorate, with representatives from the four regional health authorities, the Norwegian College of General Practice, the Norwegian Cancer Society, and the Cancer Registry of Norway was established. The steering group provides advice on matters concerning the programs' performance and development (15).

As part of this governance structure, the Directorate also established multidisciplinary advisory groups for each cancer screening program. In November 2025, the responsibility of these groups was transferred to the Cancer Registry. The BreastScreen Norway advisory group provides independent professional advice to the Cancer Registry on the administration, quality assurance and further development of the program.

In addition, advisory groups in radiology, radiography, pathology and medical physics continue to support BreastScreen Norway, as described in a previous report (1, 14).

Current birth cohorts and screening rounds

Due to the stepwise implementation of the program, the birth cohorts currently invited vary, as do the number of

completed screening rounds across screening areas (Table 1.1). The pilot program was launched in Rogaland, Hordaland, Akershus, and Oslo in 1995/1996, covering roughly 40% of women in Norway aged 50 to 69. These breast centers are now in their 16th screening round. The breast center that joined the program last, Vestfold, is currently in its 12th screening round.

The organizational structure of BreastScreen Norway has changed over time in response to changes in the healthcare system. Most recently, the breast centers in Hamar and Lillehammer merged in 2024 to form the breast center Innlandet, which is currently conducting its 2nd screening round.

The women's right to refuse permanent data storage

Participants in BreastScreen Norway have the right to refuse permanent storage of their personal information related to negative screening examinations, including name, personal identification number and address. Information from previous and future screening examinations of women who exercise this right are excluded from quality assurance, evaluation and research analyses. Information about this right is provided in the invitation letter and on the NIPH website (16).

To date, 1.2% of invited women and 1.4% of women who have attended screening have chosen to refuse permanent storage of information related to negative screening examinations (Table 1.2).

Table 1.1: Current birth cohorts, screening rounds, and screening periods in BreastScreen Norway by breast center, October 2026.

Screening area	Birth cohorts	Screening round	Start of round	End of round
Rogaland	1957-76	16	01.08.2026	30.06.2028
Hordaland	1957-76	16	19.01.2026	31.12.2027
Oslo	1957-76	16	11.02.2026	10.02.2028
Telemark	1957-76	14	01.08.2025	30.06.2027
Agder	1957-76	14	01.01.2026	31.12.2027
Troms og F	1957-76	14	01.08.2026	30.06.2028
Østfold	1957-76	13	01.08.2025	30.06.2027
Nordland	1957-76	13	01.08.2025	30.06.2027
Trøndelag	1957-76	13	15.10.2025	14.10.2027
Møre og R	1957-76	13	02.09.2026	30.06.2028
Sogn og F	1957-76	12	26.01.2025	27.01.2027
Vestfold	1957-77	12	01.01.2026	31.12.2027
Akershus Øst	1957-76	16	04.03.2026	28.02.2028
Vestre Viken	1957-76	9	23.02.2026	22.02.2028
Fonna	1957-76	4	01.01.2026	31.12.2027
Innlandet	1957-77	2	01.01.2026	31.12.2027

Table 1.2: Number (n) and proportions (%) of women who have refused permanent storage of data from negative screening examinations or opted out of future invitations, from program start through September 2026.

Screening area	Women refused permanent data storage			Opted out of the program	
	n	% of invited	% of attended	n	% of invited
Rogaland	1,387	1.4 %	1.6 %	2,909	3.0 %
Hordaland	2,177	1.8 %	2.0 %	2,657	2.2 %
Oslo	2,777	1.8 %	2.3 %	7,798	5.1 %
Telemark	554	1.1 %	1.3 %	1,567	3.2 %
Agder	845	1.1 %	1.3 %	2,768	3.6 %
Troms og F	974	1.5 %	1.7 %	1,553	2.3 %
Østfold	650	0.8 %	0.9 %	4,062	4.8 %
Nordland	573	1.0 %	1.1 %	1,679	2.9 %
Trøndelag	997	0.9 %	1.0 %	3,556	3.2 %
Møre og R	711	1.1 %	1.3 %	3,759	5.8 %
Sogn og F	210	0.8 %	0.9 %	692	2.7 %
Vestfold	494	0.8 %	0.9 %	2,673	4.3 %
Akershus Øst	1,404	1.2 %	1.4 %	4,473	4.0 %
Vestre Viken	1,356	1.1 %	1.2 %	5,359	4.2 %
Fonna	57	0.2 %	0.2 %	719	2.8 %
Innlandet	1,081	1.1 %	1.3 %	3,684	3.6 %
Total	16,247	1.2 %	1.4 %	49,908	3.7 %

Opting out

Women may opt out of BreastScreen Norway, temporarily or permanently. Approximately half of those who have opted out, have provided breast cancer diagnosis and follow-up outside the program as the reason. Overall, 3.7% of invited women have requested to opt out, ranging from 2.2% to 5.8% across screening areas (Table 1.2). Information on data processing, confidentiality, privacy, and the right to opt out, is available in the invitation letter and on the NIPH website (17).

Screening intervals

BreastScreen Norway invites women for biennial mammographic screening. Screening appointments are scheduled every two years $\pm$ six months (730 days $\pm$ 180 days). In operational terms, individual screening intervals are determined based on the date of a woman's last screening examination or date of invitation if she did not attend.

During 2021–2025, the median interval between two consecutive invitations was 735 days, and the median interval between two consecutive screening examinations following ordinary invitations was also 735 days (Table 1.3). Women who do not respond to their ordinary invitation, receive a reminder. During 2021–2025, the median time between an invitation and a reminder was 63 days (Table 1.3).

Women who attend screening following a reminder are invited again two years after the date of their screening examination. Attendance following reminders results in longer screening intervals for these women and a modest increase in the average interval in the program. Women who do not attend after the reminder receive a new invitation two years after their scheduled appointment.

The use of mobile screening units may also influence screening intervals. Mobile units remain at a screening site for up to 23 weeks, limiting the opportunity for women to attend at that location following a reminder. Once a mobile unit has moved, women generally need to attend screening at their nearest stationary screening unit.

Table 1.3: Median number of calendar days between invitations and screening examinations for women invited in 2021-2025.

Time between	Median	Interquartile range
Dispatch of two ordinary invitations	735	714-784
Dispatch of an ordinary invitation and the reminder	63	59-71
Two consecutive screening examinations following ordinary invitations	735	714-791
Two consecutive screening examinations following an ordinary invitation and a reminder	840	787-914
Two consecutive screening examinations regardless of invitation pattern	739	715-806

1.2 The Cancer Registry of Norway: Role and responsibilities

The Cancer Registry Regulations §1-9 provide the legal basis for the Cancer Registry at the NIPH to collect and process personal health data from individuals participating in BreastScreen Norway (12). This includes all women invited to the program who have not exercised their right to refuse storage of information from negative screening examinations.

Local health trusts and healthcare personnel are legally required to report cancer-related health information to the Cancer Registry (12, 18). Under the Cancer Registry Regulation §1-3, these data may be used to support the administration, management, planning, quality assurance, and evaluation of health services and health administration, as well as to produce official statistics and research (12).

When acting as the data controller, the Cancer Registry is responsible for ensuring that the processing of data in BreastScreen Norway complies with the Personal Data Act and the General Data Protection Regulation (GDPR). This includes the collection, storage, and use of data for administration, quality assurance, and research.

The use of data from BreastScreen Norway for research is subject to the same legal and ethical requirements as other research in Norway. Research projects must obtain the necessary approvals from the Regional Committees for Medical and Health Research Ethics (REK) where required, and applications for access to health data are submitted and processed through the Health Data Service (HDS).

Healthcare personnel involved in BreastScreen Norway have their professional identifier recorded together with information related to screening examinations. The purpose of this registration is program administration, monitoring, quality assurance, and quality improvement. Healthcare personnel have the right to refuse permanent storage of their professional identifier or equivalent identifier related to screening examinations (12, 19).

A quality assurance manual published by the Cancer Registry provides the foundation for BreastScreen Norway (2). The manual is based on European and other international guidelines and standards for breast cancer screening (20, 21).

Invitations

The Cancer Registry is responsible for ensuring that invitations, reminders and negative result letters are sent to women targeted by the program. The Cancer Registry plans the invitations for each screening round in close cooperation with the breast centers. For each municipality, invita-

tion schedules are developed to determine which women are invited to specific units and when they should be invited.

A custom IT program, the “Invitation Program”, automatically assigns eligible women to a screening appointment at a specific time and location. Invitations are generated and distributed three weeks before the scheduled appointment. Women who do not attend receive a reminder letter within 5-6 weeks, offering the opportunity to schedule a new appointment within four months.

All participants are informed about their screening result by letter or telephone. Notification of negative screening results is managed by the Cancer Registry, whereas women with positive screening results are contacted by the breast centers and recalled for further assessment.

Since March 2026, invitations, reminders and negative result letters in BreastScreen Norway have been distributed through Helsenorge, Norway’s national platform for digital health information and services (22). Helsenorge notifies its users of new messages through email, SMS and/or the Helsenorge-app. The platform is widely used by the Norwegian population and by May 2026, more than 90% of women invited to BreastScreen Norway received screening-related communication digitally through Helsenorge. Those who do not use Helsenorge, or do not open their message within five days despite reminders, receive the letters by regular mail.

From January to June 2025, BreastScreen Norway conducted a randomized implementation of SMS reminders to women invited to screening (23). The intervention was effective and increased attendance by approximately 4 percentage points among those who received an SMS reminder compared to those who did not. Consequently, since August 2025, all women invited to BreastScreen Norway have received an SMS reminder three days prior to their scheduled appointment, provided they are registered in the Contact and Reservation Register in Norway.

Information and communication

The Cancer Registry is responsible for providing information about BreastScreen Norway to women targeted by the program. The Cancer Registry also provides information about the program to healthcare professionals, other program stakeholders and the general public.

The primary objective is to provide women invited to screening with balanced, evidence-based and accessible information about mammographic screening to support informed decisions about participation. This information should also ensure that women have the practical information they need to make use of their screening invitation.

Women receive program information through personally addressed invitations, reminders, and result letters delivered

through Helsenorge. In areas served by mobile screening units, the Cancer Registry also provides general information to the municipalities to increase awareness of BreastScreen Norway and inform women when and where screening is available. For professionals working in the screening program, the Cancer Registry distributes newsletters and maintains a dedicated website. Also, regular webinars targeting professionals at the breast centers provide updates on program activities, ongoing projects, and new scientific findings from Norway and internationally.

Information for the general public is primarily presented through the NIPH website, social media, and press releases. The program website plays a central role in all outreach activities and is continuously updated with relevant information about BreastScreen Norway.

Collection and registration of screening data

The Cancer Registry maintains a national database containing information from BreastScreen Norway and is responsible for the registration, management and quality assurance of these data.

Data are recorded at the individual level, making it possible to follow each woman throughout the entire screening pathway, from invitation and screening examination to further assessment and diagnosis.

The screening database currently contains more than 200 variables describing the screening process and its outcomes. These include information on invitations, attendance, mammographic interpretation, recalls, assessment methods and outcomes, histopathological findings, and mammographic features.

Since 2010, the Norwegian Breast Cancer Registry has collected detailed information on diagnostic procedures, treatment, follow-up and recurrence for all breast cancers, including DCIS. This information can be merged with the screening data. Together, these linked data provide a unique resource for quality assurance, program evaluation, and breast cancer research.

IT systems

Reliable and purpose-built information technology has been a cornerstone of BreastScreen Norway since the program was established. From 1994 and until the start of the pilot project in November, dedicated software and database solutions were developed to support organized mammographic screening and enable secure exchange of information between the Cancer Registry, the breast centers, and the screening units. Today, these systems continue to support core program functions, including invitation management, screening administration, and communication of screening results. The system for distributing the invitations, re-

mindings, and negative result letters changed in March 2026 from an internal system to using an integration with the external system Helsenorge.

The IT infrastructure is based on distributed and replicated databases. This means storage of data in local databases and exchange of data between the screening units, breast centers and the Cancer Registry. Each breast center has a local database containing information from the breast center and its associated screening units. The radiology information system (RIS) in BreastScreen Norway, MedOutlook, provides access to the data for all involved partners and supports daily screening activities.

All screening mammograms are stored in the local health trusts' Picture Archiving and Communication Systems (PACS). Each examination is assigned a unique identifier that enables linkage between the mammographic images and the corresponding records in MedOutlook and MedKod. MedOutlook is an IT-system supporting screen reading and consensus meetings, while MedKod supports follow-up of screening findings.

Although the core architecture has served the program reliably for three decades, many components are now technically outdated. Modernization of the IT infrastructure is therefore a major strategic priority. Ongoing development aims to provide a more flexible and efficient platform capable of supporting emerging technologies, including artificial intelligence, and future developments such as more personalized screening approaches.

In parallel, substantial work is underway to modernize and further develop the software applications used by the breast centers in their daily screening activities. These systems must be adapted to current workflows, technological standards, and future program requirements to ensure continued high-quality screening services across Norway.

Quality assurance, improvement and research

Quality assurance and continuous quality improvement are core components of BreastScreen Norway. According to the quality assurance manual, the Cancer Registry is responsible for monitoring program performance, evaluating key quality indicators, and providing regular feedback to the breast centers (2).

Performance measures are reported in meetings, site visits and reports such as three to six annual topic-specific reports ("Minirapporter"), presenting results for each breast center. In addition, all breast centers have access to the quality assurance software, "MedStat", which enables ongoing monitoring of selected performance indicators and supports local quality improvement efforts (2, 13).

Most target values are based on published results from European screening programs and recommendations from

the European guidelines for breast cancer screening and diagnosis (20, 21). In some areas, BreastScreen Norway has established program-specific reference values informed by quality improvement initiatives, research findings, and expert consensus (13). The Cancer Registry Regulations permit quality assurance and quality improvement projects within BreastScreen Norway (12).

When performance indicators deviate from established target values, the Cancer Registry follows up with the relevant breast center. Examples include prolonged delays in screen reading or unusually high or low recall rates. If identified issues are not adequately addressed, the matter may be escalated to the Steering Group.

In addition to monitoring program performance, the Cancer Registry coordinates activities that support collaboration, learning, and quality improvement across the program. Regular meetings, workshops, and conferences bring together healthcare professionals from the breast centers to review results, share experiences, discuss challenges, and promote best practices. These activities play an important role in maintaining high and consistent quality throughout BreastScreen Norway.

The Cancer Registry and BreastScreen Norway have documented the program's contribution to reduced breast cancer mortality (5, 8), evaluated attendance patterns and social inequalities in screening participation (24, 25), and assessed

false-positive screening results and their impact on subsequent screening behaviour and breast cancer risk (26, 27). The last decade, research activities have increasingly focused on artificial intelligence, risk stratification, and personalized screening approaches. To date, data from BreastScreen Norway have resulted in more than 400 scientific publications and approximately 20 PhD degrees. Together, these activities have contributed substantially to national and international knowledge on breast cancer screening and have supported the continuous development of BreastScreen Norway.

Technical quality assurance and quality control

High technical quality of mammography equipment is essential for ensuring accurate image interpretation and maintaining the overall quality of BreastScreen Norway (28–30). The Cancer Registry and the regional health authorities share responsibility for the technical quality assurance and quality control of all mammography equipment used in the program, with the Cancer Registry serving in a coordinating role.

Technical quality control procedures are performed and evaluated by medical physicists at the local, regional, and national levels, in collaboration with radiographers at the breast centers. Responsibility for implementing any required follow-up measures rests with the local health trusts as owners of the mammography equipment.

2. Invitations and attendance

The primary aim of BreastScreen Norway is to reduce breast cancer mortality among women invited to the program through early detection of breast cancer. Chapters 2-8 present results from key performance indicators, including attendance, consensus and recall rates, cancer detection rates, positive predictive values, histopathological tumor characteristics, and mammographic features. Together, these indicators provide an important basis for program monitoring, quality assurance, evaluation, and research. In this report, invitations and examinations of women diagnosed with breast cancer before invitation are excluded from the analysis. This accounts for 5,000-10,000 invitations each year in the reporting period.

Chapter 2 presents the number of invitations and screening examinations, overall attendance rates, and attendance among women invited for a first (prevalent) or subsequent screening examination. In addition, attendance among women invited ten times and attendance by region of birth are presented.

2.1 Invitations

Over three decades (1996-2025), BreastScreen Norway has sent 7,036,765 invitations to 1,268,640 women across the country. The number of women invited annually increased from 228,580 in 2005 when BreastScreen Norway became nationwide, to 321,617 in 2025 (Figure 2.1, Table 2.1).

2.2 Attendance

Since 1996, 5,384,003 screening examinations have been performed among 1,098,147 women. After the screening program became nationwide in 2005, attendance in BreastScreen Norway declined from approximately 77% in 2006 to 74% in 2012 (Figure 2.2). After the temporary interruption of screening services during the COVID-19 pandemic in 2020 (1), attendance gradually increased and reached 79% in 2025, the highest national attendance rate reported since the program became nationwide (Table 2.1). Over the 30-year period, the average attendance rate following an ordinary invitation was 71%. Among women who received a reminder, the average attendance rate was 18%, corresponding to an almost five percentage-point increase in overall attendance, to about 76%.

During 2021–2025, the average attendance rate was 77.5%, with the highest rate observed in 2025 (79.4%). The introduction of SMS reminders in 2025 is likely to have con-

tributed to this increase (see Section 1.2). The highest attendance rates during the five-year period were observed in Rogaland, Nordland, Sogn og Fjordane, and Fonna, where more than 81% of invited women attended (Table 2.1). These screening areas have maintained high attendance rates since the program was established. Although attendance in Oslo remained below 75% during this period, which is within the acceptable range (13), it increased in 2025, reaching 73.1%.

Participation in BreastScreen Norway is influenced by a range of demographic, social, and healthcare-related factors (25, 31). Review studies have consistently shown lower attendance rates among immigrant women than non-immigrant women (32, 33). The underlying reasons are multifactorial and include barriers related to language, health literacy, cultural beliefs, and access to healthcare services (25, 34). A Norwegian registry-based study further demonstrated that the lower participation among immigrant women persists across socioeconomic strata (25). In addition, another study from Norway found slightly lower re-attendance among women with a false-positive compared with a negative screening result (27). Possible explanations include anxiety associated with the recall process, concerns about future false-positive findings, and negative experiences related to additional diagnostic examinations. The comparatively low attendance in Oslo may partly be explained by differences in population composition, including a higher proportion of immigrant women, as well as greater availability of mammographic examinations outside the organized screening program (31).

Studies conducted within BreastScreen Norway have provided additional insight into factors influencing participation. A randomized controlled trial found no difference in attendance between immigrant women receiving invitations in both Norwegian and their language of origin and those receiving invitations only in Norwegian (35). In contrast, SMS reminders increased attendance by approximately four percentage points among women who received them, with an even larger effect observed among immigrant women (23). Studies of Breast Cancer Awareness Month found no evidence of increased attendance during the campaign period (36), suggesting that the effect may be limited in an organized screening program, where appointments are pre-scheduled. Attendance has been shown to be higher at mobile screening units than at stationary units (80% versus 75%) (37). Further research is needed to better understand the persistent regional and socio-demographic differences in attendance observed across BreastScreen Norway.

Prevalent invitations represent a woman's first invitation to BreastScreen Norway, whereas subsequent invitations include all later invitations. According to the procedures (2), women aged 50 to 69 are offered ten screening examina-

tions. Throughout the program period, attendance following prevalent invitations has consistently been lower than attendance following subsequent invitations (Figure 2.3).

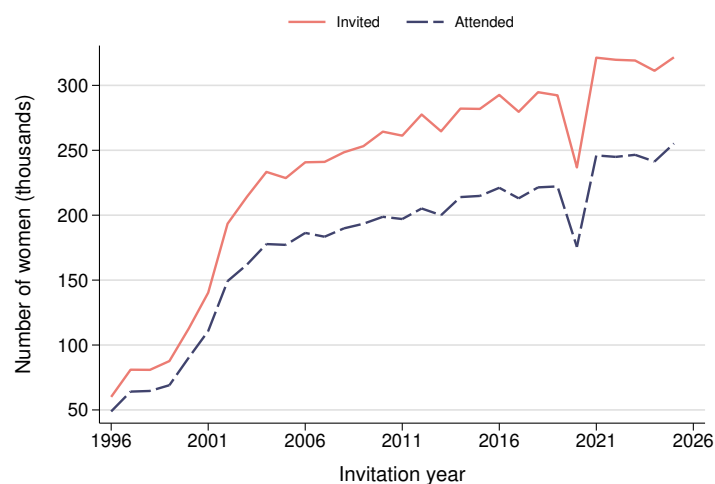


Figure 2.1: Annual number of women invited to and attended BreastScreen Norway by invitation year, 1996-2025.

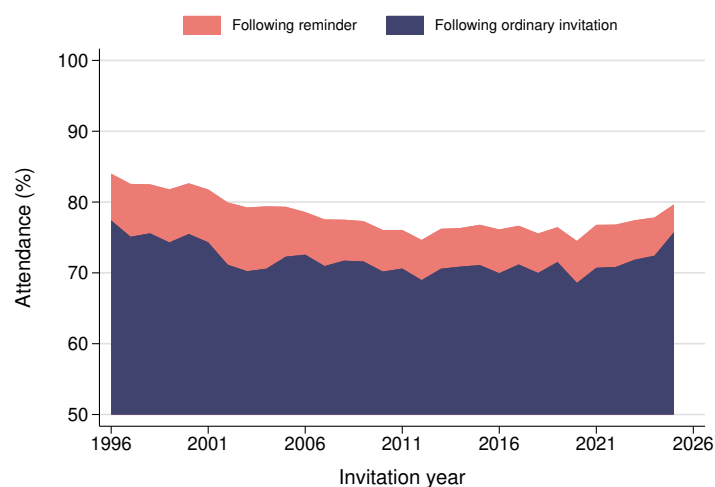


Figure 2.2: Attendance rate (%) in BreastScreen Norway following an ordinary invitation and a reminder by invitation year, 1996-2025.

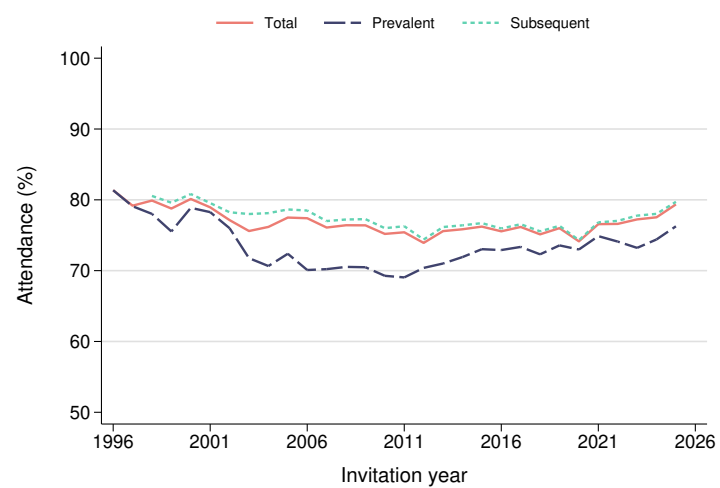


Figure 2.3: Attendance rate (%) in BreastScreen Norway among prevalently and subsequently invited women by invitation year, 1996-2025.

Table 2.1: Invitations (n) and attendance rate (%) in BreastScreen Norway by screening area and invitation year, for all invitations (upper table), prevalently invited (middle table) and subsequently invited (lower table), 2021-2025.

Total Screening area	Invitation year										Total	
	2021		2022		2023		2024		2025		n	%
	n	%	n	%	n	%	n	%	n	%		
Rogaland	19,759	81.0%	19,275	80.2%	17,235	80.3%	15,758	83.4%	21,711	82.5%	93,738	81.5%
Hordaland	25,898	77.0%	27,416	77.0%	26,265	78.3%	24,572	80.9%	30,528	81.4%	134,679	79.0%
Oslo	32,266	67.9%	33,818	70.0%	35,339	70.1%	34,268	71.0%	29,023	73.1%	164,714	70.4%
Telemark	12,817	75.0%	10,577	74.8%	11,991	76.2%	11,235	75.7%	10,912	78.5%	57,532	76.0%
Agder	19,504	79.3%	18,496	78.5%	17,488	79.4%	18,722	78.8%	17,922	80.8%	92,132	79.3%
Troms og F	15,837	77.9%	16,928	77.2%	15,908	76.9%	16,112	77.0%	16,135	78.8%	80,920	77.6%
Østfold	22,211	74.3%	21,106	74.9%	20,295	75.3%	20,851	75.2%	20,529	77.4%	104,992	75.4%
Nordland	15,174	82.1%	13,436	80.0%	13,461	82.5%	12,985	80.5%	13,863	83.2%	68,919	81.7%
Trøndelag	28,469	78.8%	26,923	79.5%	29,254	79.9%	26,044	80.2%	26,950	80.8%	137,640	79.8%
Oppland	13,009	78.4%	12,486	79.0%	15,152	78.0%					40,647	78.5%
Møre og R	15,971	78.0%	15,804	78.4%	14,616	79.9%	15,744	78.5%	16,074	80.8%	78,209	79.1%
Sogn og F	6,629	82.4%	6,760	81.1%	6,526	82.3%	6,567	82.9%	5,517	84.0%	31,999	82.5%
Vestfold	17,202	73.8%	16,256	74.7%	16,499	75.3%	15,762	76.5%	15,567	77.6%	81,286	75.5%
Hedmark	10,418	76.6%	11,780	76.8%	8,909	77.0%					31,107	76.8%
Akershus Øst	30,265	77.8%	28,818	76.0%	28,362	76.6%	26,657	75.8%	29,787	77.7%	143,889	76.8%
Vestre Viken	29,252	73.9%	29,656	75.0%	30,462	75.5%	31,657	76.1%	31,951	77.9%	152,978	75.7%
Fonna	6,643	80.7%	10,190	79.5%	11,404	82.5%	9,788	83.2%	10,667	84.1%	48,692	82.1%
Innlandet							24,528	77.4%	24,481	79.9%	49,009	78.7%
Total	321,324	76.6%	319,725	76.6%	319,166	77.2%	311,250	77.5%	321,617	79.4%	1,593,082	77.5%

Prevalent												
Rogaland	2,550	80.4%	3,273	77.4%	2,179	73.8%	1,927	81.4%	3,464	79.5%	13,393	78.5%
Hordaland	4,478	75.7%	2,652	75.3%	3,812	76.0%	4,191	79.5%	2,003	79.4%	17,136	77.1%
Oslo	4,568	65.8%	5,651	68.8%	4,000	68.5%	6,620	69.8%	2,244	70.0%	23,083	68.5%
Telemark	1,748	75.2%	1,649	70.8%	1,114	70.1%	1,514	71.1%	784	73.9%	6,809	72.2%
Agder	2,595	80.0%	3,029	76.4%	1,696	74.1%	2,314	76.0%	1,996	77.9%	11,630	77.1%
Troms og F	1,860	74.6%	2,106	73.9%	1,990	72.6%	2,225	73.7%	1,974	73.8%	10,155	73.7%
Østfold	4,142	71.6%	2,896	72.0%	2,537	72.1%	1,266	70.1%	2,772	76.3%	13,613	72.6%
Nordland	1,457	78.0%	1,897	77.0%	1,472	77.4%	1,585	72.6%	1,384	78.6%	7,795	76.7%
Trøndelag	2,014	77.3%	3,738	78.0%	4,866	77.2%	2,334	76.4%	3,326	77.5%	16,278	77.3%
Oppland	1,781	75.8%	1,387	75.1%	1,553	71.5%					4,721	74.2%
Møre og R	2,107	78.4%	2,050	72.0%	2,191	73.6%	1,599	72.2%	2,145	78.4%	10,092	75.1%
Sogn og F	770	78.6%	852	74.4%	741	74.1%	694	73.8%	596	79.9%	3,653	76.0%
Vestfold	2,055	71.8%	2,455	72.5%	1,588	70.6%	1,585	74.1%	1,490	73.6%	9,173	72.5%
Hedmark	836	74.0%	1,818	72.4%	355	69.0%					3,009	72.4%
Akershus Øst	4,289	77.0%	4,769	76.2%	3,075	72.3%	3,465	74.6%	4,052	76.2%	19,650	75.5%
Vestre Viken	3,944	74.2%	5,243	74.1%	2,582	69.8%	5,446	73.8%	2,184	72.9%	19,399	73.3%
Fonna	880	78.6%	1,153	75.4%	1,663	76.9%	1,465	80.5%	916	81.7%	6,077	78.4%
Innlandet							3,586	74.4%	2,500	73.4%	6,086	74.0%
Total	42,074	74.9%	46,618	74.1%	37,414	73.2%	41,816	74.4%	33,830	76.3%	201,752	74.5%

Subsequent												
Rogaland	17,209	81.1%	16,002	80.8%	15,056	81.2%	13,831	83.6%	18,247	83.1%	80,345	81.9%
Hordaland	21,420	77.3%	24,764	77.2%	22,453	78.7%	20,381	81.2%	28,525	81.5%	117,543	79.2%
Oslo	27,698	68.3%	28,167	70.2%	31,339	70.3%	27,648	71.3%	26,779	73.3%	141,631	70.7%
Telemark	11,069	75.0%	8,928	75.6%	10,877	76.8%	9,721	76.5%	10,128	78.9%	50,723	76.6%
Agder	16,909	79.2%	15,467	78.9%	15,792	80.0%	16,408	79.2%	15,926	81.1%	80,502	79.7%
Troms og F	13,977	78.4%	14,822	77.7%	13,918	77.5%	13,887	77.6%	14,161	79.5%	70,765	78.1%
Østfold	18,069	74.9%	18,210	75.4%	17,758	75.8%	19,585	75.5%	17,757	77.6%	91,379	75.8%
Nordland	13,717	82.5%	11,539	80.5%	11,989	83.1%	11,400	81.6%	12,479	83.7%	61,124	82.3%
Trøndelag	26,455	78.9%	23,185	79.8%	24,388	80.5%	23,710	80.6%	23,624	81.3%	121,362	80.2%
Oppland	11,228	78.8%	11,099	79.5%	13,599	78.8%					35,926	79.0%
Møre og R	13,864	78.0%	13,754	79.4%	12,425	81.0%	14,145	79.2%	13,929	81.2%	68,117	79.7%
Sogn og F	5,859	82.9%	5,908	82.1%	5,785	83.4%	5,873	84.0%	4,921	84.5%	28,346	83.3%
Vestfold	15,147	74.1%	13,801	75.1%	14,911	75.8%	14,177	76.8%	14,077	78.0%	72,113	75.9%
Hedmark	9,582	76.9%	9,962	77.6%	8,554	77.3%					28,098	77.3%
Akershus Øst	25,976	77.9%	24,049	76.0%	25,287	77.1%	23,192	76.0%	25,735	78.0%	124,239	77.0%
Vestre Viken	25,308	73.9%	24,413	75.3%	27,880	76.1%	26,211	76.6%	29,767	78.3%	133,579	76.1%
Fonna	5,763	81.0%	9,037	80.0%	9,741	83.5%	8,323	83.6%	9,751	84.3%	42,615	82.6%
Innlandet							20,942	77.9%	21,981	80.7%	42,923	79.3%
Total	279,250	76.8%	273,107	77.0%	281,752	77.8%	269,434	78.0%	287,787	79.7%	1,391,330	77.9%

2.3 Attendance after ten screening rounds

Since the start of the program, about 177,000 women have received ten invitations to screening. Among these, almost 50% have attended all ten screening examinations (Figure 2.4). An additional 16% attended nine of the ten screening examinations. Notably, only 7% of women who received ten invitations never attended organized mammographic screening. These findings illustrate a sustained confidence achieved by BreastScreen Norway and that most women participate at least once when offered repeated screening opportunities over time.

A study from BreastScreen Norway has shown that physical activity and smoking are associated with the number of screening examinations attended among women who have received ten invitations to BreastScreen Norway (38). However, further research is needed to better understand the factors underlying regular and irregular attendance over time.

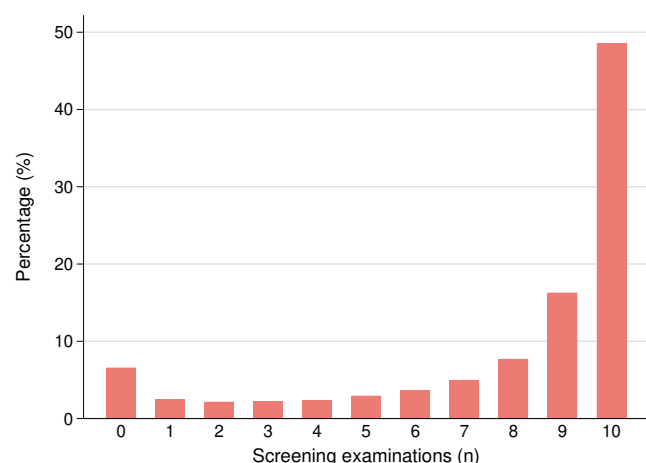


Figure 2.4: Percentage (%) of total number of attendances in BreastScreen Norway among women who have received ten invitations to screening.

2.4 Attendance among immigrants

In this report, immigrants are categorized into six groups based on country of birth according to the classification applied in Cancer in Norway 2025 (39).

Attendance in BreastScreen Norway among immigrant women has been reported to be lower than among women born in Norway (24, 32, 33, 40, 41). During 2021–2025, attendance remained relatively stable, averaging 58% among immigrant women compared with 81% among non-immigrant women (Figure 2.5). In 2025, attendance increased across all immigrant groups, as well as among Norwegian-born women (Table 2.2). The introduction of SMS reminders may have contributed to this increase.

BreastScreen Norway has continuously worked to increase attendance in the program among immigrants (24, 32, 35, 41). Studies suggest that differences in language, health literacy, cultural perceptions, and familiarity with the health-care system may contribute to lower participation. Similar patterns have been observed in other preventive health programs. Continued outreach and repeated invitations remain important, as participation may increase with longer duration of residence and greater familiarity with screening services.

Attendance is generally lower in urban than in rural areas, a pattern also observed in BreastScreen Norway during the last five years (Table 2.1). One possible contributor to this observed difference is the larger immigrant population in urban areas (31).

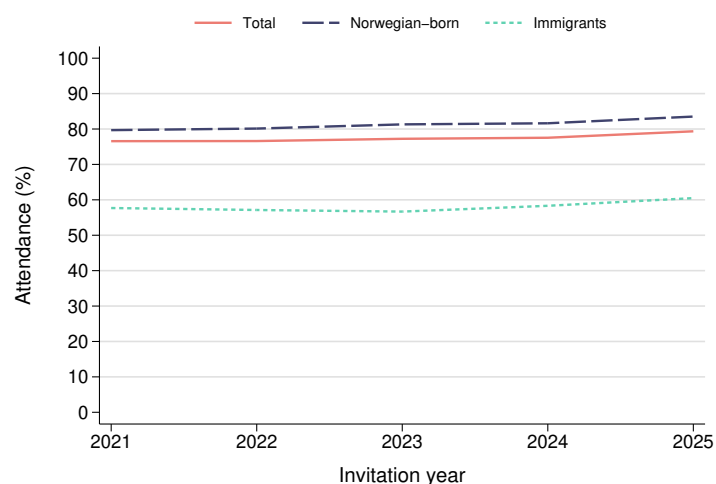


Figure 2.5: Attendance rate (%) in BreastScreen Norway among Norwegian-born and immigrants by invitation year, 2021-2025.

Table 2.2: Invitations (n) and attendance rate (%) in BreastScreen Norway by region of birth and invitation year, 2021-2025.

Region of birth	Invitation year											
	2021		2022		2023		2024		2025		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Norway	275,770	79.7%	270,666	80.1%	266,383	81.3%	256,710	81.6%	263,578	83.5%	1,333,107	81.2%
Nordic countries	6,100	74.7%	6,354	75.4%	6,151	76.4%	6,230	76.6%	6,155	79.5%	30,990	76.5%
Western Europe, North-												
America and Oceania	6,546	68.8%	7,168	69.0%	6,774	69.3%	7,222	70.7%	7,121	72.1%	34,831	70.0%
Other European Countries	10,911	50.5%	13,100	48.2%	15,182	48.5%	16,175	49.8%	17,702	51.5%	73,070	49.8%
The Middle East and Africa	7,068	48.1%	7,036	48.3%	8,034	47.4%	8,068	50.6%	8,963	53.5%	39,169	49.7%
Asia	11,670	54.9%	11,829	54.9%	13,064	55.1%	13,036	57.5%	14,284	61.5%	63,883	57.0%
Latin America												
and the Caribbean	1,884	60.7%	2,221	60.0%	2,122	62.3%	2,433	60.8%	2,385	64.0%	11,045	61.6%
Missing information	1,375	54.8%	1,351	55.4%	1,456	56.6%	1,376	60.0%	1,429	58.9%	6,987	57.1%
Total	321,324	76.6%	319,725	76.6%	319,166	77.2%	311,250	77.5%	321,617	79.4%	1,593,082	77.5%

3. Interpretation of screening mammograms

To ensure high-quality interpretation of screening mammograms, all examinations have been independently read by two radiologists since the program was established. Independent double reading with consensus for discordant scores is recommended in the European guidelines and has been shown to improve the detection of breast cancer compared with a single-reader (42–44). Artificial Intelligence (AI) is expected to play an increasing role in future screen reading and is currently being evaluated in mammographic screening programs worldwide. In Norway, the ongoing AIMS Norway study has evaluated the use of AI as a decision-support tool for radiologists since 2024 (45). As AI may influence several aspects of screening performance, including recall rates and cancer detection, implementation should be closely guided and monitored. Radiologists' performance has been shown to be related to reading volume,

and it is recommended that radiologists read at least 4,000 screening examinations annually (21, 46, 47).

In this chapter, the number of radiologists, number of screening examinations interpreted, individual interpretation scores, consensus rates, and discordant interpretations are presented.

3.1 Radiologists and interpretation scores

During screen reading, each breast is assigned an interpretation score from 1 to 5, reflecting the radiologist's level of suspicion of malignancy. A score of 1 indicates no suspicious findings; 2, probably benign findings; 3, intermediate suspicion; 4, probably malignant findings; and 5, a high suspicion of malignancy (47). The average time spent interpreting a screening examination is approximately 40 seconds (48, 49).

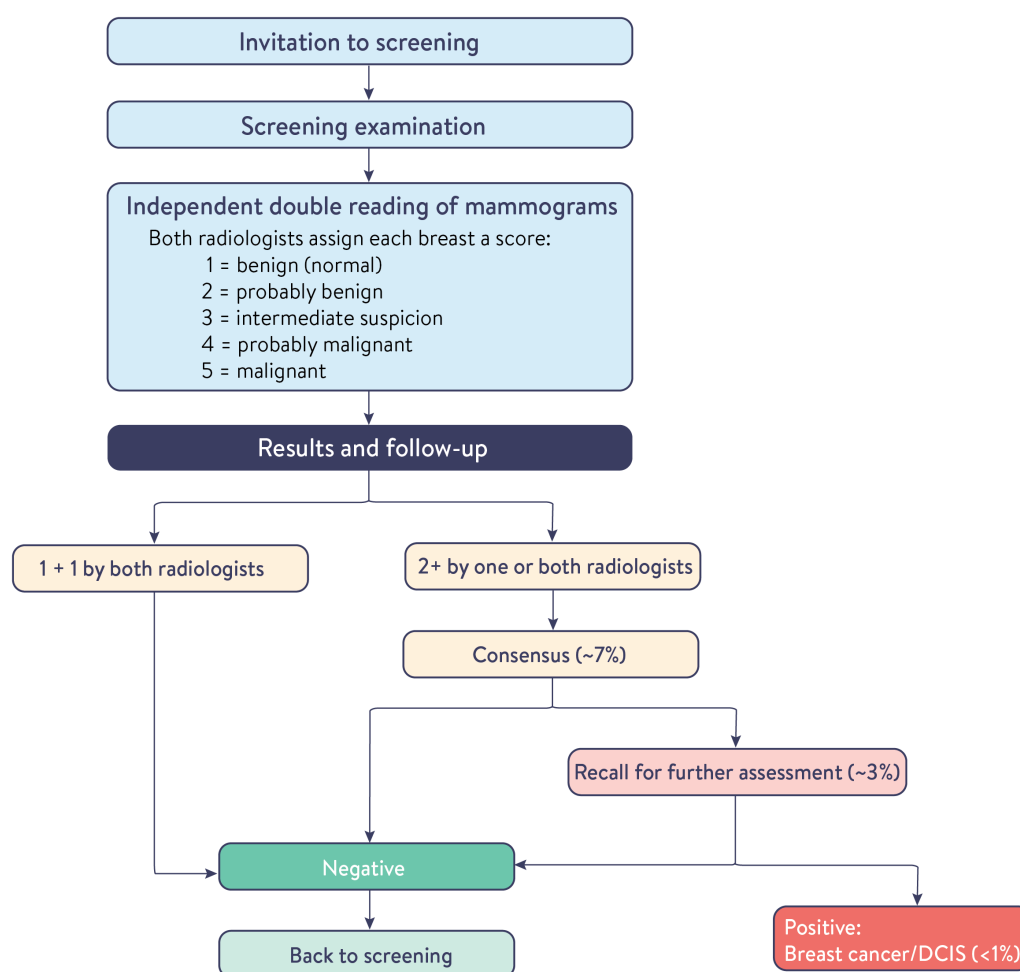


Figure 3.1: Flowchart of the interpretation procedure in BreastScreen Norway.

All screening mammograms are independently interpreted by two radiologists. Examinations scored as 1 in both breasts by both radiologists are considered negative. If either radiologist assigns a score of 2 or higher, the examination is reviewed at a consensus meeting to determine whether the woman should be recalled for further assessment. Consensus meetings are usually attended by two radiologists, with an average discussion time of 2–3 minutes per examination (48, 50). If consensus cannot be reached, a third radiologist is consulted. Examinations scored as 2 by both radiologists may be dismissed without discussion, whereas examinations assigned a score of 3 or higher are generally expected to result in recall. If such examinations are dismissed, the radiologist assigning the higher score should be informed of the final decision.

The number of radiologists involved in screening increased as BreastScreen Norway expanded nationwide. Between 2021 and 2025, approximately 100 radiologists participated

annually in screen reading (Table 3.1). The highest number was recorded in 2023, when 111 radiologists were involved in the interpretation of screening mammograms.

Between 1996 and 2025, 95% of all interpretations received a score of 1. Close to 80% of the remaining interpretations with scores of 2–5 had a score of 2 (Figure 3.2). Only 1.5% of those with a score 2–5 were assigned a score of 5, corresponding to less than 0.1% of all screen-reading assessments (51). The use of AI scores in BreastScreen Norway, including the management of screening examinations according to score level and the outcomes of subsequent assessment procedures, has been described in detail by Hovda and colleagues (52).

The predominance of low interpretation scores reflects the low prevalence of breast cancer in a screening population and highlights the importance of robust procedures for identifying the small proportion of examinations requiring further assessment.

Table 3.1: Number (n) of radiologists interpreting screening mammograms in BreastScreen Norway, and the mean (SD) and median (P25: 25th percentile, P75: 75th percentile) number of mammograms interpreted by the radiologists per year, 1996-2025. Radiologists with less than 300 annual screen-readings were excluded.

Year	Radiologists (n)	Mean number of readings	Standard deviation	Median number of readings	P25	P75
1996	18	6,565	2,425	6,701	4,093	8,447
1997	22	8,305	4,167	7,388	5,414	10,406
1998	22	8,747	4,162	8,630	5,251	11,804
1999	25	8,558	4,622	7,090	5,617	11,434
2000	35	8,010	4,362	6,623	4,746	10,165
2001	47	8,217	4,468	8,322	4,214	10,204
2002	58	8,519	4,488	8,307	4,565	11,973
2003	69	7,388	3,802	6,558	4,419	10,200
2004	73	7,115	3,382	7,274	4,750	9,574
2005	80	6,943	3,148	6,554	4,760	9,843
2006	81	7,005	3,677	6,397	4,247	9,131
2007	81	6,989	3,461	6,758	4,380	9,400
2008	80	6,990	3,274	7,032	4,080	9,234
2009	82	7,560	3,945	6,977	4,568	9,620
2010	79	7,346	3,352	7,448	4,501	8,965
2011	81	7,463	4,108	6,686	4,691	9,693
2012	77	7,698	3,508	7,549	5,143	9,434
2013	84	7,717	4,320	6,957	4,226	9,970
2014	86	7,690	4,300	6,264	4,492	11,321
2015	91	7,892	4,693	6,735	4,527	10,500
2016	94	7,327	4,350	6,196	4,447	9,351
2017	94	6,741	3,375	5,827	4,534	9,468
2018	94	6,978	3,550	6,447	4,695	9,179
2019	99	6,373	2,938	6,082	4,150	8,313
2020	94	5,330	2,663	5,031	3,536	6,284
2021	96	7,520	4,117	6,629	4,628	9,373
2022	108	7,338	4,186	6,794	4,166	8,989
2023	111	7,448	4,424	6,731	5,331	8,790
2024	101	7,342	3,553	7,574	4,613	9,744
2025	102	7,586	3,864	7,060	5,095	9,841

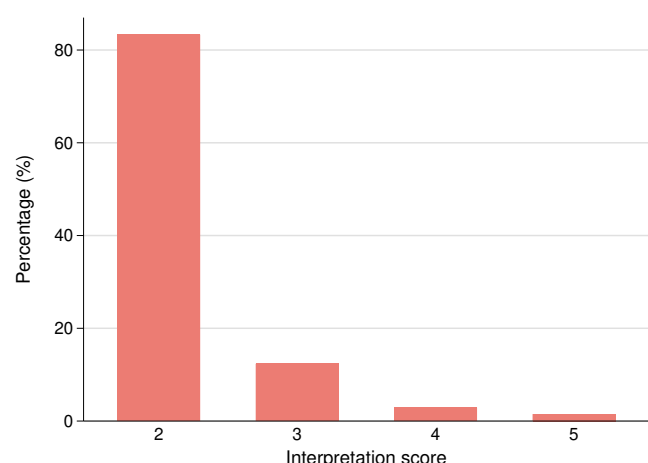


Figure 3.2: Distribution (%) of screen-readings in BreastScreen Norway with an interpretation score between 2 and 5; discussed in consensus, 1996-2025.

3.2 Consensus rates

The consensus rate, defined as the proportion of screening examinations discussed at a consensus meeting, has remained remarkably stable at around 7% throughout 30 years of organized screening in Norway (Figure 3.3). The lowest rate was observed in 1998 and the highest in 2007.

Consensus rates were consistently higher for prevalent screening examinations than for subsequent examinations, and lowest among regularly screened women. This pattern is likely explained by the absence of previous mammograms for comparison at a woman's first screening examination.

Between 2021 and 2025, the consensus rate was 7.5%, ranging from 4.4% in Telemark to 11.0% in Troms og Finnmark (Table 3.2). The lowest rate during these five years was observed in Telemark (3.2%) in 2021, and the highest, 13.4%, in Troms og Finnmark in 2022.

During the same period, the consensus rate was 16.1% for prevalent examinations and 6.0% for subsequent examinations, rates ranged from 7.0% in Telemark in 2021 to 27.7% in Troms og Finnmark in 2022 (Table 3.2). For subsequent examinations, the corresponding range was from 2.5% in Telemark in 2021 to 11.0% in Troms og Finnmark in 2022.

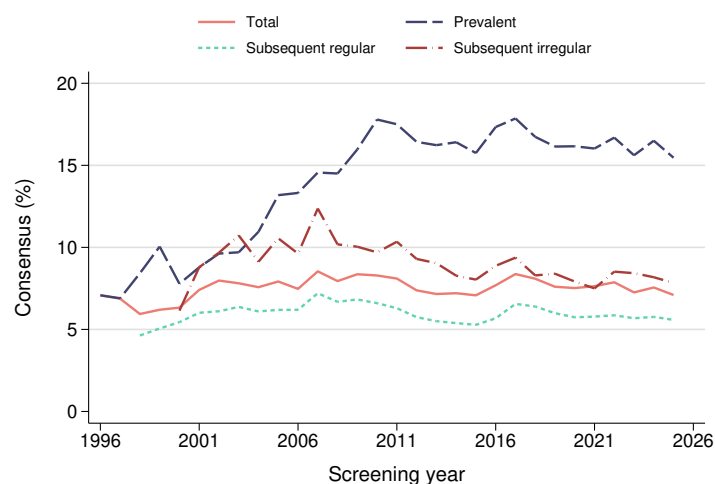


Figure 3.3: Consensus rate (%) in BreastScreen Norway among prevalently, subsequently regularly and irregularly screened by screening year, 1996-2025.

Table 3.2: Number of consensus meetings (n) and consensus rate (%) in BreastScreen Norway by screening area and screening year, for all screening examinations (upper table), prevalently screened (middle table) and subsequently screened (lower table), 2021-2025.

Total	Screening year											
	2021		2022		2023		2024		2025		Total	
Screening area	n	%	n	%	n	%	n	%	n	%	n	%
Rogaland	1,128	7.1%	1,500	9.6%	1,052	7.6%	958	7.2%	1,372	7.7%	6,010	7.9%
Hordaland	1,914	9.4%	1,658	8.1%	1,664	7.9%	1,542	7.6%	1,728	6.8%	8,506	7.9%
Oslo	1,975	9.0%	2,268	9.6%	2,274	9.1%	2,360	9.6%	2,169	10.0%	11,046	9.5%
Telemark	302	3.2%	404	5.0%	365	4.0%	458	5.3%	395	4.5%	1,924	4.4%
Agder	1,015	6.5%	809	5.6%	752	5.3%	886	5.9%	1,034	7.0%	4,496	6.1%
Troms og F	1,045	8.1%	1,728	13.4%	1,527	12.4%	1,388	11.1%	1,266	9.9%	6,954	11.0%
Østfold	1,362	8.3%	1,198	7.6%	967	6.3%	1,037	6.6%	1,282	7.9%	5,846	7.3%
Nordland	630	5.0%	636	5.8%	613	5.6%	828	7.8%	679	5.8%	3,386	6.0%
Trøndelag	1,296	6.0%	1,102	5.0%	1,456	6.2%	1,024	4.8%	1,421	6.4%	6,299	5.7%
Oppland	665	6.5%	634	6.4%	794	6.4%					2,093	6.4%
Møre og R	838	6.8%	994	8.0%	925	7.8%	857	6.9%	889	6.7%	4,503	7.2%
Sogn og F	387	7.2%	377	6.9%	343	6.4%	337	6.1%	260	5.4%	1,704	6.4%
Vestfold	696	5.6%	676	5.5%	647	5.5%	683	5.3%	615	5.0%	3,317	5.4%
Hedmark	628	7.7%	608	6.9%	563	7.3%					1,799	7.3%
Akershus Øst	1,464	6.4%	1,510	6.9%	1,364	6.2%	1,477	7.2%	1,662	7.0%	7,477	6.7%
Vestre Viken	2,803	13.1%	2,608	11.6%	2,219	9.6%	2,695	11.1%	1,826	7.8%	12,151	10.6%
Fonna	566	9.9%	520	7.0%	539	5.7%	596	7.2%	470	5.2%	2,691	6.7%
Innlandet							1,299	7.3%	1,238	6.2%	2,537	6.7%
Total	18,714	7.6%	19,230	7.9%	18,064	7.3%	18,425	7.6%	18,306	7.1%	92,739	7.5%

Prevalent												
Rogaland	442	17.5%	568	21.0%	299	16.6%	282	15.1%	524	15.2%	2,115	17.1%
Hordaland	615	16.8%	408	16.4%	584	15.1%	563	15.8%	399	14.6%	2,569	15.8%
Oslo	766	18.0%	881	19.8%	819	20.1%	990	19.0%	669	21.4%	4,125	19.6%
Telemark	103	7.0%	160	11.0%	95	10.0%	164	11.5%	99	11.2%	621	10.0%
Agder	253	11.5%	279	11.1%	167	10.2%	221	10.1%	310	16.0%	1,230	11.8%
Troms og F	301	16.8%	511	27.7%	455	25.4%	470	23.5%	397	21.0%	2,134	22.9%
Østfold	458	14.3%	387	15.1%	279	11.7%	198	14.5%	412	14.8%	1,734	14.1%
Nordland	144	11.0%	248	14.3%	171	13.1%	249	16.5%	185	14.5%	997	14.0%
Trøndelag	308	12.6%	310	10.4%	462	11.1%	233	10.0%	419	12.7%	1,732	11.4%
Oppland	208	13.6%	186	15.2%	239	15.5%					633	14.7%
Møre og R	316	14.6%	283	15.6%	295	14.8%	218	14.3%	304	13.9%	1,416	14.6%
Sogn og F	103	14.9%	113	13.7%	89	15.5%	96	12.7%	55	9.5%	456	13.3%
Vestfold	247	13.7%	277	12.9%	172	14.3%	232	12.7%	188	11.9%	1,116	13.0%
Hedmark	190	18.5%	245	16.0%	101	19.1%					536	17.4%
Akershus Øst	538	13.9%	676	16.2%	485	14.9%	552	17.5%	533	13.7%	2,784	15.2%
Vestre Viken	1,055	27.1%	942	22.8%	619	21.2%	1,085	24.7%	563	20.5%	4,264	23.6%
Fonna	141	18.2%	143	13.4%	186	13.8%	226	15.6%	130	12.8%	826	14.6%
Innlandet							407	13.9%	337	14.3%	744	14.1%
Total	6,188	16.0%	6,617	16.7%	5,517	15.6%	6,186	16.5%	5,524	15.5%	30,032	16.1%

Subsequent												
Rogaland	686	5.2%	932	7.3%	753	6.2%	676	5.9%	848	5.9%	3,895	6.1%
Hordaland	1,299	7.8%	1,250	6.9%	1,080	6.2%	979	5.8%	1,329	5.9%	5,937	6.5%
Oslo	1,209	6.8%	1,387	7.3%	1,455	7.0%	1,370	7.1%	1,500	8.1%	6,921	7.2%
Telemark	199	2.5%	244	3.7%	270	3.3%	294	4.0%	296	3.8%	1,303	3.4%
Agder	762	5.7%	530	4.4%	585	4.7%	665	5.2%	724	5.6%	3,266	5.2%
Troms og F	744	6.7%	1,217	11.0%	1,072	10.1%	918	8.7%	869	7.9%	4,820	8.9%
Østfold	904	6.8%	811	6.1%	688	5.3%	839	5.8%	870	6.5%	4,112	6.1%
Nordland	486	4.4%	388	4.2%	442	4.6%	579	6.3%	494	4.8%	2,389	4.8%
Trøndelag	988	5.2%	792	4.2%	994	5.2%	791	4.2%	1,002	5.3%	4,567	4.8%
Oppland	457	5.2%	448	5.2%	555	5.1%					1,460	5.1%
Møre og R	522	5.1%	711	6.7%	630	6.4%	639	5.9%	585	5.3%	3,087	5.9%
Sogn og F	284	6.0%	264	5.7%	254	5.3%	241	5.0%	205	4.9%	1,248	5.4%
Vestfold	449	4.2%	399	3.9%	475	4.5%	451	4.1%	427	4.0%	2,201	4.1%
Hedmark	438	6.2%	363	5.0%	462	6.4%					1,263	5.9%
Akershus Øst	926	4.8%	834	4.7%	879	4.7%	925	5.4%	1,129	5.7%	4,693	5.1%
Vestre Viken	1,748	10.0%	1,666	9.1%	1,600	7.9%	1,610	8.1%	1,263	6.1%	7,887	8.2%
Fonna	425	8.6%	377	6.0%	353	4.3%	370	5.4%	340	4.2%	1,865	5.4%
Innlandet							892	6.0%	901	5.1%	1,793	5.5%
Total	12,526	6.1%	12,613	6.2%	12,547	5.9%	12,239	5.9%	12,782	5.8%	62,707	6.0%

3.3 Discordant interpretation scores

A screening examination is considered discordant when one radiologist assigns a score of 1 to both breasts, while the other assigns a score of 2 or higher to one or both breasts. Both discordant examinations and examinations with concordant positive scores (a score of 2 or higher assigned by both radiologists) are discussed at a consensus meeting. Approximately 25% of discordant examinations and 75% of examinations with concordant positive scores are recalled for further assessment (44).

During 2021–2025, discordant interpretations accounted for 76% of all examinations discussed at consensus, ranging from 64% in Telemark to 86% in Fonna (Table 3.3). This finding highlights that most consensus discussions arise from differences in interpretation scores between radiologists rather than from agreement on positive findings.

The proportion of discordant interpretations was lower among prevalently screened women than among subsequently screened women (Table 3.4). During 2021–2025, 70% of prevalent examinations discussed at consensus had discordant scores, compared with 76% of subsequent examinations.

Table 3.3: Proportion (%) of discordant interpretation scores among cases discussed at consensus in BreastScreen Norway, by screening area and screening year, 2021-2025.

Screening area	Screening year											
	2021		2022		2023		2024		2025		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Rogaland	71.3%	71.4%	73.8%	79.1%	73.2%	78.8%	68.4%	73.4%	79.0%	80.7%	73.8%	77.0%
Hordaland	62.0%	71.4%	68.6%	68.6%	63.7%	66.1%	62.7%	70.1%	67.7%	73.3%	64.5%	70.1%
Oslo	71.8%	76.3%	71.1%	78.7%	71.8%	78.4%	73.2%	80.7%	70.1%	75.0%	71.7%	77.8%
Telemark	67.0%	64.8%	65.6%	57.8%	62.1%	55.6%	63.4%	64.6%	71.7%	77.0%	65.7%	64.3%
Agder	72.7%	77.7%	73.5%	80.4%	73.7%	85.5%	74.7%	84.7%	80.0%	84.5%	75.2%	82.5%
Troms og F	70.4%	79.2%	69.1%	79.0%	69.2%	78.5%	65.5%	75.1%	68.0%	75.5%	68.3%	77.5%
Østfold	71.6%	79.4%	74.4%	76.8%	72.4%	80.8%	74.7%	79.4%	71.1%	81.5%	72.6%	79.6%
Nordland	70.1%	74.5%	77.0%	76.3%	70.8%	75.8%	73.9%	76.9%	71.4%	73.7%	73.1%	75.4%
Trøndelag	67.5%	76.2%	72.9%	76.5%	76.6%	82.7%	70.4%	78.3%	76.6%	81.1%	73.5%	79.1%
Oppland	70.2%	75.9%	69.4%	75.2%	67.4%	80.5%					68.9%	77.5%
Møre og R	58.2%	64.4%	58.7%	67.5%	64.1%	65.2%	56.0%	66.8%	64.8%	73.2%	60.6%	67.4%
Sogn og F	82.5%	86.6%	74.3%	83.0%	69.7%	85.0%	71.9%	83.8%	85.5%	82.9%	76.1%	84.4%
Vestfold	70.9%	76.4%	71.8%	74.4%	76.7%	71.4%	66.8%	71.8%	71.8%	78.7%	71.3%	74.5%
Hedmark	60.5%	75.6%	66.1%	73.3%	68.3%	71.0%					64.6%	73.2%
Akershus Øst	74.2%	74.4%	73.4%	75.1%	68.0%	77.5%	72.1%	81.3%	75.6%	81.5%	72.8%	78.2%
Vestre Viken	61.9%	73.1%	64.3%	73.7%	62.7%	76.4%	66.2%	74.8%	68.9%	77.3%	64.6%	74.9%
Fonna	75.9%	84.7%	72.7%	84.6%	78.0%	87.3%	75.2%	85.4%	78.5%	87.6%	76.0%	85.8%
Innlandet							70.8%	78.8%	69.1%	76.8%	70.0%	77.8%
Total	68.1%	75.1%	70.1%	75.4%	69.4%	76.6%	68.9%	76.7%	72.3%	78.1%	69.7%	76.4%

Table 3.4: Proportion (%) of discordant interpretation scores among cases discussed at consensus for prevalently (pre) and subsequently (sub) screened women in BreastScreen Norway, by screening area and screening year, 2021-2025.

Screening area	Screening year											
	2021		2022		2023		2024		2025		Total	
	Pre	Sub	Pre	Sub	Pre	Sub	Pre	Sub	Pre	Sub	Pre	Sub
Rogaland	71.3%	71.4%	73.8%	79.1%	73.2%	78.8%	68.4%	73.4%	79.0%	80.7%	73.8%	76.8%
Hordaland	62.0%	71.4%	68.6%	68.6%	63.7%	66.1%	62.7%	70.1%	67.7%	73.3%	64.5%	70.1%
Oslo	71.8%	76.3%	71.1%	78.7%	71.8%	78.4%	73.2%	80.7%	70.1%	75.0%	71.7%	77.9%
Telemark	67.0%	64.8%	65.6%	57.8%	62.1%	55.6%	63.4%	64.6%	71.7%	77.0%	66.0%	64.6%
Agder	72.7%	77.7%	73.5%	80.4%	73.7%	85.5%	74.7%	84.7%	80.0%	84.5%	75.3%	82.5%
Troms og F	70.4%	79.2%	69.1%	79.0%	69.2%	78.5%	65.5%	75.1%	68.0%	75.5%	68.4%	77.6%
Østfold	71.6%	79.4%	74.4%	76.8%	72.4%	80.8%	74.7%	79.4%	71.1%	81.5%	72.9%	79.7%
Nordland	70.1%	74.5%	77.0%	76.3%	70.8%	75.8%	73.9%	76.9%	71.4%	73.7%	73.3%	75.5%
Trøndelag	67.5%	76.2%	72.9%	76.5%	76.6%	82.7%	70.4%	78.3%	76.6%	81.1%	73.7%	78.9%
Oppland	70.2%	75.9%	69.4%	75.2%	67.4%	80.5%					68.9%	77.5%
Møre og R	58.2%	64.4%	58.7%	67.5%	64.1%	65.2%	56.0%	66.8%	64.8%	73.2%	60.7%	67.6%
Sogn og F	82.5%	86.6%	74.3%	83.0%	69.7%	85.0%	71.9%	83.8%	85.5%	82.9%	76.4%	84.4%
Vestfold	70.9%	76.4%	71.8%	74.4%	76.7%	71.4%	66.8%	71.8%	71.8%	78.7%	71.2%	74.4%
Hedmark	60.5%	75.6%	66.1%	73.3%	68.3%	71.0%					64.6%	73.2%
Akershus Øst	74.2%	74.4%	73.4%	75.1%	68.0%	77.5%	72.1%	81.3%	75.6%	81.5%	72.8%	78.3%
Vestre Viken	61.9%	73.1%	64.3%	73.7%	62.7%	76.4%	66.2%	74.8%	68.9%	77.3%	64.6%	74.9%
Fonna	75.9%	84.7%	72.7%	84.6%	78.0%	87.3%	75.2%	85.4%	78.5%	87.6%	76.1%	85.8%
Innlandet							70.8%	78.8%	69.1%	76.8%	70.2%	77.9%
Total	68.1%	75.1%	70.1%	75.4%	69.4%	76.6%	68.9%	76.7%	72.3%	78.1%	69.8%	76.4%

Studies from BreastScreen Norway have reported that about 20% of screen-detected cancers have discordant interpretation scores, meaning that the examination was selected for consensus by only one of the two radiologists (44, 53). Although the optimal proportion of discordant screen-detected cancers is unknown, these findings highlight the value of independent assessment in mammographic screening. The substantial proportion of screen-detected cancers identified through discordant interpretations indicates that independent double reading contributes to the detection of cancers that might otherwise have been missed.

The proportion of discordant interpretation scores ranged from 25% in 2021 to 30% in 2025. At breast center level, variation was observed from year to year, ranging from 13% in 2021 to 35% in 2022 in Hedmark. Some variation is expected because the annual number of screen-detected cancers is relatively small within individual breast centers. Breast centers with a stable workforce of dedicated breast radiologists may therefore be expected to show more stable rates over time.

As new approaches to screen reading, including AI, are being evaluated, maintaining robust quality assurance procedures remains essential. After 30 years of organized screening, discordant interpretations continue to demonstrate the contribution of independent double reading to the detec-

tion of cancers that may not have been identified through single reading alone.

Table 3.5: Proportion (%) of discordant interpretation scores among screen-detected breast cancers (DCIS and invasive) in BreastScreen Norway, by screening area and screening year, 2021-2025.

Screening area	Screening year					
	2021	2022	2023	2024	2025	Total
Rogaland	16.2%	25.9%	21.0%	13.3%	31.7%	22.3%
Hordaland	16.7%	16.4%	28.4%	21.8%	27.2%	22.5%
Oslo	27.2%	38.6%	29.9%	34.2%	26.3%	31.1%
Telemark	7.5%	14.3%	17.2%	13.0%	20.0%	14.1%
Agder	32.4%	31.0%	42.5%	38.1%	34.4%	35.4%
Troms og F	27.1%	27.9%	26.4%	16.9%	24.6%	24.8%
Østfold	31.6%	24.7%	28.2%	19.8%	27.1%	26.5%
Nordland	24.3%	29.6%	23.0%	25.8%	22.6%	25.0%
Trøndelag	21.7%	30.4%	42.6%	39.5%	43.3%	35.9%
Oppland	23.9%	27.1%	25.0%			25.2%
Møre og R	21.2%	19.7%	18.8%	21.7%	25.9%	21.6%
Sogn og F	42.1%	32.4%	25.0%	41.7%	31.6%	34.8%
Vestfold	34.2%	26.2%	30.9%	34.2%	44.3%	33.8%
Hedmark	13.3%	34.8%	26.0%			24.8%
Akershus Øst	31.1%	23.1%	28.0%	31.8%	28.7%	28.4%
Vestre Viken	29.6%	28.1%	25.3%	18.3%	27.1%	25.4%
Fonna	32.7%	30.4%	34.0%	34.6%	47.2%	36.0%
Innlandet				24.8%	22.5%	23.7%
Total	25.4%	27.0%	28.5%	26.4%	30.0%	27.5%

4. Recall for further assessment

Recall for further assessment is an essential component of mammographic screening, enabling timely evaluation of suspicious findings identified on the screening mammograms. Most recalled women are not diagnosed with breast cancer, and false-positive screening results may lead to anxiety among the women, lower attendance in the subsequent screening round and inefficient use of healthcare resources. Maintaining a low recall rate without compromising cancer detection is therefore an important quality objective in organized screening programs (54, 55).

4.1 Recall rates

The overall recall rate due to abnormal mammographic findings remained between 3% and 4% throughout the 30 years of BreastScreen Norway (Figure 4.1). The rate was highest for women attending their first screening examination (prevalently screened), and lowest for women with subsequent regular participation. Recall rates are generally higher at prevalent than at subsequent screening examinations, primarily because previous mammograms are unavailable for comparison (56, 57). Differences in age, mammographic

density, screening history, and other participant characteristics may also contribute (56, 58).

Recall rates among prevalently screened women increased during the transition from screen-film to digital mammography in BreastScreen Norway and have been consistently above 6% from 2006 to 2025. Women with a subsequent regular attendance pattern had a recall rate below 2.5% during this period, while women with an irregular attendance pattern had a rate of about 3.4%.

Recall due to technically inadequate images varied between screening areas, but the overall rate was less than 0.1% over the last five years. The rate was higher in the early years of the screening program and decreased until around 2010 when digital mammography had been implemented nationwide and the images became available for the radiographers immediately after the examination (Figure 4.2). The recall rate due to clinical symptoms decreased during the early years of the program and has stabilized at approximately 0.25%. The higher rate in the early years may partly reflect the larger proportion of women attending their first screening examination.

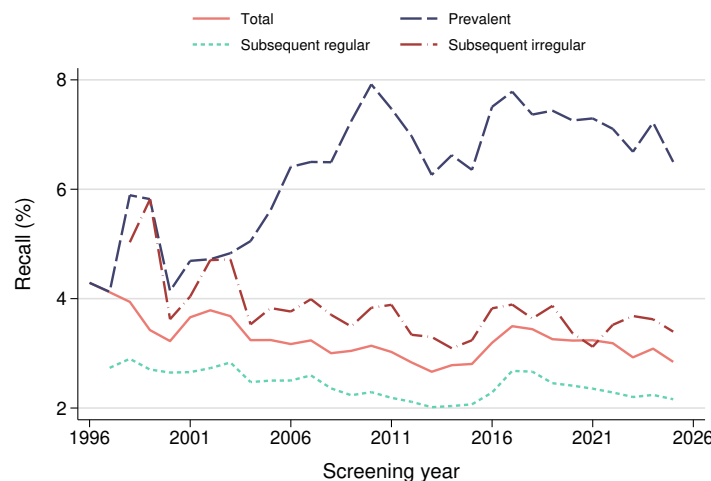


Figure 4.1: Recall rate (%) due to abnormal mammographic findings in BreastScreen Norway by attendance pattern and screening year, 1996-2025.

For the period 2021 to 2025, the average recall rate due to abnormal mammographic findings was 3.1% (Table 4.1). The rate varied between screening areas, ranging from 1.6% in Telemark to 3.9% in Oslo.

For prevalently screened women, the recall rate was 7.0% over the last five years (Table 4.1), varying from 3.4% in Telemark to 9.2% in Vestre Viken. For all subsequently screened women, the recall rate was 2.4%, varying from 1.3% to 2.9% between screening areas (Table 4.1).

Women with regular screening attendance had lower recall rates than women with irregular attendance, 2.2% and 3.4%, respectively, during the last five years (Table 4.2). The higher recall rate among women with irregular attendance

is likely attributable to longer screening intervals, which allow more time for mammographic changes to develop and become mammographically visible.

Recall rates varied by region of birth throughout the period 2021-2025 (Table 4.3). The overall rate was 3.0% among women born in Norway. The highest recall rates were observed among women born in "Other European countries" and "The Middle East and Africa", at 4.2% and 4.0%, respectively. Variation by region of birth may reflect differences in screening history, attendance pattern or other underlying characteristics associated with screening participation and breast cancer risk. However, some groups include small numbers, and the rates should therefore be interpreted with caution.

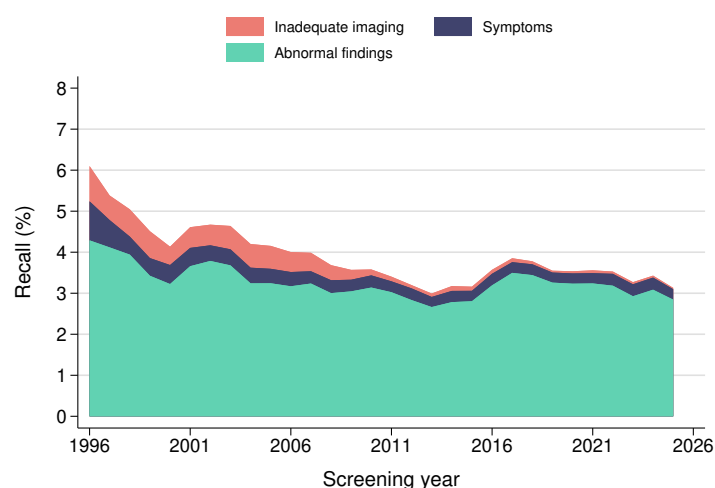


Figure 4.2: Recall rate (%) due to abnormal mammographic findings, symptoms, or inadequate images in BreastScreen Norway by screening year, 1996-2025.

Table 4.1: Number of recalls (n) and recall rate (%) due to abnormal mammographic findings by screening area and screening year in BreastScreen Norway, for all screening examinations (upper table), prevalently screened (middle table) and subsequently screened (lower table), 2021-2025.

Total	Screening year											
	2021		2022		2023		2024		2025		Total	
Screening area	n	%	n	%	n	%	n	%	n	%	n	%
Rogaland	516	3.3%	509	3.3%	419	3.0%	398	3.0%	556	3.1%	2,398	3.1%
Hordaland	889	4.4%	712	3.5%	769	3.6%	698	3.4%	827	3.3%	3,895	3.6%
Oslo	827	3.8%	868	3.7%	946	3.8%	967	3.9%	895	4.1%	4,503	3.9%
Telemark	122	1.3%	191	2.4%	155	1.7%	148	1.7%	95	1.1%	711	1.6%
Agder	577	3.7%	506	3.5%	418	3.0%	520	3.5%	505	3.4%	2,526	3.4%
Troms og F	480	3.7%	634	4.9%	443	3.6%	430	3.4%	371	2.9%	2,358	3.7%
Østfold	417	2.5%	368	2.3%	282	1.8%	309	2.0%	389	2.4%	1,765	2.2%
Nordland	236	1.9%	208	1.9%	249	2.3%	305	2.9%	272	2.3%	1,270	2.2%
Trøndelag	430	2.0%	412	1.9%	570	2.4%	446	2.1%	556	2.5%	2,414	2.2%
Oppland	279	2.7%	258	2.6%	345	2.7%					882	2.7%
Møre og R	329	2.7%	357	2.9%	308	2.6%	325	2.6%	330	2.5%	1,649	2.6%
Sogn og F	194	3.6%	188	3.4%	161	3.0%	173	3.1%	138	2.9%	854	3.2%
Vestfold	323	2.6%	307	2.5%	323	2.7%	368	2.8%	287	2.3%	1,608	2.6%
Hedmark	232	2.8%	256	2.9%	223	2.9%					711	2.9%
Akershus Øst	900	3.9%	828	3.8%	694	3.2%	731	3.6%	740	3.1%	3,893	3.5%
Vestre Viken	960	4.5%	949	4.2%	769	3.3%	939	3.9%	662	2.8%	4,279	3.7%
Fonna	230	4.0%	228	3.1%	214	2.3%	273	3.2%	241	2.7%	1,186	3.0%
Innlandet							499	2.8%	470	2.4%	969	2.6%
Total	7,941	3.2%	7,779	3.2%	7,288	2.9%	7,529	3.1%	7,334	2.8%	37,871	3.1%

Prevalent												
Rogaland	193	7.6%	183	6.8%	122	6.8%	122	6.5%	196	5.7%	816	6.6%
Hordaland	312	8.5%	174	7.0%	261	6.8%	259	7.3%	195	7.1%	1,201	7.4%
Oslo	329	7.7%	381	8.6%	357	8.8%	458	8.8%	296	9.5%	1,821	8.6%
Telemark	38	2.6%	67	4.6%	32	3.4%	52	3.7%	23	2.6%	212	3.4%
Agder	152	6.9%	198	7.9%	112	6.9%	120	5.5%	152	7.8%	734	7.0%
Troms og F	161	9.0%	196	10.6%	142	7.9%	163	8.2%	132	7.0%	794	8.5%
Østfold	157	4.9%	121	4.7%	90	3.8%	58	4.2%	148	5.3%	574	4.7%
Nordland	51	3.9%	72	4.1%	68	5.2%	86	5.7%	74	5.8%	351	4.9%
Trøndelag	114	4.7%	121	4.0%	179	4.3%	97	4.2%	160	4.9%	671	4.4%
Oppland	92	6.0%	73	6.0%	112	7.2%					277	6.4%
Møre og R	129	6.0%	104	5.7%	91	4.6%	89	5.8%	117	5.4%	530	5.5%
Sogn og F	57	8.2%	60	7.3%	47	8.2%	56	7.4%	29	5.0%	249	7.3%
Vestfold	123	6.8%	137	6.4%	91	7.5%	132	7.2%	94	6.0%	577	6.7%
Hedmark	84	8.2%	111	7.2%	45	8.5%					240	7.8%
Akershus Øst	362	9.4%	375	9.0%	275	8.4%	304	9.6%	257	6.6%	1,573	8.6%
Vestre Viken	383	9.8%	363	8.8%	244	8.4%	439	10.0%	236	8.6%	1,665	9.2%
Fonna	80	10.3%	81	7.6%	95	7.0%	122	8.3%	74	7.3%	452	7.9%
Innlandet							151	5.1%	139	5.9%	290	5.5%
Total	2,817	7.3%	2,817	7.1%	2,363	6.7%	2,708	7.2%	2,322	6.5%	13,027	7.0%

Subsequent												
Rogaland	323	2.4%	326	2.5%	297	2.4%	276	2.4%	360	2.5%	1,582	2.5%
Hordaland	577	3.5%	538	3.0%	508	2.9%	439	2.6%	632	2.8%	2,694	2.9%
Oslo	498	2.8%	487	2.5%	589	2.8%	509	2.6%	599	3.2%	2,682	2.8%
Telemark	84	1.0%	124	1.9%	123	1.5%	96	1.3%	72	0.9%	499	1.3%
Agder	425	3.2%	308	2.6%	306	2.5%	400	3.1%	353	2.8%	1,792	2.8%
Troms og F	319	2.9%	438	4.0%	301	2.8%	267	2.5%	239	2.2%	1,564	2.9%
Østfold	260	2.0%	247	1.9%	192	1.5%	251	1.7%	241	1.8%	1,191	1.8%
Nordland	185	1.7%	136	1.5%	181	1.9%	219	2.4%	198	1.9%	919	1.9%
Trøndelag	316	1.7%	291	1.5%	391	2.0%	349	1.8%	396	2.1%	1,743	1.8%
Oppland	187	2.1%	185	2.1%	233	2.1%					605	2.1%
Møre og R	200	2.0%	253	2.4%	217	2.2%	236	2.2%	213	1.9%	1,119	2.1%
Sogn og F	137	2.9%	128	2.7%	114	2.4%	117	2.4%	109	2.6%	605	2.6%
Vestfold	200	1.9%	170	1.7%	232	2.2%	236	2.1%	193	1.8%	1,031	1.9%
Hedmark	148	2.1%	145	2.0%	178	2.5%					471	2.2%
Akershus Øst	538	2.8%	453	2.6%	419	2.3%	427	2.5%	483	2.4%	2,320	2.5%
Vestre Viken	577	3.3%	586	3.2%	525	2.6%	500	2.5%	426	2.0%	2,614	2.7%
Fonna	150	3.0%	147	2.3%	119	1.5%	151	2.2%	167	2.1%	734	2.1%
Innlandet							348	2.3%	331	1.9%	679	2.1%
Total	5,124	2.5%	4,962	2.4%	4,925	2.3%	4,821	2.3%	5,012	2.3%	24,844	2.4%

Table 4.2: Number of recalls (n) and recall rate (%) due to abnormal mammographic findings by screening area and screening year, for subsequent regular screening examinations (upper table), and subsequent irregular screening examinations (lower table), in BreastScreen Norway, 2021-2025.

Subsequent regular												
Screening area	Screening year											
	2021		2022		2023		2024		2025		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Rogaland	282	2.3%	290	2.4%	268	2.4%	238	2.3%	290	2.5%	1,368	2.4%
Hordaland	460	3.4%	358	2.7%	457	2.9%	369	2.4%	568	2.7%	2,212	2.8%
Oslo	397	2.6%	408	2.4%	498	2.6%	462	2.6%	535	3.1%	2,300	2.7%
Telemark	70	1.0%	107	1.8%	108	1.4%	78	1.1%	57	0.8%	420	1.2%
Agder	390	3.2%	273	2.5%	278	2.4%	367	3.1%	314	2.6%	1,622	2.7%
Troms og F	282	2.8%	376	3.7%	276	2.8%	240	2.5%	209	2.1%	1,383	2.8%
Østfold	222	1.8%	215	1.8%	170	1.4%	216	1.6%	210	1.7%	1,033	1.7%
Nordland	168	1.6%	116	1.4%	168	1.8%	199	2.3%	182	1.9%	833	1.8%
Trøndelag	193	1.4%	257	1.5%	342	1.9%	312	1.8%	344	1.9%	1,448	1.7%
Oppland	104	2.0%	160	2.2%	214	2.0%					478	2.1%
Møre og R	173	1.9%	219	2.3%	195	2.1%	221	2.2%	195	1.9%	1,003	2.1%
Sogn og F	123	2.9%	113	2.7%	105	2.3%	107	2.4%	98	2.5%	546	2.5%
Vestfold	167	1.7%	131	1.4%	206	2.1%	206	2.0%	175	1.8%	885	1.8%
Hedmark	127	1.9%	126	1.9%	159	2.4%					412	2.1%
Akershus Øst	386	2.7%	382	2.4%	378	2.2%	397	2.5%	431	2.3%	1,974	2.4%
Vestre Viken	379	3.1%	494	3.1%	447	2.4%	429	2.3%	367	1.9%	2,116	2.5%
Fonna	137	3.0%	118	2.1%	105	1.4%	142	2.2%	157	2.1%	659	2.1%
Innlandet							324	2.3%	296	1.8%	620	2.0%
Total	4,060	2.4%	4,143	2.3%	4,374	2.2%	4,307	2.2%	4,428	2.2%	21,312	2.2%

Subsequent irregular												
Rogaland	41	3.3%	36	3.6%	29	3.9%	38	2.9%	70	2.5%	214	3.0%
Hordaland	117	3.8%	180	3.9%	51	3.7%	70	5.3%	64	4.5%	482	4.1%
Oslo	101	4.2%	79	3.5%	91	4.9%	47	3.5%	64	4.4%	382	4.1%
Telemark	14	2.1%	17	2.8%	15	2.7%	18	4.0%	15	2.7%	79	2.8%
Agder	35	3.4%	35	3.8%	28	3.6%	33	4.2%	39	4.7%	170	3.9%
Troms og F	37	3.9%	62	6.1%	25	3.1%	27	3.2%	30	3.4%	181	4.0%
Østfold	38	3.1%	32	2.8%	22	2.7%	35	3.9%	31	3.2%	158	3.1%
Nordland	17	2.3%	20	3.0%	13	2.4%	20	3.5%	16	2.5%	86	2.7%
Trøndelag	123	2.2%	34	1.7%	49	3.7%	37	3.0%	52	4.4%	295	2.6%
Oppland	83	2.3%	25	2.0%	19	3.3%					127	2.3%
Møre og R	27	2.4%	34	3.5%	22	3.5%	15	2.2%	18	2.7%	116	2.8%
Sogn og F	14	2.9%	15	3.4%	9	3.3%	10	3.5%	11	4.2%	59	3.4%
Vestfold	33	3.4%	39	4.0%	26	3.0%	30	3.8%	18	2.2%	146	3.3%
Hedmark	21	3.9%	19	3.7%	19	3.6%					59	3.7%
Akershus Øst	152	3.2%	71	3.9%	41	3.8%	30	2.9%	52	3.4%	346	3.4%
Vestre Viken	198	3.7%	92	4.0%	78	4.6%	71	5.0%	59	3.8%	498	4.0%
Fonna	13	4.4%	29	4.1%	14	2.8%	9	2.1%	10	2.5%	75	3.2%
Innlandet							24	3.1%	35	2.8%	59	2.9%
Total	1,064	3.1%	819	3.5%	551	3.7%	514	3.6%	584	3.4%	3,532	3.4%

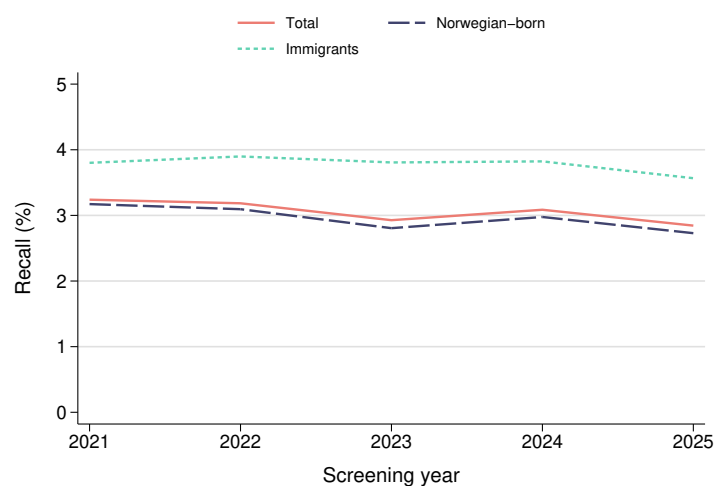


Figure 4.3: Recall rate (%) due to abnormal mammographic findings, among Norwegian-born and immigrants by screening year, in BreastScreen Norway, 2021-2025.

Table 4.3: Number of recalls (n) and recall rate (%) due to abnormal mammographic findings by region of birth and screening year, for all screening examinations in BreastScreen Norway, 2021-2025.

Region of birth	Screening year											
	2021		2022		2023		2024		2025		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Norway	6,948	3.2%	6,709	3.1%	6,138	2.8%	6,314	3.0%	6,067	2.7%	32,176	3.0%
Nordic countries	158	3.5%	168	3.6%	163	3.4%	168	3.5%	182	3.7%	839	3.5%
Western Europe, North-												
America and Oceania	155	3.5%	168	3.4%	152	3.2%	172	3.4%	171	3.3%	818	3.3%
Other European Countries	206	3.8%	291	4.8%	323	4.4%	359	4.5%	342	3.7%	1,521	4.2%
The Middle East and Africa	140	4.1%	143	4.3%	157	4.0%	148	3.7%	182	3.8%	770	4.0%
Asia	260	4.1%	222	3.5%	284	3.9%	287	3.9%	318	3.6%	1,371	3.8%
Latin America												
and the Caribbean	50	4.4%	60	4.5%	45	3.4%	48	3.3%	41	2.6%	244	3.6%
Missing information	24	3.2%	18	2.4%	26	3.2%	33	3.9%	31	3.6%	132	3.3%
Total	7,941	3.2%	7,779	3.2%	7,288	2.9%	7,529	3.1%	7,334	2.8%	37,871	3.1%

4.2 Recall and consensus

The consensus rate presented in Chapter 3.2 was 7.5% and the recall rate presented in Chapter 4.1, 3.1%. Thus, approximately 40% (37,871/92,739) of examinations discussed at consensus resulted in recall for further assessment while 60% (54,868/92,739) were dismissed (Figure 4.4). These findings demonstrate the important role of consensus discussions in resolving uncertain mammographic findings and limiting the recall rate.

The organization and use of consensus meetings varies across breast centers (Figure 4.5). While some centers incorporate consensus as part of training and professional development, others primarily use them as a decision-making process embedded in routine clinical practice. The possible association with cancer detection is therefore important to assess together with recall rate, positive predictive value, and interval cancer rate.

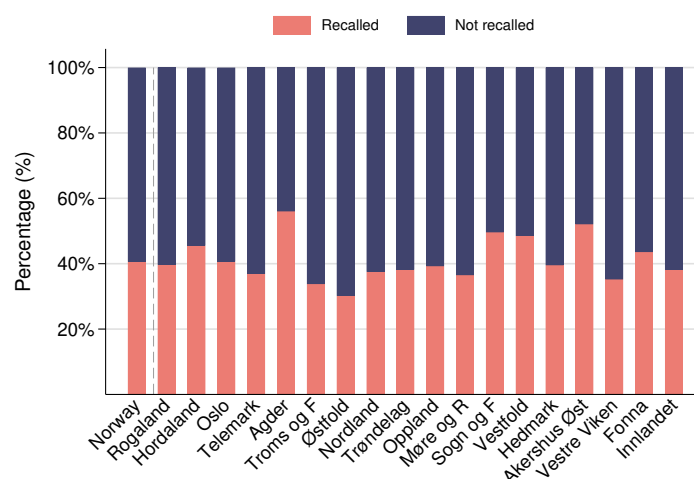


Figure 4.4: Distribution (%) of recalled and not recalled women among cases discussed at consensus by screening area in BreastScreen Norway, 2021-2025.

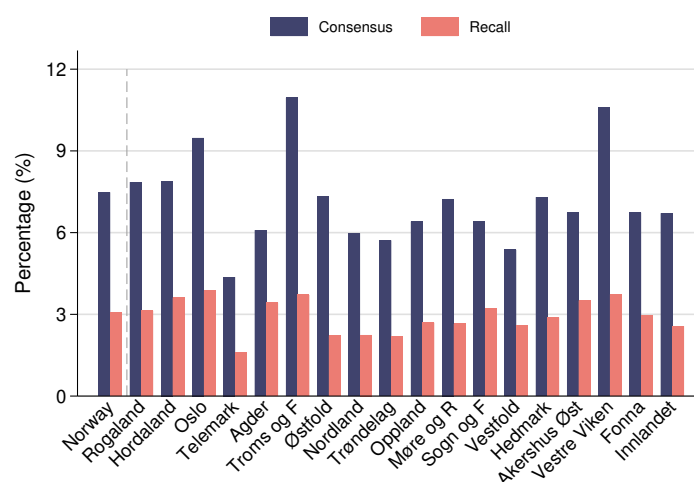


Figure 4.5: Recall rate (%) and consensus rate (%) among screened women by screening area in BreastScreen Norway, 2021-2025.

4.3 Procedures for further assessment

BreastScreen Norway has established procedures for further assessment following abnormal mammographic findings, clinical symptoms and technically inadequate images (2, 47). Further assessment of abnormal mammographic findings is based on triple assessment, comprising diagnostic imaging, clinical examination when indicated, and needle biopsy when indicated. Diagnostic imaging may include additional mammographic views, digital breast tomosynthesis, ultrasound, and, in selected cases, contrast-enhanced mammography or magnetic resonance imaging.

From the initiation of BreastScreen Norway through the end of 2025, 97% of women with abnormal findings or

symptoms on the screening mammograms or with clinical symptoms had a registered diagnostic workup within 6 months of screening (Table 4.4). Among women recalled due to abnormal findings, 44% underwent an assessment that included needle biopsy.

The use of diagnostic procedures varied across screening areas (Table 4.5). Hordaland had the highest proportion of women undergoing mammography, ultrasound and biopsy (58%), whereas Sogn og Fjordane had the lowest proportion (21%). These differences may reflect variations in recall rates, case mix and local assessment practices across breast centers.

Table 4.4: Frequency of registered diagnostic follow-up patterns (n and %) among women with abnormal findings and symptoms in BreastScreen Norway, 1996-2025.

Procedures	Abnormal findings		Symptoms		Total	
	n	%	n	%	n	%
Mammo, ultrasound and biopsy	60,795	35.9%	1,450	9.1%	62,245	33.6%
Ultrasound and biopsy	9,508	5.6%	1,556	9.7%	11,064	6.0%
Mammo and biopsy	3,104	1.8%	6	0.0%	3,110	1.7%
Biopsy only	699	0.4%	117	0.7%	816	0.4%
Mammograms and ultrasound	74,166	43.8%	5,035	31.5%	79,201	42.7%
Mammo only or ultrasound only	17,433	10.3%	6,868	42.9%	24,301	13.1%
No registered follow-up within 6 months	3,802	2.2%	966	6.0%	4,768	2.6%

Table 4.5: Frequency of registered diagnostic follow-up patterns (n and %) among women with abnormal findings in BreastScreen Norway, by screening area, 2021-2025*.

Screening area	Mammo, ultrasound and biopsy		Ultrasound and biopsy		Mammo and ultrasound		Mammo only or ultrasound only		No registered follow-up within 6 months	
	n	%	n	%	n	%	n	%	n	%
Rogaland	1,008	42.1%	8	0.3%	1,301	54.3%	26	1.1%	54	2.3%
Hordaland	2,251	57.8%	86	2.2%	1,402	36.0%	69	1.8%	85	2.2%
Oslo	2,008	44.6%	60	1.3%	2,259	50.2%	118	2.6%	58	1.3%
Telemark	397	55.9%	15	2.1%	268	37.7%	28	3.9%	2	0.3%
Agder	978	38.8%	111	4.4%	1,209	47.9%	202	8.0%	22	0.9%
Troms og F	878	37.2%	30	1.3%	1,328	56.3%	86	3.6%	36	1.5%
Østfold	514	29.1%	180	10.2%	752	42.6%	298	16.9%	20	1.1%
Nordland	576	45.4%	9	0.7%	671	52.8%	7	0.6%	7	0.6%
Trøndelag	1,109	45.9%	53	2.2%	956	39.6%	93	3.9%	203	8.4%
Oppland	386	43.8%	8	0.9%	473	53.7%	7	0.8%	7	0.8%
Møre og R	775	47.0%	76	4.6%	683	41.4%	107	6.5%	7	0.4%
Sogn og F	175	20.5%	81	9.5%	463	54.2%	113	13.2%	22	2.6%
Vestfold	655	40.7%	27	1.7%	862	53.6%	43	2.7%	21	1.3%
Hedmark	315	44.4%	8	1.1%	375	52.9%	3	0.4%	8	1.1%
Akershus Øst	1,742	44.7%	101	2.6%	1,875	48.2%	92	2.4%	83	2.1%
Vestre Viken	1,839	43.0%	227	5.3%	1,795	42.0%	367	8.6%	50	1.2%
Fonna	553	46.7%	5	0.4%	616	52.0%	6	0.5%	5	0.4%
Innlandet	457	47.2%	9	0.9%	452	46.6%	18	1.9%	33	3.4%
Total	16,616	43.9%	1,094	2.9%	17,740	46.9%	1,683	4.4%	723	1.9%

* No cases in procedure-group "Biopsy only" or "Mammo and biopsy" in this period

5. Breast cancer detection

In this report, screen-detected cancer is defined as ductal carcinoma in situ (DCIS) or invasive breast cancer diagnosed within 182 days (six months) of a screening examination among women recalled for further assessment because of abnormal findings, clinical symptoms, or technically inadequate images.

Interval cancer is defined as breast cancer diagnosed after a negative screening result or more than six months after a false-positive screening result and within two years of screening (59). Because interval cancer can only be identified after a two-year follow-up period, data are currently available for those who participated through 2023. Consequently, the term the “last five years” refers to interval cancers diagnosed among women screened between 2019 and 2023 and followed for interval cancer through 2025.

Between 1996 and 2025, approximately 31,400 screen-detected breast cancers were diagnosed among women attending BreastScreen Norway, of which about 5,500 (18%)

were DCIS. Among all screen-detected cancers, 98.3% were detected following abnormal mammographic findings, 1.5% following recall due to clinical symptoms, and 0.2% due to technically inadequate images. Approximately 8,400 interval cancers were diagnosed between 1996 and 2023, accounting for nearly one quarter of all breast cancers identified among women participating in the screening program during that period.

5.1 Screen-detected cancer

Since the start-up of the screening program, the overall cancer detection rate has remained stable, ranging from 5 to 6 per 1000 screening examinations (Figure 5.1). The rates were highest for the subsequent irregularly screened women, followed by the prevalently screened, while the lowest rate was among subsequent regularly screened women. This might reflect the small number of women in the irregular screened group.

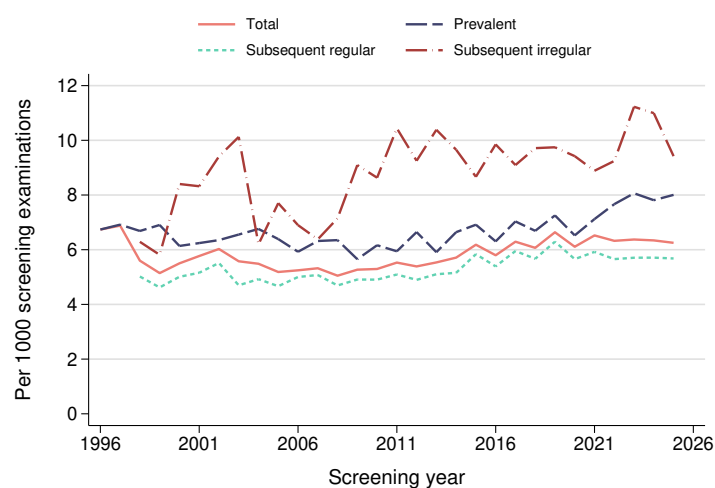


Figure 5.1: Rate of screen-detected breast cancers (DCIS and invasive) per 1000 screening examinations (‰) in BreastScreen Norway by attendance pattern and screening year, 1996-2025.

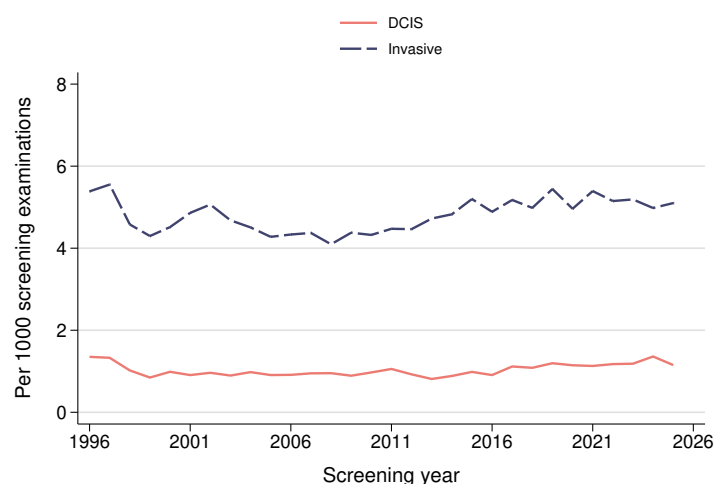


Figure 5.2: Rate (%) of screen-detected, DCIS and invasive breast cancer, per 1000 screening examinations (%) in BreastScreen Norway, 1996-2025.

The rate of screen-detected DCIS has remained close to 1 per 1,000 screening examinations since the start-up of the program (Figure 5.2). The rate of screen-detected invasive breast cancer showed some variation over time, ranging from approximately 4 to 5.5 per 1,000 screening examinations, but without major long-term fluctuations.

Between 2021 and 2025, the average rate of screen-detected cancer was 6.4 per 1000 screening examinations (Table 5.1). As of May 31, 2026, 1612 screen-detected cancers had been reported among women screened in 2025. Because cancer registration may be incomplete at the time of data extraction, the 2025 detection rate may be revised.

During 2021-2025, the highest rates of screen-detected cancer were observed in Vestre Viken, Hordaland, Rogaland, and Oslo (7.9, 7.0, 6.9, and 6.9 per 1000 screening examinations, respectively; Table 5.1). The lowest rate was observed in Sogn og Fjordane (4.2 per 1000 screening examinations). Because the number of screened women in Sogn og Fjordane was relatively small, the results should be interpreted with caution.

The rate of screen-detected DCIS was 1.2 per 1,000 screening examinations for 2021-2025 for all breast centers (Table 5.2). The rate was lowest in Sogn og Fjordane and Hedmark (0.7) and highest in Vestre Viken (1.8).

The rate of invasive screen-detected cancers was 5.2 per 1,000 screening examinations (Table 5.3). Although some variation was observed between screening areas, rates remained between 4 and 6 per 1,000 screening examinations in most areas.

The detection rate among prevalently screened women was 7.7 per 1000 screening examinations during 2021-2025 (Table 5.4). Rates ranged from 4.7 per 1000 in Sogn og Fjordane to 10.5 per 1000 in Vestre Viken. Among subsequently screened women, the corresponding rate was 6.1 per 1000 screening examinations, ranging from 4.1 per 1000 in Sogn og Fjordane to 7.4 per 1000 in Vestre Viken.

Among subsequently screened women, the detection rate was higher after irregular than after regular attendance, at 9.7 versus 5.7 per 1,000 screening examinations during 2021-2025 (Table 5.5). Irregular attendance reflects longer intervals since the previous screening examination and has been shown to result in less favorable histopathological tumor characteristics than regular attendance (60).

Rates among Norwegian-born women and immigrants followed similar patterns over time and remained relatively stable throughout the study period, suggesting only modest differences between the groups (Figure 5.3).

Women born in the Nordic countries had an average detection rate comparable to women born in Norway (6.4 per 1000) (Table 5.6). The highest rate was observed among women born in "Other European countries" (6.9 per 1000), whereas lower rates were observed among women born in "Asia" (6.1 per 1000), "Latin America and the Caribbean" (5.7 per 1000), and "The Middle East and Africa" (5.6 per 1000). Differences should be interpreted with caution because of the small numbers in several groups.

Table 5.1: Number (n) and rate of screen-detected breast cancers (DCIS and invasive) per 1000 screening examinations (‰) in BreastScreen Norway by screening area and year, 2021-2025.

Screening area	Screening year											
	2021		2022		2023		2024		2025		Total	
	n	‰	n	‰	n	‰	n	‰	n	‰	n	‰
Rogaland	99	6.3	116	7.5	105	7.5	90	6.7	120	6.7	530	6.9
Hordaland	144	7.1	134	6.5	141	6.7	142	7.0	191	7.5	752	7.0
Oslo	147	6.7	153	6.5	187	7.5	149	6.0	171	7.9	807	6.9
Telemark	53	5.6	49	6.1	58	6.4	54	6.2	35	4.0	249	5.7
Agder	102	6.6	87	6.0	73	5.2	97	6.5	90	6.1	449	6.1
Troms og F	85	6.6	86	6.7	72	5.8	71	5.7	69	5.4	383	6.0
Østfold	98	5.9	97	6.1	85	5.5	81	5.1	96	5.9	457	5.7
Nordland	74	5.9	54	5.0	61	5.6	62	5.8	53	4.5	304	5.4
Trøndelag	129	6.0	112	5.1	141	6.0	124	5.8	141	6.4	647	5.9
Oppland	67	6.5	59	6.0	76	6.0					202	6.2
Møre og R	85	6.9	76	6.1	64	5.4	83	6.7	85	6.4	393	6.3
Sogn og F	19	3.5	34	6.2	16	3.0	24	4.3	19	4.0	112	4.2
Vestfold	73	5.8	65	5.3	68	5.8	79	6.1	61	5.0	346	5.6
Hedmark	45	5.5	46	5.2	50	6.5					141	5.7
Akershus Øst	151	6.6	160	7.3	150	6.9	132	6.5	160	6.7	753	6.8
Vestre Viken	179	8.4	171	7.6	190	8.2	202	8.3	166	7.1	908	7.9
Fonna	49	8.6	46	6.2	50	5.3	52	6.2	53	5.9	250	6.2
Innlandet							105	5.9	102	5.1	207	5.5
Total	1,599	6.5	1,545	6.3	1,587	6.4	1,547	6.3	1,612	6.3	7,890	6.4

Table 5.2: Number (n) and rate of screen-detected DCIS, per 1000 screening examinations (‰) in BreastScreen Norway by screening area and year, 2021-2025.

Screening area	Screening year											
	2021		2022		2023		2024		2025		Total	
	n	‰	n	‰	n	‰	n	‰	n	‰	n	‰
Rogaland	16	1.0	29	1.9	19	1.4	22	1.6	21	1.2	107	1.4
Hordaland	39	1.9	25	1.2	29	1.4	28	1.4	45	1.8	166	1.5
Oslo	17	0.8	30	1.3	30	1.2	30	1.2	37	1.7	144	1.2
Telemark	7	0.7	7	0.9	14	1.5	15	1.7	3	0.3	46	1.0
Agder	14	0.9	17	1.2	14	1.0	28	1.9	23	1.6	96	1.3
Troms og F	8	0.6	11	0.9	13	1.1	13	1.0	9	0.7	54	0.9
Østfold	21	1.3	16	1.0	11	0.7	14	0.9	10	0.6	72	0.9
Nordland	5	0.4	10	0.9	11	1.0	14	1.3	8	0.7	48	0.8
Trøndelag	24	1.1	26	1.2	22	0.9	23	1.1	26	1.2	121	1.1
Oppland	11	1.1	10	1.0	13	1.0					34	1.0
Møre og R	12	1.0	13	1.0	14	1.2	11	0.9	17	1.3	67	1.1
Sogn og F	2	0.4	10	1.8	2	0.4	2	0.4	3	0.6	19	0.7
Vestfold	7	0.6	12	1.0	12	1.0	13	1.0	14	1.1	58	0.9
Hedmark	6	0.7	6	0.7	6	0.8					18	0.7
Akershus Øst	34	1.5	22	1.0	30	1.4	27	1.3	23	1.0	136	1.2
Vestre Viken	44	2.1	33	1.5	45	2.0	60	2.5	27	1.1	209	1.8
Fonna	10	1.8	10	1.4	10	1.1	11	1.3	13	1.4	54	1.3
Innlandet							21	1.2	18	0.9	39	1.0
Total	277	1.1	287	1.2	295	1.2	332	1.4	297	1.2	1,488	1.2

Table 5.3: Number (n) and rate of screen-detected invasive breast cancers in BreastScreen Norway, per 1000 screening examinations (‰) by screening area and year, 2021-2025.

Screening area	Screening year											
	2021		2022		2023		2024		2025		Total	
	n	‰	n	‰	n	‰	n	‰	n	‰	n	‰
Rogaland	83	5.2	87	5.6	86	6.2	68	5.1	99	5.6	423	5.5
Hordaland	105	5.2	109	5.3	112	5.3	114	5.6	146	5.7	586	5.4
Oslo	130	5.9	123	5.2	157	6.3	119	4.9	134	6.2	663	5.7
Telemark	46	4.8	42	5.2	44	4.9	39	4.5	32	3.7	203	4.6
Agder	88	5.7	70	4.8	59	4.2	69	4.6	67	4.5	353	4.8
Troms og F	77	6.0	75	5.8	59	4.8	58	4.6	60	4.7	329	5.2
Østfold	77	4.7	81	5.1	74	4.8	67	4.3	86	5.3	385	4.8
Nordland	69	5.5	44	4.0	50	4.6	48	4.5	45	3.9	256	4.5
Trøndelag	105	4.9	86	3.9	119	5.1	101	4.7	115	5.2	526	4.8
Oppland	56	5.4	49	5.0	63	5.0					168	5.1
Møre og R	73	5.9	63	5.1	50	4.2	72	5.8	68	5.2	326	5.2
Sogn og F	17	3.2	24	4.4	14	2.6	22	4.0	16	3.3	93	3.5
Vestfold	66	5.3	53	4.3	56	4.8	66	5.1	47	3.8	288	4.7
Hedmark	39	4.8	40	4.5	44	5.7					123	5.0
Akershus Øst	117	5.1	138	6.3	120	5.5	105	5.1	137	5.7	617	5.6
Vestre Viken	135	6.3	138	6.2	145	6.3	142	5.9	139	5.9	699	6.1
Fonna	39	6.8	36	4.9	40	4.2	41	4.9	40	4.4	196	4.9
Innlandet							84	4.7	84	4.2	168	4.4
Total	1,322	5.4	1,258	5.2	1,292	5.2	1,215	5.0	1,315	5.1	6,402	5.2

Table 5.4: Rate of screen-detected breast cancers (DCIS and invasive) per 1000 prevalent (pre) and subsequent (sub) screening examinations (‰) in BreastScreen Norway by screening area and year, 2021-2025.

Screening area	Screening year											
	2021		2022		2023		2024		2025		Total	
	Pre	Sub	Pre	Sub	Pre	Sub	Pre	Sub	Pre	Sub	Pre	Sub
Rogaland	6.7	6.2	8.5	7.2	12.8	6.8	8.6	6.4	6.1	6.9	8.0	6.5
Hordaland	9.3	6.6	8.9	6.2	7.5	6.5	9.0	6.6	11.7	7.0	9.1	6.6
Oslo	4.7	7.2	8.8	6.0	8.6	7.3	7.1	5.8	10.9	7.4	7.8	6.7
Telemark	4.8	5.7	5.5	6.2	7.3	6.3	4.2	6.6	6.8	3.7	5.5	5.7
Agder	6.8	6.5	8.3	5.5	5.5	5.1	9.2	6.0	9.3	5.6	7.9	5.8
Troms og F	10.0	6.1	7.6	6.5	6.7	5.7	9.0	5.0	9.0	4.7	8.5	5.6
Østfold	7.5	5.6	6.6	6.0	6.7	5.3	6.6	5.0	7.6	5.6	7.1	5.5
Nordland	4.6	6.1	6.3	4.7	6.9	5.4	6.6	5.7	5.5	4.4	6.0	5.3
Trøndelag	6.5	5.9	5.7	5.0	5.7	6.1	5.6	5.8	5.2	6.6	5.7	5.9
Oppland	8.5	6.2	4.9	6.1	5.8	6.1					6.5	6.1
Møre og R	6.0	7.1	5.5	6.2	7.5	5.0	11.1	6.1	7.3	6.3	7.3	6.1
Sogn og F	4.3	3.4	6.0	6.2	5.2	2.7	5.3	4.2	1.7	4.3	4.7	4.1
Vestfold	5.5	5.9	7.5	4.8	2.5	6.2	2.7	6.7	6.3	4.8	5.1	5.7
Hedmark	9.8	4.9	8.5	4.5	1.9	6.8					7.8	5.4
Akershus Øst	6.7	6.5	8.9	7.0	12.3	5.9	7.9	6.2	8.5	6.4	8.8	6.4
Vestre Viken	9.0	8.3	8.5	7.4	12.7	7.6	12.3	7.4	10.2	6.6	10.5	7.4
Fonna	10.3	8.3	9.4	5.7	9.6	4.5	9.5	5.5	7.9	5.6	9.3	5.7
Innlandet							4.4	6.2	7.2	4.8	5.7	5.4
Total	7.1	6.4	7.7	6.1	8.1	6.1	7.8	6.1	8.0	6.0	7.7	6.1

Table 5.5: Rate of screen-detected breast cancers (DCIS and invasive) per 1000 subsequent regular (reg) and subsequent irregular (irreg) screening examinations (‰) in BreastScreen Norway by screening area and year, 2021-2025.

Screening area	Screening year											
	2021		2022		2023		2024		2025		Total	
	Reg	Irreg	Reg	Irreg	Reg	Irreg	Reg	Irreg	Reg	Irreg	Reg	Irreg
Rogaland	5.6	12.1	6.9	11.1	6.0	18.7	5.7	12.0	6.9	6.9	6.0	10.6
Hordaland	6.8	5.8	5.5	8.2	6.2	9.4	5.9	14.3	7.0	7.7	6.3	8.3
Oslo	6.5	11.3	5.8	7.1	6.9	11.3	5.4	10.4	7.3	9.0	6.4	9.8
Telemark	5.2	11.8	5.5	13.4	6.0	10.6	5.9	17.6	2.8	16.3	5.0	13.7
Agder	6.6	5.8	5.2	9.8	4.6	12.9	5.7	11.4	5.3	10.8	5.5	9.9
Troms og F	5.9	7.3	6.1	10.8	5.5	7.5	4.9	6.0	4.3	10.3	5.4	8.5
Østfold	5.2	8.9	5.8	8.7	4.8	12.2	4.3	15.4	5.1	11.4	5.0	11.0
Nordland	5.8	9.5	4.3	9.1	5.3	7.5	5.7	5.3	4.2	7.8	5.1	8.0
Trøndelag	4.5	9.5	4.9	6.0	5.9	9.0	5.6	9.6	6.1	13.5	5.4	9.3
Oppland	5.2	7.5	5.7	8.9	5.8	10.5					5.6	8.1
Møre og R	7.1	7.0	5.9	9.2	4.3	14.2	6.1	5.9	6.4	4.5	6.0	8.1
Sogn og F	3.6	2.0	5.7	11.4	2.6	3.7	4.2	3.5	4.3	3.8	4.1	5.1
Vestfold	5.1	13.3	3.8	14.2	6.3	4.7	6.1	14.1	4.4	8.6	5.2	11.1
Hedmark	4.3	12.8	4.6	3.9	6.5	11.5					5.1	9.5
Akershus Øst	6.2	7.5	6.7	9.4	5.5	12.0	5.9	11.7	6.1	9.1	6.1	9.0
Vestre Viken	7.6	9.6	6.9	11.2	6.8	15.8	7.0	13.4	6.0	14.8	6.8	11.8
Fonna	7.1	27.0	4.6	14.1	4.0	11.9	5.5	4.7	5.5	7.6	5.2	12.4
Innlandet							6.0	9.1	4.7	7.2	5.3	7.9
Total	5.9	8.9	5.7	9.2	5.7	11.2	5.7	11.0	5.7	9.4	5.7	9.7

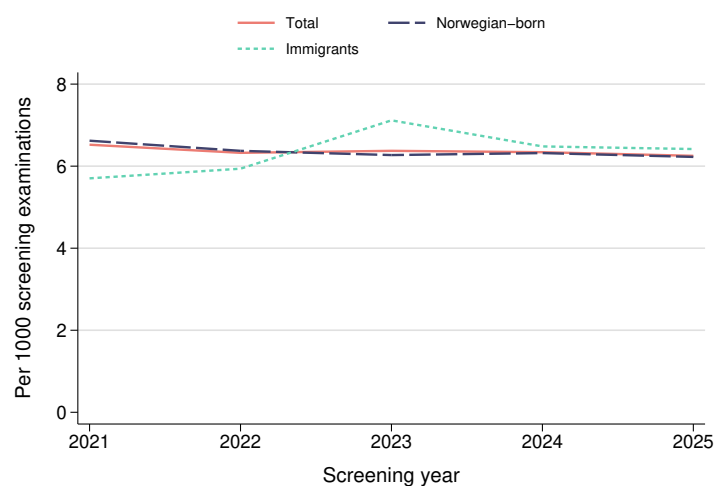


Figure 5.3: Rate of screen-detected breast cancers (DCIS and invasive) per 1000 screening examinations (%) in BreastScreen Norway among Norwegian-born and immigrants by screening year, 2021-2025.

Table 5.6: Number (n) and rate of screen-detected breast cancers (DCIS and invasive) per 1000 screening examinations (%) in BreastScreen Norway by region of birth and screening year, 2021-2025.

Region of birth	Screening year											
	2021		2022		2023		2024		2025		Total	
	n	%o	n	%o	n	%o	n	%o	n	%o	n	%o
Norway	1,450	6.6	1,382	6.4	1,372	6.3	1,341	6.3	1,384	6.2	6,929	6.4
Nordic countries	27	6.0	25	5.3	37	7.8	25	5.2	39	7.9	153	6.4
Western Europe, North-												
America and Oceania	30	6.8	33	6.7	26	5.5	37	7.2	36	6.9	162	6.6
Other European Countries	36	6.6	44	7.2	58	7.9	54	6.7	57	6.2	249	6.9
The Middle East and Africa	14	4.1	18	5.5	23	5.9	21	5.2	33	6.8	109	5.6
Asia	33	5.1	36	5.7	54	7.4	49	6.6	49	5.5	221	6.1
Latin America												
and the Caribbean	6	5.3	4	3.0	8	6.0	12	8.1	9	5.8	39	5.7
Missing information	3	4.0	3	4.1	9	10.9	8	9.5	5	5.8	28	7.0
Total	1,599	6.5	1,545	6.3	1,587	6.4	1,547	6.3	1,612	6.3	7,890	6.4

5.2 Interval cancer

The rate of interval cancers has remained relatively stable at approximately 1.8 per 1000 screening examinations since the start of BreastScreen Norway (Figure 5.5).

Most interval cancers were diagnosed one year or more after the preceding screening examination (Figure 5.4). This distribution has remained largely unchanged since the start of the program and reflects the fact that interval cancers occur throughout the screening interval rather than being concentrated shortly after a negative screening examination (3, 61).

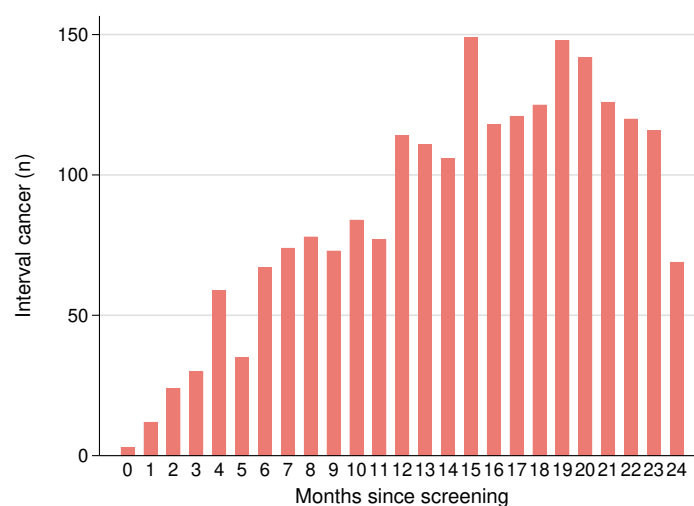


Figure 5.4: Distribution (n) of interval cancers (DCIS and invasive) in BreastScreen Norway by months since last screening among women screened 2019-2023 and followed two years.

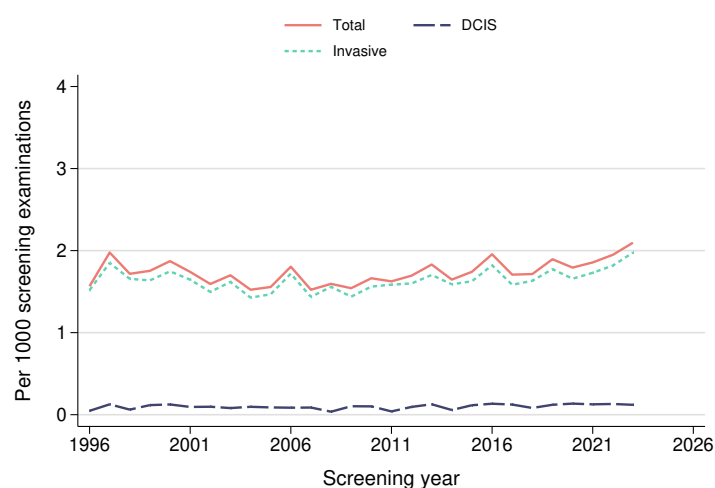


Figure 5.5: Rate (‰) of interval, DCIS and invasive breast cancer, in BreastScreen Norway among women screened 1996-2023 and followed two years.

On average, 1.9 interval cancers were diagnosed per 1000 screening examinations among women screened between 2019 and 2023 (Table 5.7). Rates varied across screening areas during this period. Because the number of interval cancers diagnosed annually within screening areas was small, these differences should be interpreted with caution. However, the lowest interval cancer rates were observed in Hordaland (1.3 per 1000 screening examinations) and in Oppland and Akershus Øst (1.7 per 1000 screening examinations), whereas the highest rates were observed in Oslo and Østfold, both with 2.3 interval cancers per 1000 screening examinations.

The rate of interval DCIS was low throughout the report period, with rates close to zero and little variation over time (Figure 5.5).

Systematic radiologic review of screening and diagnostic mammograms from women subsequently diagnosed with interval cancer can identify recurring interpretive and technical challenges and support quality improvement. Such reviews are a part of the quality assurance in BreastScreen Norway (47).

Table 5.7: Number (n) and rate (‰) of interval cancers (DCIS and invasive) per 1000 screening examinations in BreastScreen Norway by screening area and screening year among women screened 2019-2023 and followed two years.

Screening area	Screening year											
	2019		2020		2021		2022		2023		Total	
	n	%o	n	%o	n	%o	n	%o	n	%o	n	%o
Rogaland	34	1.7	33	2.8	29	1.8	15	1.0	24	1.7	135	1.8
Hordaland	35	1.6	15	1.1	20	1.0	26	1.3	28	1.3	124	1.3
Oslo	44	2.2	34	2.2	58	2.6	58	2.5	54	2.2	248	2.3
Telemark	12	1.5	13	1.9	24	2.5	20	2.5	17	1.9	86	2.1
Agder	36	2.8	19	1.6	28	1.8	24	1.7	29	2.1	136	2.0
Troms og F	20	1.6	21	2.2	19	1.5	26	2.0	27	2.2	113	1.9
Østfold	24	1.8	26	2.2	41	2.5	31	2.0	41	2.7	163	2.3
Nordland	20	1.9	19	2.0	29	2.3	27	2.5	25	2.3	120	2.2
Trøndelag	43	2.1	24	1.8	42	2.0	44	2.0	46	2.0	199	2.0
Oppland	13	1.4	8	1.2	19	1.8	16	1.6	25	2.0	81	1.7
Møre og R	27	2.4	15	1.7	17	1.4	30	2.4	34	2.9	123	2.2
Sogn og F	10	1.9	9	2.7	5	0.9	15	2.7	15	2.8	54	2.2
Vestfold	20	1.8	5	0.5	25	2.0	24	2.0	27	2.3	101	1.8
Hedmark	10	1.1	10	1.6	19	2.3	19	2.2	18	2.3	76	1.9
Akershus Øst	37	2.1	16	1.2	28	1.2	42	1.9	43	2.0	166	1.7
Vestre Viken	38	1.8	32	2.1	42	2.0	42	1.9	52	2.3	206	2.0
Fonna			6	1.3	10	1.8	17	2.3	17	1.8	50	1.8
Total	423	1.9	305	1.8	455	1.9	476	1.9	522	2.1	2,181	1.9

The interval cancer rate is an important indicator of screening sensitivity. However, the rate should not be interpreted in isolation. A high interval cancer rate combined with a low screen-detected cancer rate may indicate low program sensitivity, whereas high rates of both screen-detected and interval cancer may partly reflect a high underlying breast cancer incidence. Program sensitivity, calculated as the number of screen-detected cancers divided by the total number of screen-detected and interval cancers, provides

a complementary measure. For BreastScreen Norway, the sensitivity remained stable throughout the screening period, varying between approximately 75% and 81% during the period since start-up (Figure 5.6). Specificity, calculated as the number of true-negative results divided by the total number of true-negative and false positive results, was consistently high and showed little variation over time, remaining above 97.2% after 2004.

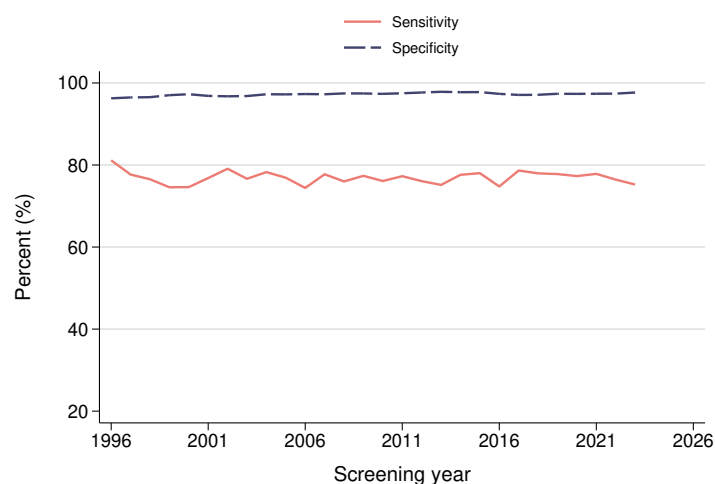


Figure 5.6: Sensitivity (%) and specificity (%) in BreastScreen Norway among women screened 1996-2023 and followed two years.

6. Positive predictive values

The positive predictive value (PPV) of a test is the probability that an event with a positive test result is a true positive (62).

In mammographic screening, PPV-1 refers to the proportion of breast cancers detected among women recalled due to abnormal mammographic findings. A high PPV-1 indicates that a high proportion of women recalled for further assessment is diagnosed with breast cancer.

PPV-3 refers to the proportion of breast cancers diagnosed among women undergoing an invasive procedure. In BreastScreen Norway, 1-2% of recalled women for whom a biopsy was recommended were reported not to have undergone this procedure. BreastScreen Norway is not reporting PPV-2 as an early performance measure.

Recall assessments, biopsies and cancer cases are reported to the Cancer Registry by radiologists and pathologists at the breast centers. BreastScreen Norway also registers the results of benign biopsies to monitor PPV-3, among other purposes. See Section 7.9 for more details on reporting and completeness of data.

6.1 PPV-1

PPV-1 has remained stable at approximately 20% during the last 15 years (Figure 6.1).

For the period 2021-2025, PPV-1 was 11% for prevalently screened women and 26% for subsequently screened (Ta-

ble 6.2). Across screening areas, PPV-1 ranged from 13% in Sogn og Fjordane to 35% in Telemark (Table 6.1). Sogn og Fjordane had the lowest PPV-1 for prevalently (6%) and subsequently (16%) screened women, while Telemark had the highest, 16% and 43%, respectively (Table 6.2). The stability of PPV-1 during the last decade indicates that the balance between recall and cancer detection has remained relatively consistent.

6.2 PPV-3

PPV-3 increased from roughly 35% in 1996 to about 45% in 2024 (Figure 6.1). PPV-3 was higher among subsequently screened women than among prevalently screened women, irrespective of attendance pattern among the subsequently screened. The increase in PPV-3 over time suggests a more selective use of biopsy procedures, with a larger proportion of biopsied women ultimately being diagnosed with breast cancer.

For the period 2021-2024, the overall PPV-3 for the included screening areas was 44%. The value ranged from 30% in Hordaland to 67% in Østfold (Table 6.3). Hordaland had the lowest PPV-3 among both prevalently (18%) and subsequently screened women (36%) (Table 6.4). Østfold had the highest PPV-3 (42%), for prevalently screened and for subsequently screened women (78%).

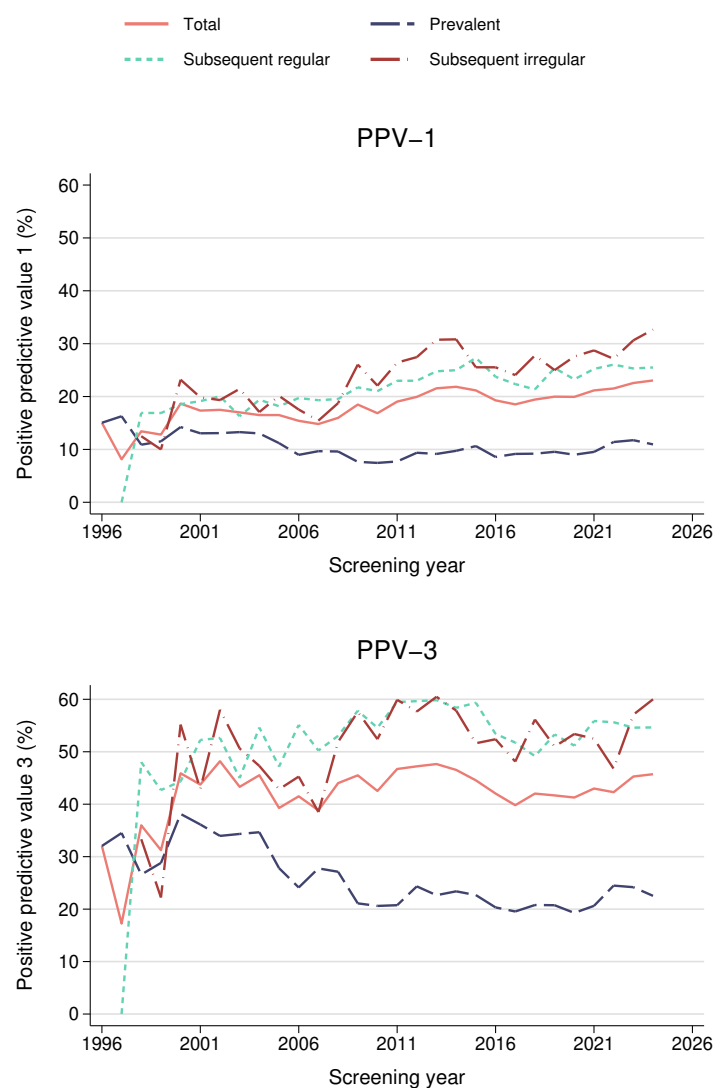


Figure 6.1: Positive predictive value of recall (PPV-1, upper panel, 1996-2025) and invasive procedures (PPV-3, lower panel, 1996-2024) by attendance pattern and screening year, in BreastScreen Norway. PPV-1 was defined as the proportion of screen-detected breast cancers (DCIS and invasive) among women recalled because of abnormal mammographic findings. PPV-3 was defined as the proportion of screen-detected breast cancers among women who underwent an invasive procedure.

Table 6.1: PPV-1: Proportion (%) of screen-detected breast cancers (DCIS and invasive) in BreastScreen Norway among women recalled due to abnormal findings (PPV-1) by screening area and screening year, for all screening examinations, 2021-2025.

Screening area	Screening year					Total
	2021	2022	2023	2024	2025	
Rogaland	19.0%	22.4%	25.1%	22.1%	21.4%	21.9%
Hordaland	16.2%	18.4%	17.9%	20.2%	22.7%	19.1%
Oslo	17.5%	17.3%	19.3%	15.3%	18.9%	17.7%
Telemark	43.4%	25.7%	37.4%	36.5%	36.8%	35.0%
Agder	17.2%	17.0%	16.3%	18.3%	17.2%	17.2%
Troms og F	17.1%	13.4%	15.8%	16.5%	18.3%	15.9%
Østfold	23.5%	25.8%	30.1%	24.9%	24.2%	25.4%
Nordland	31.4%	25.0%	24.5%	20.0%	19.5%	23.7%
Trøndelag	30.0%	26.9%	24.6%	27.1%	24.6%	26.4%
Oppland	23.3%	22.9%	22.0%			22.7%
Møre og R	25.8%	21.0%	20.1%	25.5%	24.8%	23.5%
Sogn og F	9.8%	18.1%	9.9%	13.3%	13.8%	13.0%
Vestfold	22.3%	20.8%	21.1%	21.5%	21.3%	21.4%
Hedmark	19.4%	17.6%	21.1%			19.3%
Akershus Øst	16.6%	19.3%	21.3%	17.9%	21.5%	19.2%
Vestre Viken	18.5%	17.8%	24.4%	21.4%	24.3%	21.0%
Fonna	20.9%	19.3%	23.4%	17.9%	21.6%	20.5%
Innlandet				20.6%	21.5%	21.1%
Total	19.9%	19.6%	21.4%	20.3%	21.6%	20.5%

Table 6.2: PPV-1: Proportion (%) of screen-detected breast cancers (DCIS and invasive) in BreastScreen Norway among women recalled due to abnormal findings (PPV-1) by screening area and screening year, for prevalently and subsequently screened, 2021-2025.

Screening area	Screening year											
	2021		2022		2023		2024		2025		Total	
	Pre	Sub	Pre	Sub	Pre	Sub	Pre	Sub	Pre	Sub	Pre	Sub
Rogaland	8.3%	25.4%	12.6%	27.9%	18.9%	27.6%	13.1%	26.1%	10.7%	27.2%	12.1%	26.9%
Hordaland	10.9%	19.1%	12.6%	20.3%	11.1%	21.5%	12.4%	24.8%	15.4%	25.0%	12.2%	22.1%
Oslo	6.1%	25.1%	10.2%	22.8%	9.8%	25.1%	8.1%	21.8%	11.5%	22.5%	9.1%	23.5%
Telemark	18.4%	54.8%	11.9%	33.1%	21.9%	41.5%	11.5%	50.0%	26.1%	40.3%	16.0%	43.1%
Agder	9.2%	20.0%	10.1%	21.4%	7.1%	19.6%	16.7%	18.8%	11.2%	19.8%	10.8%	19.9%
Troms og F	10.6%	20.4%	6.6%	16.4%	7.0%	19.9%	11.0%	19.9%	12.9%	21.3%	9.4%	19.2%
Østfold	15.3%	28.5%	14.0%	31.6%	17.8%	35.9%	15.5%	27.1%	13.5%	30.7%	15.0%	30.5%
Nordland	11.8%	36.8%	13.9%	30.9%	13.2%	28.7%	11.6%	23.3%	9.5%	23.2%	12.0%	28.2%
Trøndelag	14.0%	35.8%	14.0%	32.3%	13.4%	29.7%	13.4%	30.9%	10.0%	30.6%	12.8%	31.7%
Oppland	12.0%	28.9%	8.2%	28.6%	8.0%	28.8%					9.4%	28.8%
Møre og R	10.1%	36.0%	9.6%	25.7%	14.3%	22.6%	19.1%	28.0%	12.8%	31.5%	12.8%	28.5%
Sogn og F	5.3%	11.7%	8.3%	22.7%	6.4%	11.4%	5.4%	17.1%	3.4%	16.5%	6.0%	15.9%
Vestfold	8.1%	31.0%	11.7%	28.2%	3.3%	28.0%	3.8%	31.4%	10.6%	26.4%	7.6%	29.1%
Hedmark	11.9%	23.6%	11.7%	22.1%	2.2%	25.8%					10.0%	24.0%
Akershus Øst	7.2%	22.9%	9.9%	27.2%	14.2%	26.0%	7.9%	25.1%	12.8%	26.1%	10.1%	25.3%
Vestre Viken	9.1%	24.8%	9.6%	22.9%	15.2%	28.8%	12.3%	29.4%	11.4%	31.5%	11.3%	27.1%
Fonna	10.0%	26.7%	12.3%	23.1%	13.7%	31.1%	10.7%	23.8%	10.8%	26.3%	11.5%	26.0%
Innlandet							8.6%	25.9%	11.5%	25.7%	10.0%	25.8%
Total	9.6%	25.6%	10.7%	24.6%	11.8%	26.1%	10.7%	25.6%	12.0%	26.1%	10.9%	25.6%

Table 6.3: PPV-3: Proportion (%) of screen-detected breast cancers (DCIS and invasive) diagnosed after an invasive procedure (PPV-3) by screening area and screening year, for all screening examinations in BreastScreen Norway, 2021-2024.

Screening area	Screening year				Total
	2021	2022	2023	2024	
Rogaland	55.4%	55.1%	56.8%	48.1%	53.9%
Hordaland	27.7%	29.6%	28.8%	32.6%	29.5%
Oslo	38.0%	NA	NA	NA	38.0%
Telemark	66.2%	50.5%	66.7%	62.8%	61.1%
Agder	41.9%	36.8%	38.0%	40.8%	39.5%
Troms og F	NA	NA	37.6%	NA	37.6%
Østfold	63.2%	66.9%	68.5%	70.6%	67.0%
Nordland	60.7%	51.0%	54.0%	NA	55.5%
Trøndelag	59.7%	52.4%	50.0%	50.6%	52.9%
Oppland	47.8%	50.4%	52.8%		50.4%
Møre og R	48.9%	43.1%	41.6%	50.0%	46.0%
Sogn og F	41.3%	46.6%	31.4%	47.9%	42.2%
Vestfold	51.4%	43.5%	54.8%	54.9%	51.0%
Hedmark	41.7%	40.9%	46.5%		42.9%
Akershus Øst	34.3%	40.2%	44.6%	39.1%	39.2%
Vestre Viken	38.4%	NA	NA	NA	38.4%
Fonna	45.7%	44.4%	42.7%	40.2%	43.1%
Innlandet				42.9%	42.9%
Total	42.9%	43.8%	45.0%	44.7%	44.0%

NA (Not available): Excluded due to more than 10% missing data.

Table 6.4: PPV-3: Proportion (%) of screen-detected breast cancers (DCIS and invasive) diagnosed after an invasive procedure (PPV-3) by screening area and screening year, for prevalently and subsequently screened in BreastScreen Norway, 2021-2024.

Screening area	Screening year									
	2021		2022		2023		2024		Total	
	Pre	Sub	Pre	Sub	Pre	Sub	Pre	Sub	Pre	Sub
Rogaland	25.8%	71.3%	28.7%	71.7%	36.5%	67.2%	30.8%	55.0%	30.4%	66.1%
Hordaland	17.6%	33.6%	18.6%	33.5%	16.1%	36.5%	18.2%	42.4%	17.5%	36.2%
Oslo	13.2%	54.1%	NA	NA	NA	NA	NA	NA	13.2%	54.1%
Telemark	31.8%	79.3%	24.2%	64.1%	43.8%	71.8%	24.0%	78.7%	29.2%	73.2%
Agder	22.6%	48.9%	26.7%	41.5%	15.7%	46.9%	32.8%	43.6%	24.9%	45.2%
Troms og F	NA	NA	NA	NA	16.7%	47.6%	NA	NA	16.7%	47.6%
Østfold	43.6%	74.0%	47.2%	73.6%	36.4%	86.2%	37.5%	80.0%	41.5%	77.9%
Nordland	30.0%	66.7%	32.3%	59.2%	31.0%	61.9%	NA	NA	31.2%	63.0%
Trøndelag	27.6%	71.5%	26.2%	63.9%	30.4%	57.7%	24.1%	58.4%	27.3%	62.4%
Oppland	22.9%	61.4%	19.4%	61.6%	20.9%	66.3%			21.3%	63.3%
Møre og R	19.1%	67.9%	19.2%	53.3%	24.5%	51.0%	35.4%	55.9%	24.0%	57.0%
Sogn og F	27.3%	45.7%	20.8%	59.2%	16.7%	39.4%	21.4%	58.8%	20.9%	51.7%
Vestfold	21.3%	66.7%	23.5%	60.8%	15.0%	62.5%	12.2%	71.8%	19.3%	65.7%
Hedmark	28.6%	47.9%	27.1%	51.6%	5.9%	54.8%			24.0%	51.6%
Akershus Øst	14.8%	47.7%	20.6%	56.4%	29.3%	54.8%	17.3%	54.6%	20.1%	53.0%
Vestre Viken	19.2%	50.7%	NA	NA	NA	NA	NA	NA	19.2%	50.7%
Fonna	21.6%	58.8%	30.3%	51.5%	26.0%	55.2%	26.5%	49.3%	26.0%	53.6%
Innlandet							17.1%	54.9%	17.1%	54.9%
Total	20.6%	55.0%	24.5%	53.8%	24.2%	54.9%	22.5%	55.3%	22.7%	54.8%

NA (Not available): Excluded due to more than 10% missing data.

7. Tumor histopathology

In this report, tumor histopathology was reported only for women screened through the end of 2024 for screen-detected cancer and screened until the end of 2022 for interval cancer. This was to ensure completeness of histopathological characteristics and because neoadjuvant treatment can last up to seven months. Consequently, some women diagnosed in 2025 had not completed their treatment before data extraction, and their treatment status had therefore not yet been recorded. Women who received neoadjuvant therapy, as well as those with unknown treatment status, were thus excluded from the analyses presented in Section 7.4-7.9. Detailed information about these numbers is provided in section 7.3.

Only the first screen-detected or interval cancer diagnosed following participation in BreastScreen Norway was included in this report. Women with a history of breast cancer or breast cancer recurrence prior to their invitation were not eligible for inclusion.

Most tumor characteristics presented in this chapter are routinely considered when treatment recommendations are determined. However, histologic type of invasive cancers and mode of detection are generally not included in treatment algorithms. This is despite evidence that invasive lobular carcinoma differs from invasive carcinoma of no special type (NST) in growth pattern and clinical presentation, and that screen-detected and interval/clinical cancers differ in biological characteristics and prognosis, even after adjustment for established prognostic factors (63–65). These findings suggest that factors not currently incorporated into treatment decision-making may provide additional information about tumor biology and clinical outcome (66).

7.1 Histologic type

Histologic type describes the microscopic characteristics of a tumor and forms the basis for classification into distinct tumor entities (67). Histologic classification is based on morphological features that are associated with distinct biological, clinical and prognostic characteristics. In this

report, tumors are classified as DCIS, invasive carcinoma of no special type (NST), invasive lobular carcinoma (ILC), and other invasive carcinoma types.

From 1996 to 2024, the proportion of DCIS among all screen-detected breast cancers remained stable between 15-20% (Figure 7.1). Among prevalently screened women, the proportion varied between 15 and 30%, whereas the proportion among subsequently screened varied between 10 and 20%.

The proportion of DCIS among screen-detected breast cancers was 19% in BreastScreen Norway during 2020-2024 (Table 7.1). The proportion ranged from 14% in Hedmark to 24% in Vestre Viken. Invasive carcinoma of no special type (NST) accounted for 67% of screen-detected cancers. Invasive lobular carcinomas (ILC) and other invasive carcinomas (Other) accounted for 11% and 4%, respectively (Table 7.1). For all breast cancers diagnosed in Norway in 2025, regardless of age and mode of detection, invasive carcinoma NST accounted for 67% of cases, DCIS for 14%, invasive lobular carcinoma for 9%, and other invasive carcinoma types for 10%. Thus, the histologic distribution of screen-detected cancers in BreastScreen Norway was broadly similar to that observed nationally (68).

Before the introduction of organized screening in 1996, DCIS accounted for less than 5% of all breast malignancies (69). The proportion of DCIS increased substantially following the implementation of BreastScreen Norway, likely reflecting improved reporting and registration practices as well as increased detection of asymptomatic lesions, many of which present as microcalcifications on mammograms (70). The higher proportion of DCIS among screen-detected cancers compared with all breast cancers diagnosed nationally is consistent with the ability of mammographic screening to detect calcification on screening mammograms, indicating pre-invasive disease before progression to invasive cancer.

Only about 7% of interval cancers were classified as DCIS, which fits well with the fact that the calcification in DCIS is typically asymptomatic and is most often detected through mammographic findings rather than clinical presentation.

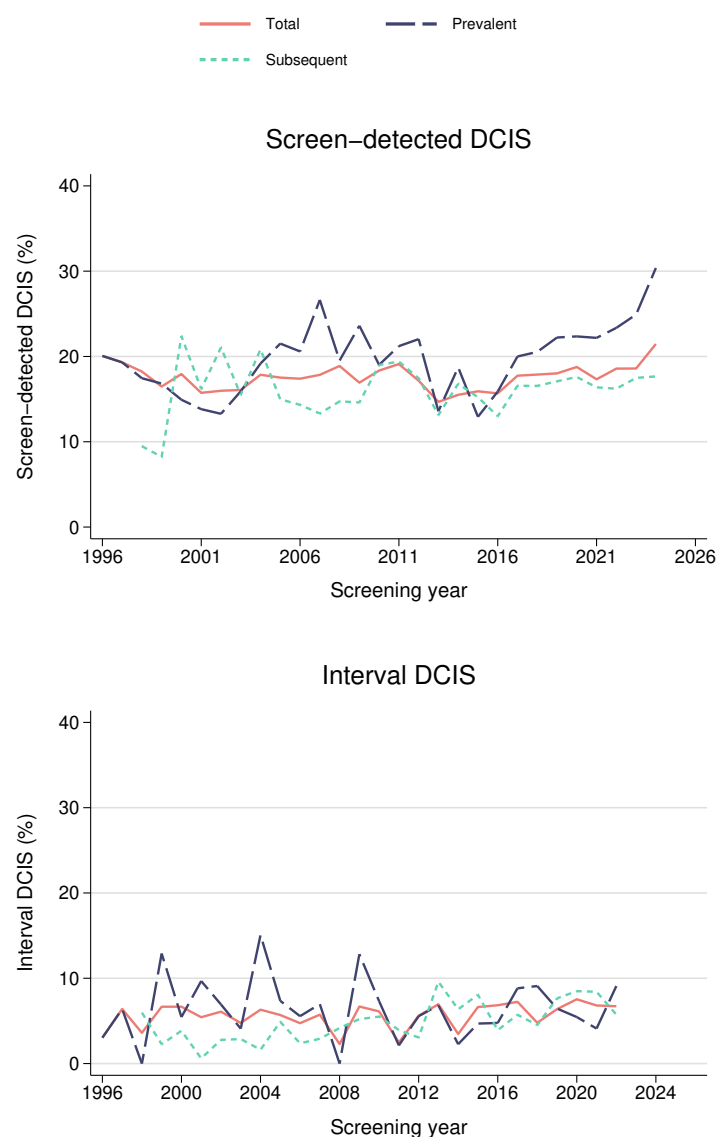


Figure 7.1: Proportion (%) of ductal carcinoma in situ (DCIS) among screen-detected breast cancers, screened 1996-2024 (upper panel), and interval cancers, screened 1996-2022 (lower panel), in BreastScreen Norway, overall and by screening history (prevalent or subsequent).

Table 7.1: Number (n) and proportion (%) of histologic type [ductal carcinoma in situ (DCIS), invasive carcinoma of no special type (NST), invasive lobular carcinoma (ILC) and other invasive carcinomas (Other)] for screen-detected breast cancer in BreastScreen Norway by screening area, 2020-2024.

Screening area	DCIS		NST		ILC		Other	
	n	%	n	%	n	%	n	%
Rogaland	101	20.1%	347	69.1%	35	7.0%	19	3.8%
Hordaland	134	21.0%	424	66.5%	62	9.7%	18	2.8%
Oslo	130	17.8%	465	63.6%	87	11.9%	49	6.7%
Telemark	46	19.2%	164	68.6%	20	8.4%	9	3.8%
Agder	82	18.9%	280	64.7%	50	11.5%	21	4.8%
Troms og F	54	14.4%	271	72.3%	41	10.9%	9	2.4%
Østfold	71	16.3%	283	64.9%	59	13.5%	23	5.3%
Nordland	50	17.1%	203	69.5%	26	8.9%	13	4.5%
Trøndelag	112	19.2%	391	67.1%	53	9.1%	27	4.6%
Oppland	40	16.8%	171	71.8%	22	9.2%	5	2.1%
Møre og R	64	18.0%	244	68.5%	38	10.7%	10	2.8%
Sogn og F	17	16.2%	71	67.6%	12	11.4%	5	4.8%
Vestfold	57	17.0%	236	70.2%	29	8.6%	14	4.2%
Hedmark	26	13.9%	139	74.3%	10	5.3%	12	6.4%
Akershus Øst	131	19.7%	443	66.6%	76	11.4%	15	2.3%
Vestre Viken	203	23.6%	510	59.4%	120	14.0%	26	3.0%
Fonna	47	19.8%	156	65.8%	24	10.1%	10	4.2%
Innlandet	21	20.0%	66	62.9%	15	14.3%	3	2.9%
Total	1,386	18.9%	4,864	66.5%	779	10.6%	288	3.9%

7.2 Characteristics of DCIS

DCIS includes a wide spectrum of diseases ranging from low-grade lesions with a low risk of progression and breast cancer mortality, to extensive high-grade lesions that may harbor foci of invasive disease (71). Breast cancer mortality following a diagnosis of DCIS is low, with approximately 1–1.5% of women dying from breast cancer within 10 years of diagnosis. Nevertheless, this risk remains higher than that expected in the general female population, suggesting that DCIS may serve as a marker of increased long-term breast cancer risk (72). Women aged 50 years or older diagnosed with DCIS have been reported to have lower all-cause mortality than women in the general population, likely reflecting, at least in part, the healthy participant effect (73). Women who attend mammographic screening may differ systematically from non-attenders with respect to health status, comorbidity, health-seeking behavior, and socioeconomic factors. This phenomenon, often referred to as the healthy screen effect, may contribute to improved overall survival independent of the direct benefits of screening. Consequently, survival differences between attenders and non-attenders should be interpreted with caution (65, 74).

Tumor diameter and Van Nuys grade of DCIS are important parameters in the quality assurance of the screening program (75). The proportion of grade I DCIS should remain low to minimize the detection and treatment of lesions with a low malignant potential. Although a low proportion of grade I DCIS is generally considered desirable, no consensus exists regarding an optimal threshold. This remains a challenge when using DCIS grade distribution as a quality indicator in mammographic screening.

In BreastScreen Norway during 2020-2024, 27% of DCIS tumors were smaller than 11 mm, while 12% exceeded 50 mm (Table 7.2). The proportion of tumors larger than 50 mm

ranged from 9% in 2021 to 13% in 2023. During 2020-2024, grade I DCIS accounted for 18%, while grade III accounted for 67% (Table 7.3). The proportion of grade II DCIS ranged from 13% in 2023 and 2024 to 19% in 2021, while grade III DCIS ranged from 64% in 2021 to 68% in 2020 and 2022.

The predominance of grade III DCIS is consistent with the ability of mammographic screening to detect lesions with histopathological features associated with a higher risk of progression. Tumor diameter and grade were not presented by screening area because the numbers were small.

Table 7.2: Distribution (%) of tumor diameter (<11 mm, 11-20 mm, 21-50 mm, >50 mm) of screen-detected ductal carcinoma in situ (DCIS) in BreastScreen Norway, by screening year, 2020-2024.

	<11 mm	11-20 mm	21-50 mm	>50 mm
2020 (n=200)	28%	24%	37%	11%
2021 (n=284)	26%	30%	35%	9%
2022 (n=289)	28%	29%	32%	11%
2023 (n=306)	27%	28%	32%	13%
2024 (n=323)	26%	28%	34%	12%
Total (n=1,402)	27%	28%	34%	12%

Table 7.3: Distribution (%) of Van Nuys grade for screen-detected ductal carcinoma in situ (DCIS) in BreastScreen Norway by screening year, 2020-2024.

	Grade I	Grade II	Grade III
2020 (n=216)	16%	17%	68%
2021 (n=303)	17%	19%	64%
2022 (n=319)	18%	14%	68%
2023 (n=325)	20%	13%	67%
2024 (n=354)	20%	13%	67%
Total (n=1,517)	18%	15%	67%

7.3 Impact of neoadjuvant treatment on histological tumor characteristics

Women with invasive breast cancer who received neoadjuvant therapy, as well as those with unknown neoadjuvant treatment status, were excluded from analyses of tumor diameter, lymph node status, histologic grade and immunohistochemical subtypes, as neoadjuvant therapy may alter these parameters and the recorded values may therefore not reflect the original tumor characteristics.

Neoadjuvant treatment has been registered in the Cancer Registry since 2009. The number of women receiving neoadjuvant therapy has increased gradually over time, reaching approximately 100 and 150 cases annually in recent years for screen-detected and interval cancers, respectively (Figure 7.2).

Around 2020, the guidelines for using neoadjuvant treatment changed, from a threshold of >50 mm tumor diameter to >20 mm (76). During 2020-2024, 9.5% of women with invasive screen-detected breast cancer received neoadjuvant therapy, while 1.1% had unknown status (Table 7.4). Among women with invasive interval cancer screened during 2018-2022, the corresponding proportions were 25.9% and 3.9%, respectively. The substantially higher use of neoadjuvant therapy among women with interval cancers is consistent with the generally less favorable tumor characteristics observed for interval cancers compared with screen-detected cancers. The proportion receiving neoadjuvant treatment varied across screening areas.

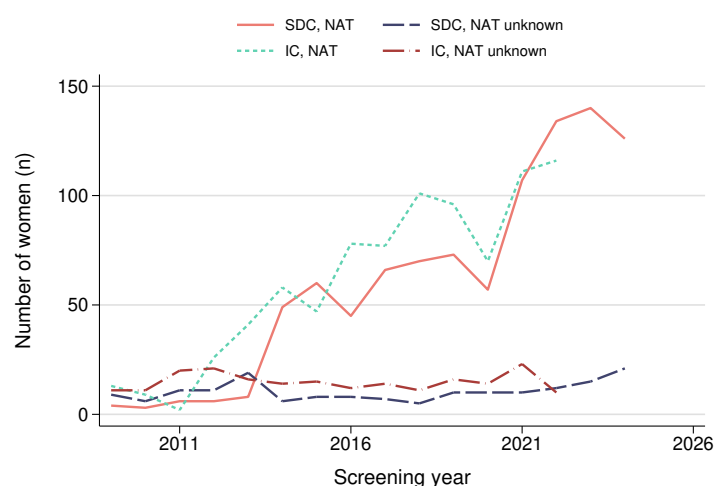


Figure 7.2: Number (n) of women with invasive screen-detected breast cancer (screened 2009-2024) or invasive interval cancer (screened 2009-2022) in BreastScreen Norway who received neoadjuvant treatment (NAT) or had unknown neoadjuvant treatment status (NAT unknown).

Table 7.4: Number of invasive breast cancer cases in total (N) in BreastScreen Norway, number (n) and proportion (%) of women with invasive screen-detected breast cancer (screened 2020-2024) or invasive interval cancer (screened 2018-2022) who received neoadjuvant treatment (NAT), not received neoadjuvant treatment (No NAT), or had unknown neoadjuvant treatment status (NAT unknown).

Screen detected cancer								Interval cancer							
Screening area	N	NAT		No NAT		NAT unknown		N	NAT		No NAT		NAT unknown		
		n	%	n	%	n	%		n	%	n	%	n	%	
Rogaland	401	64	16.0%	332	82.8%	5	1.2%	141	52	36.9%	83	58.9%	6	4.3%	
Hordaland	504	78	15.5%	418	82.9%	8	1.6%	105	40	38.1%	59	56.2%	6	5.7%	
Oslo	601	62	10.3%	533	88.7%	6	1.0%	210	53	25.2%	147	70.0%	10	4.8%	
Telemark	193	14	7.3%	176	91.2%	3	1.6%	81	21	25.9%	58	71.6%	2	2.5%	
Agder	351	35	10.0%	312	88.9%	4	1.1%	117	25	21.4%	84	71.8%	8	6.8%	
Troms og F	321	28	8.7%	289	90.0%	4	1.2%	97	32	33.0%	63	65.0%	2	2.1%	
Østfold	365	27	7.4%	332	91.0%	6	1.6%	138	22	15.9%	112	81.2%	4	2.9%	
Nordland	242	21	8.7%	220	90.9%	1	0.4%	108	35	32.4%	70	64.8%	3	2.8%	
Trøndelag	471	31	6.6%	435	92.4%	5	1.1%	167	40	24.0%	126	75.5%	1	0.6%	
Oppland	198	4	2.0%	192	97.0%	2	1.0%	72	8	11.1%	62	86.1%	2	2.8%	
Møre og R	292	13	4.5%	278	95.2%	1	0.3%	91	20	22.0%	68	74.7%	3	3.3%	
Sogn og F	88	16	18.2%	72	81.8%			48	20	41.7%	26	54.2%	2	4.2%	
Vestfold	279	15	5.4%	262	93.9%	2	0.7%	94	24	25.5%	66	70.2%	4	4.3%	
Hedmark	161	3	1.9%	158	98.4%			75	6	8.0%	64	85.3%	5	6.7%	
Akershus Øst	534	68	12.7%	462	86.5%	4	0.7%	149	38	25.5%	103	69.1%	8	5.4%	
Vestre Viken	656	48	7.3%	598	91.1%	10	1.5%	178	47	26.4%	123	69.1%	8	4.5%	
Fonna	190	31	16.3%	154	81.1%	5	2.6%	33	11	33.3%	22	66.7%			
Innlandet	84	6	7.1%	76	90.5%	2	2.4%								
Total	5,931	564	9.5%	5,299	89.3%	68	1.1%	1,904	494	25.9%	1,336	70.2%	74	3.9%	

7.4 Tumor diameter

Women who received neoadjuvant therapy, as well as those with unknown neoadjuvant treatment status, were excluded from the analyses in this section.

Overall, the tumor diameter distribution among invasive screen-detected cancers remained relatively stable between 1996 and 2024, with 35-40% of the cases measuring 10 mm or less and approximately 45% measuring 11-20 mm (Figure 7.3). Among invasive interval cancers, the proportion of tumors measuring 10 mm or less remained stable at approximately 20% during the period 1996-2022 (Figure 7.3), while the proportion of cases measuring 11-20

mm was 40%. Cancers larger than 50 mm were more common among invasive interval cancers than among invasive screen-detected cancers.

Between 2020 and 2024, 45% of the reported invasive screen-detected tumors were 11-20 mm, and 19% were larger than 20 mm (Table 7.5). Among invasive interval cancers in women screened during 2019-2022, about 45% measured 11-20 mm. A substantially lower proportion of invasive interval cancers than invasive screen-detected cancers measured less than 11 mm, whereas invasive interval cancers had nearly twice the proportion of tumors larger than 20 mm.

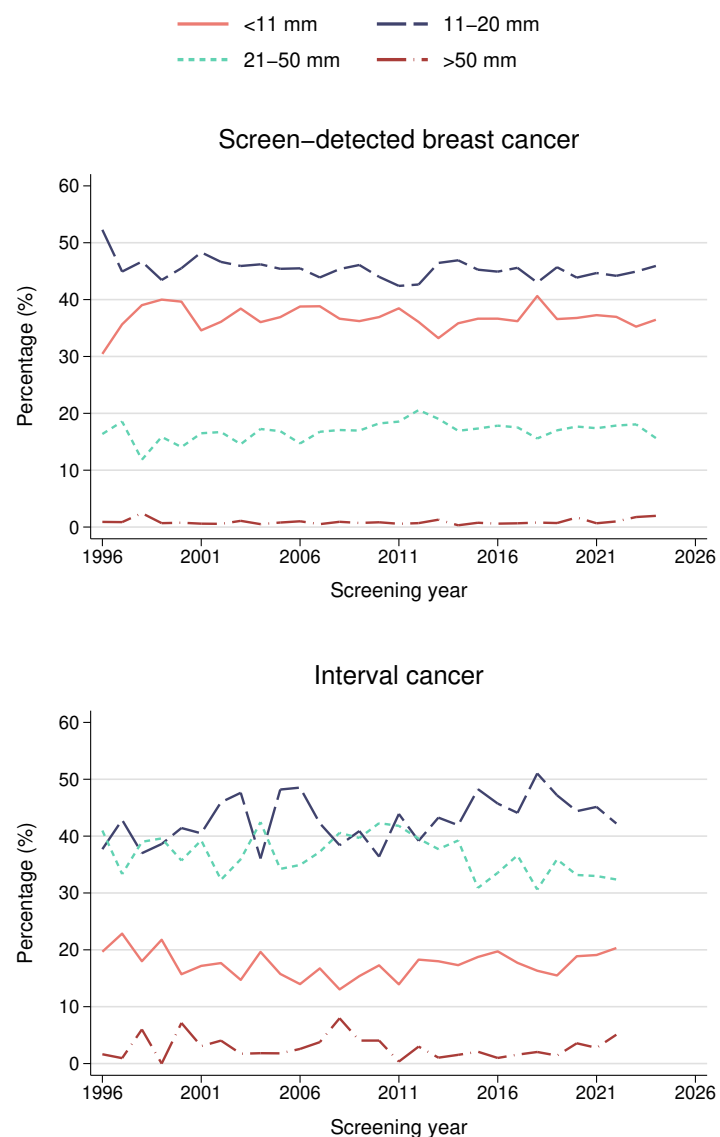


Figure 7.3: Distribution (%) of tumor diameter categories (<11 mm, 11-20 mm, 21-50 mm, >50 mm) in BreastScreen Norway for invasive screen-detected breast cancer, screened 1996-2024 (upper panel), and invasive interval cancer, screened 1996-2022 (lower panel). Neoadjuvantly treated lesions and lesions with unknown neoadjuvant status are excluded.

Table 7.5: Number (n) and proportion (%) of tumor diameter categories (<11 mm, 11-20 mm and >20 mm) in BreastScreen Norway by screening area, for invasive screen-detected breast cancer, screened 2020-2024 (upper table), and invasive interval cancer, screened 2018-2022 (lower table). Neoadjuvantly treated lesions and lesions with unknown neoadjuvant status are excluded.

Screen-detected breast cancer						
Screening area	<11 mm		11-20 mm		>20 mm	
	n	%	n	%	n	%
Rogaland	119	35.8%	142	42.8%	71	21.4%
Hordaland	154	37.0%	178	42.8%	84	20.2%
Oslo	194	36.5%	217	40.9%	120	22.6%
Telemark	68	38.6%	71	40.3%	37	21.0%
Agder	124	39.7%	149	47.8%	39	12.5%
Troms og F	109	37.7%	142	49.1%	38	13.1%
Østfold	113	34.0%	152	45.8%	67	20.2%
Nordland	95	43.2%	100	45.5%	25	11.4%
Trøndelag	172	39.6%	189	43.5%	73	16.8%
Oppland	69	36.3%	81	42.6%	40	21.1%
Møre og R	107	38.6%	134	48.4%	36	13.0%
Sogn og F	30	41.7%	31	43.1%	11	15.3%
Vestfold	93	35.5%	123	46.9%	46	17.6%
Hedmark	59	37.6%	74	47.1%	24	15.3%
Akershus Øst	152	33.0%	217	47.1%	92	20.0%
Vestre Viken	181	30.3%	252	42.2%	164	27.5%
Fonna	67	43.5%	78	50.6%	9	5.8%
Innlandet	26	34.2%	37	48.7%	13	17.1%
Total	1,932	36.5%	2,367	44.8%	989	18.7%

Interval cancer						
Screening area	<11 mm		11-20 mm		>20 mm	
	n	%	n	%	n	%
Rogaland	10	12.0%	47	56.6%	26	31.3%
Hordaland	13	22.0%	27	45.8%	19	32.2%
Oslo	33	22.6%	78	53.4%	35	24.0%
Telemark	*	*	*	*	30	52.6%
Agder	14	16.7%	41	48.8%	29	34.5%
Troms og F	15	24.2%	27	43.5%	20	32.3%
Østfold	24	21.4%	43	38.4%	45	40.2%
Nordland	8	11.4%	29	41.4%	33	47.1%
Trøndelag	21	16.9%	50	40.3%	53	42.7%
Oppland	9	14.5%	30	48.4%	23	37.1%
Møre og R	15	22.1%	32	47.1%	21	30.9%
Sogn og F	5	19.2%	9	34.6%	12	46.2%
Vestfold	13	19.7%	31	47.0%	22	33.3%
Hedmark	10	16.1%	26	41.9%	26	41.9%
Akershus Øst	16	15.5%	49	47.6%	38	36.9%
Vestre Viken	26	21.3%	53	43.4%	43	35.2%
Fonna	*	*	14	63.6%	*	*
Total	*	*	*	*	*	*

* Cells with n<5, and additional cells required to prevent back-calculation, have been suppressed to protect confidentiality.

Median tumor diameter was 13 mm for invasive screen-detected cancers diagnosed during 2020-2024 and 17 mm for invasive interval cancers diagnosed in women screened during 2018 to 2022 (Table 7.6). Tumors tended to have smaller diameters than those reported in the 20- and 25-year reports from BreastScreen Norway (1, 3). This is probably due to exclusion of the neoadjuvantly treated tumors.

Median tumor diameter for invasive screen-detected cancers ranged from 11 mm in Fonna to 15 mm in Vestre Viken. Median tumor diameter among invasive interval cancers ranged from 15 mm in Fonna to 21 mm in Telemark (Table 7.6).

Prior analyses of tumor characteristics have demonstrated tumor diameter as the only prognostic tumor characteristic that differed between invasive interval cancers detected in the first (18 mm) and second year (20 mm) of the screening interval (61).

A study from BreastScreen Norway on cases diagnosed between 2012 and 2016 reported evidence that pathologists displayed a terminal digit preference for zeroes and fives when recording tumor size (77). The study found an excess of tumors recorded as 10, 20 or 50 mm, which define the bor-

der values for T1c, T2, and T3 tumors. A digit preference for zeroes and fives may increase the likelihood of understaging of tumors in this report. This measurement bias may have resulted in tumor misclassifications and could potentially have influenced staging and treatment recommendations.

Tumor diameter distributions observed in BreastScreen Norway are consistent with the primary aim of mammographic screening, namely the detection of breast cancer at a lower tumor burden. More than one-third of invasive screen-detected cancers measured 10 mm or less, compared with fewer than one in five interval cancers. Similarly, the median tumor diameter was substantially lower for screen-detected cancers than for interval cancers (12.7 mm versus 17 mm). These findings are consistent with previous results from BreastScreen Norway demonstrating that screen-detected cancers are diagnosed with smaller tumor diameters than both interval cancers and breast cancers diagnosed among non-participants (64, 65, 78). Given the well-established association between tumor diameter, treatment options, and prognosis, the observed differences support the contribution of mammographic screening to earlier detection and reduced tumor burden at diagnosis (79).

Table 7.6: Median tumor diameter with the corresponding interquartile range (P25: 25th percentile, P75: 75th percentile) by screening year and screening area in BreastScreen Norway, for invasive screen-detected breast cancers, screened 2020-2024 (upper table) and invasive interval cancers, screened 2018-2022 (lower table). Neoadjuvantly treated lesions and lesions with unknown neoadjuvant status are excluded.

Screen-detected breast cancer						
Screening area	Screening year					Total
	2020	2021	2022	2023	2024	
	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)
Rogaland	12.5 (8.5 - 18.5)	12.0 (8.0 - 17.0)	12.0 (9.0 - 18.0)	13.0 (10.0 - 22.0)	14.0 (9.0 - 20.0)	12.5 (9.0 - 19.0)
Hordaland	14.0 (10.0 - 21.0)	11.0 (8.0 - 17.0)	13.0 (7.0 - 20.0)	12.0 (9.0 - 20.0)	13.0 (9.9 - 18.2)	13.0 (9.0 - 19.0)
Oslo	13.0 (9.0 - 18.0)	12.0 (8.5 - 20.0)	13.0 (8.0 - 19.0)	15.0 (9.0 - 21.0)	12.0 (9.0 - 20.0)	13.0 (9.0 - 20.0)
Telemark	16.0 (10.0 - 19.5)	11.0 (8.0 - 22.0)	12.5 (8.0 - 19.0)	13.0 (9.0 - 18.0)	12.0 (8.0 - 21.0)	12.5 (8.0 - 19.0)
Agder	11.8 (7.0 - 17.0)	12.0 (8.8 - 15.0)	12.0 (8.4 - 15.0)	13.0 (9.5 - 17.0)	11.2 (9.0 - 14.1)	12.0 (8.1 - 15.0)
Troms og F	11.0 (9.0 - 18.0)	11.0 (8.0 - 14.0)	12.0 (9.5 - 17.0)	15.0 (9.0 - 20.0)	15.0 (10.0 - 19.5)	12.0 (9.0 - 17.0)
Østfold	11.0 (9.0 - 17.0)	13.0 (8.0 - 21.0)	14.0 (9.5 - 21.0)	14.0 (9.0 - 16.0)	12.0 (9.0 - 17.0)	12.0 (9.0 - 18.0)
Nordland	12.0 (8.8 - 17.0)	13.0 (8.5 - 15.0)	10.0 (8.0 - 17.0)	11.0 (8.0 - 14.0)	11.5 (9.0 - 17.5)	11.0 (8.5 - 16.0)
Trøndelag	14.0 (9.0 - 20.0)	13.0 (9.0 - 19.0)	13.0 (9.0 - 18.0)	12.0 (8.0 - 18.0)	11.0 (7.0 - 16.0)	12.0 (8.0 - 18.0)
Oppland	11.0 (7.0 - 16.0)	13.6 (8.0 - 20.0)	14.0 (10.0 - 18.0)	12.5 (8.0 - 20.0)		13.0 (8.0 - 18.0)
Møre og R	11.0 (7.0 - 15.0)	11.0 (8.0 - 15.0)	13.0 (8.2 - 17.0)	10.0 (7.0 - 14.0)	13.0 (9.0 - 17.0)	12.0 (8.0 - 16.0)
Sogn og F	13.0 (8.0 - 14.0)	18.0 (10.0 - 20.0)	12.0 (8.0 - 16.5)	8.0 (3.2 - 15.0)	11.0 (8.0 - 17.0)	12.5 (8.0 - 18.0)
Vestfold	12.0 (7.0 - 15.0)	14.0 (10.0 - 19.0)	12.5 (9.0 - 18.0)	11.0 (7.0 - 14.0)	12.0 (8.8 - 14.5)	12.0 (8.0 - 16.0)
Hedmark	13.5 (9.0 - 19.0)	12.0 (8.5 - 18.0)	12.0 (8.0 - 16.0)	12.0 (9.0 - 19.0)		12.0 (9.0 - 18.0)
Akershus Øst	13.5 (9.5 - 20.0)	15.0 (10.0 - 20.0)	14.0 (9.0 - 20.0)	12.0 (9.0 - 18.0)	14.0 (9.0 - 18.0)	14.0 (9.0 - 20.0)
Vestre Viken	15.0 (9.8 - 23.0)	15.0 (9.0 - 21.0)	13.2 (8.0 - 21.0)	15.2 (9.0 - 22.0)	13.0 (9.0 - 21.0)	15.0 (9.0 - 21.3)
Fonna	10.8 (8.4 - 13.5)	10.9 (8.9 - 15.1)	11.0 (6.1 - 14.5)	10.1 (5.7 - 12.6)	11.2 (7.4 - 14.2)	10.8 (7.2 - 14.2)
Innlandet					13.5 (9.0 - 19.0)	13.5 (9.0 - 19.0)
Total	13.0 (9.0 - 18.0)	12.0 (8.5 - 18.0)	13.0 (8.0 - 18.0)	12.0 (9.0 - 19.0)	12.0 (9.0 - 18.0)	12.7 (9.0 - 18.0)

Interval cancer						
Screening area	Screening year					Total
	2018	2019	2020	2021	2022	
	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)	Median (IQR)
Rogaland	15.0 (13.0 - 21.0)	17.0 (12.9 - 22.0)	17.5 (13.0 - 24.5)	16.0 (12.0 - 24.0)	17.5 (12.0 - 45.0)	16.0 (12.9 - 23.0)
Hordaland	24.0 (18.0 - 25.0)	16.0 (10.6 - 26.0)	18.0 (11.0 - 22.0)	17.0 (13.1 - 18.0)	17.0 (8.0 - 23.0)	18.0 (11.0 - 24.0)
Oslo	18.0 (12.0 - 20.0)	16.0 (12.0 - 21.5)	15.0 (9.0 - 20.5)	16.0 (10.0 - 20.0)	16.0 (12.0 - 20.5)	16.0 (12.0 - 20.0)
Telemark	17.0 (15.0 - 30.0)	24.0 (14.0 - 30.0)	21.5 (15.2 - 29.8)	18.0 (13.0 - 22.0)	25.0 (16.0 - 33.0)	21.0 (15.0 - 29.0)
Agder	17.0 (12.0 - 21.0)	15.5 (11.5 - 20.5)	22.0 (13.0 - 24.0)	17.0 (12.0 - 23.0)	14.5 (11.0 - 21.0)	16.0 (12.0 - 22.0)
Troms og F	22.0 (20.0 - 24.0)	17.0 (11.0 - 21.0)	17.5 (11.0 - 32.5)	15.0 (10.0 - 19.0)	15.0 (11.0 - 25.0)	17.5 (11.0 - 23.0)
Østfold	21.0 (11.0 - 30.0)	16.0 (14.0 - 23.0)	15.0 (8.5 - 23.0)	18.5 (15.0 - 24.0)	10.2 (9.0 - 21.0)	16.5 (11.0 - 24.0)
Nordland	15.0 (11.0 - 22.0)	19.0 (11.0 - 25.0)	16.0 (14.0 - 20.0)	22.0 (19.0 - 25.0)	25.5 (20.0 - 30.0)	20.0 (15.0 - 25.0)
Trøndelag	16.5 (11.5 - 25.0)	21.0 (16.0 - 29.0)	25.0 (13.0 - 32.0)	17.0 (11.0 - 22.0)	15.0 (12.0 - 23.0)	18.0 (13.0 - 25.0)
Oppland	19.0 (11.0 - 24.0)	16.0 (13.0 - 19.0)	21.0 (12.0 - 25.0)	19.0 (16.0 - 30.0)	19.0 (12.0 - 25.0)	18.0 (12.0 - 25.0)
Møre og R	13.5 (10.0 - 23.0)	17.0 (10.0 - 28.0)	15.5 (11.0 - 18.0)	14.0 (10.5 - 25.0)	16.5 (11.0 - 22.0)	15.5 (11.0 - 22.5)
Sogn og F	16.0 (12.0 - 70.0)	17.0 (11.0 - 21.0)	21.0 (12.0 - 60.0)	12.0 (9.0 - 18.0)	22.0 (15.0 - 62.0)	19.0 (12.0 - 36.0)
Vestfold	17.0 (11.5 - 20.5)	17.0 (11.0 - 22.0)	23.5 (19.5 - 63.0)	17.0 (9.0 - 21.6)	17.0 (12.0 - 24.0)	17.0 (12.0 - 22.0)
Hedmark	17.0 (15.0 - 19.0)	21.0 (13.0 - 25.5)	15.8 (10.5 - 22.5)	19.0 (12.0 - 24.0)	21.0 (15.0 - 35.0)	18.0 (14.0 - 23.0)
Akershus Øst	13.5 (12.0 - 19.9)	16.0 (13.0 - 24.0)	18.0 (15.0 - 21.0)	20.0 (13.0 - 25.0)	18.0 (15.0 - 30.0)	16.0 (13.0 - 25.0)
Vestre Viken	16.0 (14.0 - 24.0)	18.0 (11.0 - 25.0)	12.5 (9.0 - 25.0)	16.5 (12.0 - 21.5)	17.0 (11.7 - 26.0)	16.2 (11.0 - 24.0)
Fonna			15.0 (10.3 - 19.0)	14.0 (7.9 - 20.9)	17.2 (14.2 - 18.4)	15.0 (12.9 - 19.7)
Total	17.0 (12.0 - 22.5)	18.0 (12.0 - 25.0)	17.0 (11.5 - 24.0)	17.2 (12.0 - 23.0)	17.2 (12.0 - 25.0)	17.0 (12.0 - 24.0)

7.5 Histologic grade

The Nottingham histologic score system (80) was used for reporting histologic grade for invasive breast cancers. Women who received neoadjuvant therapy, as well as those with unknown treatment status, were excluded from the analyses presented in this section.

Among invasive screen-detected breast cancers, the proportion with histologic grade I declined from around 48% in 1996 to about 25% in 2024, while the proportion of grade II cancers remained around 50% for most of the study period and increased slightly in recent years (Figure 7.4). The proportion of histologic grade III cancers increased from about 9% in 1996 to about 20% in 2005 when the screening program became nationwide and has been stable around 20% since.

The decline in grade I cancers and the corresponding increase in grade III cancers over time are likely related to the gradual transition from a screening program dominated by prevalent examinations to one consisting primarily of subsequent screening examinations. During the implementation phase of BreastScreen Norway, many cancers detected at first screening represented tumors that had accumulated in the population over several years, including slowly growing lesions that are more likely to be of lower histologic grade. As the population became regularly screened, these tumors were progressively removed from the screening pool, increasing the relative proportion of cancers with less favorable histologic characteristics (81–83). Changes in mammographic technology, diagnostic practice, and histopatho-

logic classification may also have contributed to the observed trends (84–86).

For invasive interval cancers, the proportion with histologic grade I decreased from above 20% at the start-up of the program to a stable value of about 15% during the last decade (Figure 7.4). Among invasive interval cancers, grade II tumors generally accounted for 40%–60% of cases, whereas grade III tumors accounted for 25%–40%.

From 2020 to 2024, 54% of invasive screen-detected cancers were classified as histologic grade II, while 22% were classified as histologic grade III (Table 7.7). There were substantial variations in the distribution of histologic grade between screening areas. For example, in Agder and Møre og Romsdal, 14% and 37% of cancers were classified as grade III, respectively. This variation has been recognized since the start-up of the screening program and has been discussed several times. Whether these differences reflect true variation in tumor biology or variation in grading practices between pathology departments remains unknown. A recent nationwide study from Norway demonstrated substantial variation in histologic grading across breast centers, whereas variation in breast cancer-specific survival was limited (87). The relationship between these findings remains to be clarified.

During the last five years, 55% of invasive interval cancers were classified as histologic grade II, while about 30% were classified as histologic grade III (Table 7.7). Overall, approximately 80% of invasive interval cancers were classified as histologic grade II or III. As observed for screen-detected cancers, substantial variation in grade distribution was evident between screening areas.

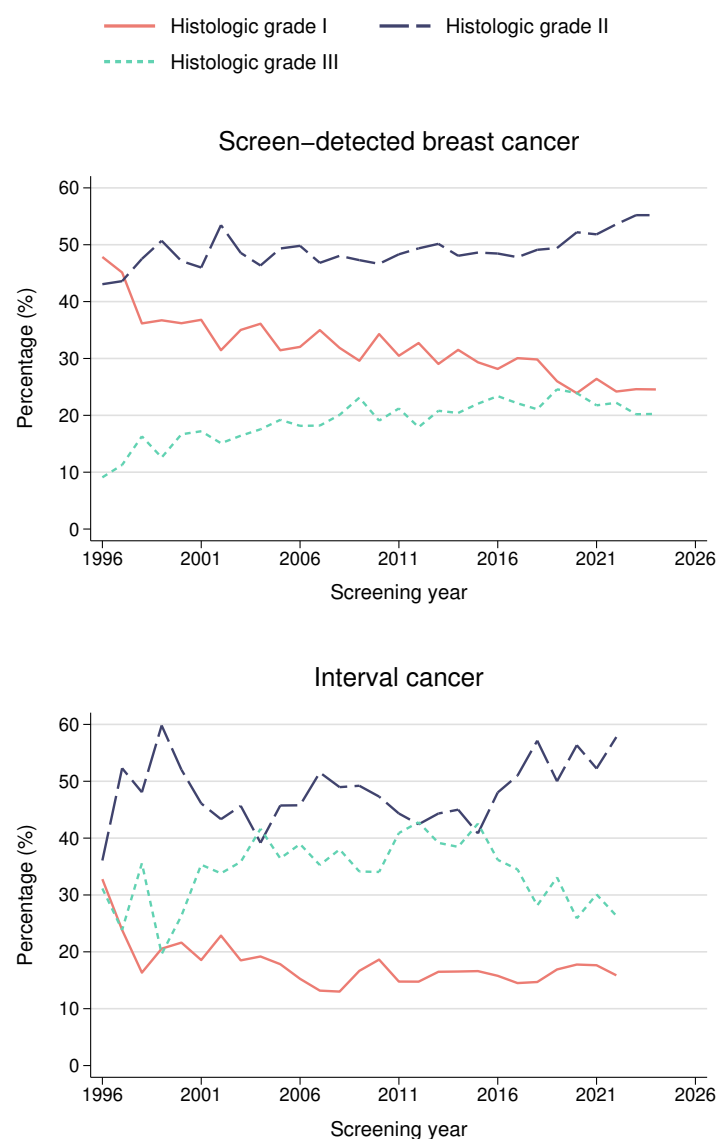


Figure 7.4: Distribution (%) of histologic grade in BreastScreen Norway for invasive screen-detected breast cancers, screened 1996-2024 (upper panel), and invasive interval cancers, screened 1996-2022 (lower panel) by screening year. Neoadjuvantly treated lesions and lesions with unknown neoadjuvant status are excluded.

Table 7.7: Number (n) and proportion (%) of histologic grade (1-3) in BreastScreen Norway, by screening area, for invasive screen-detected breast cancer, screened 2020-2024, and invasive interval cancer, screened 2018-2022. Neoadjuvantly treated lesions and lesions with unknown neoadjuvant status are excluded.

Screening area	Screen-detected breast cancer						Interval cancer					
	I		II		III		I		II		III	
	n	%	n	%	n	%	n	%	n	%	n	%
Rogaland	120	36.1%	135	40.7%	77	23.2%	20	24.1%	34	41.0%	29	34.9%
Hordaland	120	28.8%	202	48.6%	94	22.6%	10	17.2%	33	56.9%	15	25.9%
Oslo	114	21.5%	298	56.2%	118	22.3%	31	21.1%	73	49.7%	43	29.3%
Telemark	38	21.6%	101	57.4%	37	21.0%	7	12.3%	32	56.1%	18	31.6%
Agder	79	25.4%	188	60.5%	44	14.1%	12	14.3%	56	66.7%	16	19.0%
Troms og F	108	37.4%	128	44.3%	53	18.3%	17	27.0%	34	54.0%	12	19.0%
Østfold	39	11.8%	225	68.0%	67	20.2%	14	12.5%	59	52.7%	39	34.8%
Nordland	68	31.2%	107	49.1%	43	19.7%	10	14.3%	37	52.9%	23	32.9%
Trøndelag	92	21.1%	232	53.3%	111	25.5%	9	7.3%	71	57.3%	44	35.5%
Oppland	58	30.4%	102	53.4%	31	16.2%	10	16.1%	39	62.9%	13	21.0%
Møre og R	65	23.5%	110	39.7%	102	36.8%	18	26.5%	25	36.8%	25	36.8%
Sogn og F	17	23.6%	38	52.8%	17	23.6%	*	*	14	53.8%	*	*
Vestfold	60	22.9%	163	62.2%	39	14.9%	12	18.2%	31	47.0%	23	34.8%
Hedmark	51	32.3%	83	52.5%	24	15.2%	11	17.5%	36	57.1%	16	25.4%
Akershus Øst	122	26.4%	247	53.5%	93	20.1%	14	13.6%	64	62.1%	25	24.3%
Vestre Viken	102	17.1%	353	59.1%	142	23.8%	16	13.1%	75	61.5%	31	25.4%
Fonna	38	24.7%	84	54.5%	32	20.8%	*	*	13	59.1%	*	*
Innlandet	21	27.6%	41	53.9%	14	18.4%						
Total	1,312	24.8%	2837	53.7%	1138	21.5%	*	*	726	54.6%	*	*

* Cells with n<5, and additional cells required to prevent back-calculation, have been suppressed to protect confidentiality.

7.6 Lymph node involvement

Lymph node involvement is an important component of breast cancer staging and is strongly associated with treatment recommendations and prognosis (76). Women who received neoadjuvant therapy, as well as those with unknown neoadjuvant treatment status, were excluded from analyses presented in this section.

The proportion of lymph node-positive invasive screen-detected cancers varied between 20% and 30% in the period from the start-up of the screening program until 2010, after which it stabilized at around 20% (Figure 7.5). Among invasive interval cancers, the proportion of lymph node-positive cancers decreased from about 45% in the first decade of the screening program to less than 30% in 2022 (Figure 7.5).

The reasons for this decline might be related to the increasing use of neoadjuvant treatment during the study period, as women receiving neoadjuvant therapy were excluded from these analyses.

Overall, 16% of women diagnosed with invasive screen-detected cancer during 2020-2024 had lymph node involvement (Table 7.8). The proportion varied across screening areas, from 10% in Fonna to 22% in Østfold. Among women with invasive interval cancer, 25% had lymph node involvement, ranging from 15% in Hordaland to 36% in Telemark for those screened 2018-2022 (Table 7.8). As observed for histologic grade, substantial variation between screening areas was evident. Whether these differences reflect true variation in case mix, diagnostic practice, pathological assessment, or random variation remains uncertain.

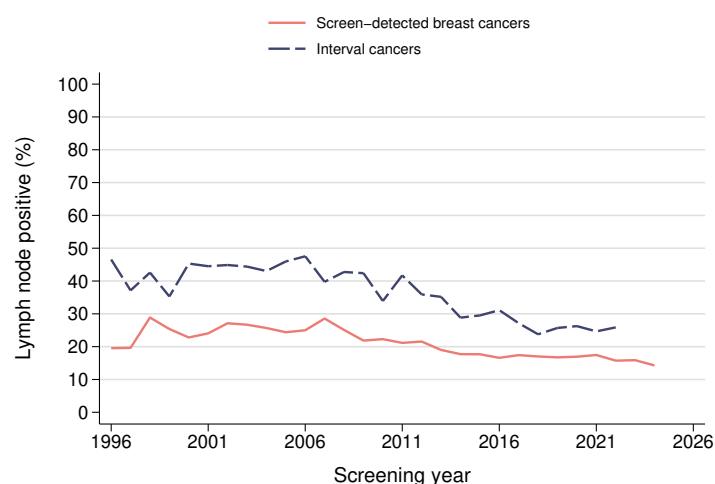


Figure 7.5: Proportion (%) of lymph node-positive invasive screen-detected breast cancers, screened 1996-2024, and invasive interval cancers, screened 1996-2022, in BreastScreen Norway, by screening year. Neoadjuvantly treated lesions and lesions with unknown neoadjuvant status are excluded.

Among women with invasive screen-detected cancer and lymph node involvement, 91% had 1-9 positive lymph nodes, while 9% had 10 or more positive lymph nodes during 2020-2024 (Table 7.9). The proportion of 1-9 positive lymph nodes ranged from 78% in Fonna to 100% in Telemark. Among women with invasive interval cancers and lymph node involvement, 95% had 1-9 positive lymph nodes (Table 7.9). The proportion ranged from 89% in Vestre Viken to 100% in several screening areas. Thus, among women with lymph node-positive disease, extensive nodal involvement (≥ 10 positive lymph nodes) was uncommon in both screen-detected and interval cancers.

Compared with screen-detected cancers, interval cancers consistently showed a higher proportion of lymph node involvement. These findings suggest that the principal difference between screen-detected and interval cancers lies in the frequency of lymph node involvement rather than in the extent of nodal disease among women with positive lymph nodes. Together with the observed differences in tumor diameter and histologic grade, the results indicate that interval cancers more often present with less favorable prognostic characteristics than screen-detected cancers.

Table 7.8: Number (n) and proportion (%) of cases with lymph node involvement in BreastScreen Norway, by screening area, for invasive screen-detected breast cancer, screened 2020-2024, and invasive interval cancer, screened 2018-2022. Neoadjuvantly treated lesions and lesions with unknown neoadjuvant status are excluded.

Screening area	Screen-detected cancer		Interval cancer	
	n	%	n	%
Rogaland	47	14.2%	14	16.9%
Hordaland	51	12.2%	9	15.3%
Oslo	86	16.5%	31	21.2%
Telemark	31	17.6%	21	36.2%
Agder	48	15.5%	17	20.2%
Troms og F	44	15.3%	19	30.2%
Østfold	74	22.4%	27	24.1%
Nordland	35	16.1%	24	34.3%
Trøndelag	84	19.5%	34	27.4%
Oppland	34	18.1%	15	24.2%
Møre og R	48	17.4%	23	33.8%
Sogn og F	11	15.5%	6	23.1%
Vestfold	45	17.3%	17	26.2%
Hedmark	17	10.9%	17	27.0%
Akershus Øst	67	14.6%	30	29.7%
Vestre Viken	98	16.5%	26	21.5%
Fonna	15	9.9%	5	22.7%
Innlandet	8	10.7%		
Total	843	16.0%	335	25.2%

Table 7.9: Number (n) and proportion (%) of cases with 1-9 positive lymph nodes among lymph node-positive invasive screen-detected breast cancer, screened 2020-2024, and lymph node-positive invasive interval cancer, screened 2018-2022, in BreastScreen Norway by screening area. Neoadjuvantly treated lesions and lesions with unknown neoadjuvant status are excluded.

Screening area	Screen-detected cancer		Interval cancer	
	n	%	n	%
Rogaland	46	95.8%	14	100.0%
Hordaland	50	98.0%	9	100.0%
Oslo	83	85.6%	31	96.9%
Telemark	31	100.0%	21	100.0%
Agder	44	88.0%	17	100.0%
Troms og F	41	91.1%	18	94.7%
Østfold	73	97.3%	27	100.0%
Nordland	35	94.6%	24	100.0%
Trøndelag	82	92.1%	34	94.4%
Oppland	33	86.8%	15	100.0%
Møre og R	43	86.0%	21	91.3%
Sogn og F	11	91.7%	6	100.0%
Vestfold	42	89.4%	16	88.9%
Hedmark	16	84.2%	16	88.9%
Akershus Øst	65	92.9%	29	90.6%
Vestre Viken	95	92.2%	25	89.3%
Fonna	14	77.8%	5	100.0%
Innlandet	8	88.9%		
Total	812	91.3%	328	95.3%

7.7 Stage distribution

The stage distribution became more favorable over time for both invasive screen-detected and interval cancers (Figure 7.6). Among screen-detected cancers, the proportion diagnosed at stage I increased from approximately 60% in 1996 to about 75% in 2024, while the proportion diagnosed at stage II decreased from approximately 35% to about 20% during the reported period. Stage III or higher remained uncommon throughout the period. Among in-

terval cancers, stage II dominated the first part of the reported period, but stage I became the most common stage from around 2010. In recent years, approximately 55% of interval cancers were diagnosed at stage I, 40% at stage II, and fewer than 5% at stage III or higher. Changes in both stage coding and the definitions of variables used for stage classification occurred during the reported period. Consequently, trends in stage distribution over time should be interpreted with caution (88).

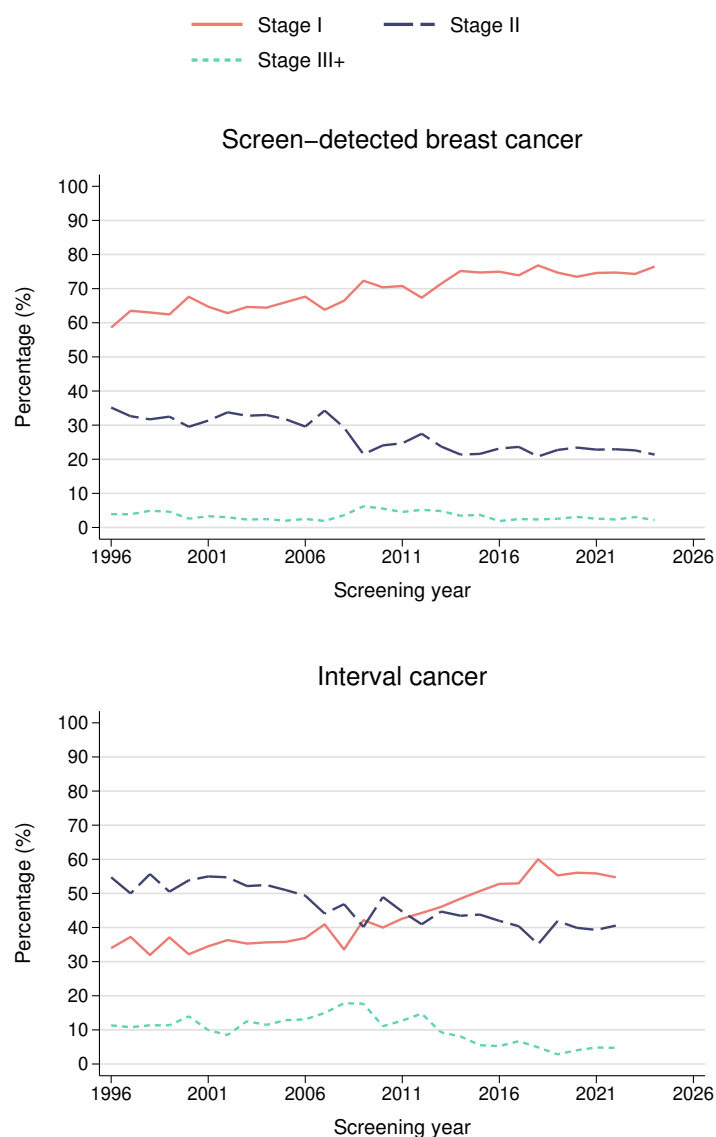


Figure 7.6: Distribution (%) of stage for invasive screen-detected breast cancers, screened 1996-2024 (upper panel), and invasive interval cancers, screened 1996-2022 (lower panel) in BreastScreen Norway by screening year. Neoadjuvantly treated lesions and lesions with unknown neoadjuvant status are excluded.

The stage distribution varied across screening areas (Table 7.10). For screen-detected cancers, the proportion diagnosed at stage I ranged from approximately 70% to 90%. Stage III or higher was uncommon across all screening areas.

Stage I interval cancers accounted for 56.3%, stage II cancers for 39.5%, and stage III+ cancers for 4.3% of all interval cancers among women screened in 2018-2022 (not in table).

Table 7.10: Number (n) and proportion (%) of stage (1-3+) in BreastScreen Norway, by screening area, for invasive screen-detected breast cancer, screened 2020-2024. Neoadjuvantly treated lesions and lesions with unknown neoadjuvant status are excluded.

Screening area	Screen-detected breast cancer					
	I		II		III+	
	n	%	n	%	n	%
Rogaland	232	69.9%	*	*	*	*
Hordaland	319	76.3%	93	22.2%	6	1.4%
Oslo	391	73.4%	126	23.6%	16	3.0%
Telemark	129	73.3%	42	23.9%	5	2.8%
Agder	252	80.8%	50	16.0%	10	3.2%
Troms og F	226	78.2%	55	19.0%	8	2.8%
Østfold	233	70.2%	87	26.2%	12	3.6%
Nordland	182	82.7%	*	*	*	*
Trøndelag	328	75.4%	92	21.1%	15	3.4%
Oppland	136	70.8%	49	25.5%	7	3.6%
Møre og R	215	77.6%	51	18.4%	11	4.0%
Sogn og F	57	79.2%	*	*	*	*
Vestfold	196	74.8%	58	22.1%	8	3.1%
Hedmark	126	79.7%	*	*	*	*
Akershus Øst	333	72.1%	119	25.8%	10	2.2%
Vestre Viken	414	69.2%	165	27.6%	19	3.2%
Fonna	137	89.0%	*	*	*	*
Innlandet	56	73.7%	*	*	*	*
Total	3,962	74.8%	*	*	*	*

* Cells with n<5, and additional cells required to prevent back-calculation, have been suppressed to protect confidentiality.

7.8 Immunohistochemical subtypes

Immunohistochemical subtypes provide important information about tumor biology, treatment options, and prognosis (89). Despite recent advances in treatment, such as immunotherapy, triple-negative breast cancer remains associated with a less favorable prognosis than HER2-positive disease because of its more aggressive biological behavior, including a higher risk of early recurrence and metastatic disease (90).

Using estrogen receptor (ER), progesterone receptor (PR) and Human Epidermal Growth Factor Receptor 2 (HER2) status, Ki-67, and histologic grade (when data on Ki-67 are unavailable), invasive cancers were classified into immunohistochemical subtypes according to a slightly modified St. Gallen definition (Table 7.11) (91).

Data on ER and PR status have been complete for screen-detected cancers since the start of BreastScreen Norway. HER2 status has been registered sporadically since 2005 and systematically since 2012–2013, while Ki-67 has been partially registered since 2010 (see section 7.9).

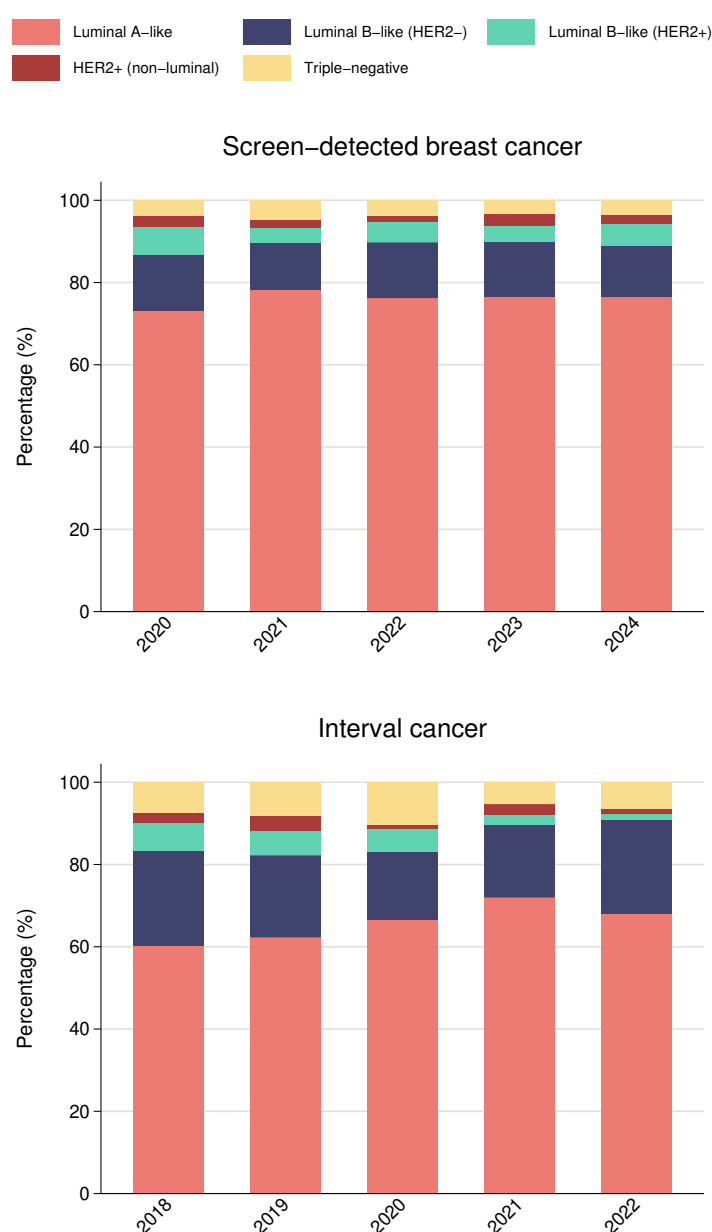


Figure 7.7: Distribution (%) of immunohistochemical subtypes in BreastScreen Norway, of invasive screen-detected breast cancers, screened 2020-2024 (upper panel) and invasive interval cancers, screened 2018-2022 (lower panel). Neoadjuvantly treated lesions and lesions with unknown neoadjuvant status are excluded.

Table 7.11: Classification of immunohistochemical subtypes based on a modification of the St. Gallen definition (91).

Subtype	Criteria
Luminal A	ER+, PR-/PR+, HER2-, Ki-67<31 or grade<3 and missing Ki-67
Luminal B HER2-	ER+, PR-/PR+, HER2-, Ki-67>=31 or grade=3 and missing Ki-67
Luminal B HER2+	ER+, PR-/PR+, HER2+
HER2+	ER-, PR-, HER2+
Triple-negative	ER-, PR-, HER2-

For the analysis in this chapter, we have excluded women who received neoadjuvant therapy, as well as those with unknown neoadjuvant treatment status (for more details, see Section 7.3).

Luminal A was the dominant subtype among both screen-detected and interval cancers (Figure 7.7). During 2020–2024, 76% of invasive screen-detected cancers were classified as Luminal A, compared with 66% of invasive interval cancers (not in table). Conversely, Luminal B (HER2-) tumors accounted for a larger proportion of interval cancers than screen-detected cancers (20 versus 13%), as did triple-negative tumors (7 versus 4%).

The observed variation between screening areas warrants further investigation, as it may reflect differences in tumor biology, case mix, or classification of the variables used to define immunohistochemical subtypes, including ER, PR, HER2, Ki-67, and histologic grade. Compared with screen-detected cancers, interval cancers showed a less favorable distribution of immunohistochemical subtypes, with lower proportions of Luminal A tumors and higher proportions of Luminal B and triple-negative tumors. These findings are consistent with the differences observed for tumor diameter, histologic grade, and lymph node involvement, and support previous observations that interval cancers often present with biologically less favorable characteristics than screen-detected cancers (65).

7.9 Completeness of data

The systems and processes for data collection and registration of invitations, attendance, recall, and cancer detection have remained largely unchanged since the start-up of the screening program, and data for these parameters are 100% complete. However, there have been several changes in the processes for biopsy registration. The completeness analyses presented in this section are restricted to invasive breast cancers and include tumor diameter, histologic grade, lymph node status, hormonal receptor status and HER2+. Completeness is not reported separately for composite variables, such as stage and tumor subtype, because it is determined by the completeness of their constituent variables.

Since the start-up of BreastScreen Norway, the proportion of complete data has increased for all tumor characteristics for invasive screen-detected and interval cancers (Figure 7.8). Information on HER2 status has been collected and registered since 2005, but not systematically until 2012-2013. The proportion of complete data on tumor diameter for invasive interval cancers generally decreased from 1996 onwards and was at its lowest in 2006. The temporary decline in completeness of tumor diameter data for interval cancers around 2006 may reflect changes in data collection procedures associated with the continued implementation of the screening program and modifications to the database infrastructure.

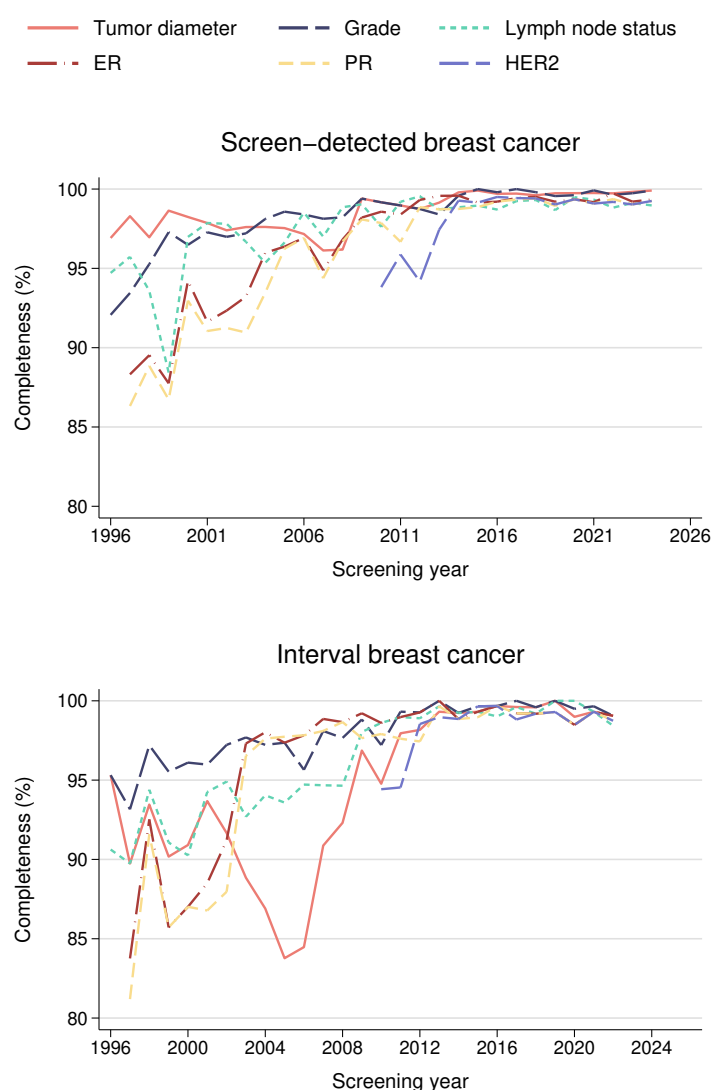


Figure 7.8: Proportion (%) of complete data on tumor characteristics in BreastScreen Norway for invasive screen-detected breast cancers, screened 1996-2024 (upper panel) and invasive interval cancers, screened 1996-2022 (lower panel). HER2 is displayed from 2010.

Data on all histopathological tumor characteristics were almost 100% complete for both invasive screen-detected (women screened 2020-2024) and invasive interval cancers (women screened 2018-2022) (Table 7.12). The completeness of data on tumor characteristics was consistent across screening areas (Table 7.12). This high level of complete-

ness strengthens confidence in the reported distributions of tumor diameter, histologic grade, lymph node involvement, and immunohistochemical subtypes. Nevertheless, changes in registration practices over time, particularly for HER2 status and certain histopathological variables, should be considered when interpreting long-term trends.

Table 7.12: Proportion (%) of complete data in BreastScreen Norway on tumor diameter, histologic grade, lymph node status, estrogen (ER) and progesterone (PR) receptor status, and HER2 status, by screening area, for invasive screen-detected breast cancers, screened 2020-2024 (upper table) and invasive interval cancers, screened 2018-2022 (lower table).

Screen-detected breast cancer						
	Tumor diameter	Histologic grade	Lymph node status	ER	PR	HER2
Rogaland	100.0%	100.0%	99.7%	99.4%	99.1%	99.1%
Hordaland	99.5%	99.5%	100.0%	99.5%	99.5%	99.5%
Oslo	99.6%	99.4%	97.9%	97.7%	97.7%	97.6%
Telemark	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Agder	100.0%	99.7%	99.4%	99.7%	99.4%	99.4%
Troms og F	100.0%	100.0%	99.7%	99.3%	99.0%	99.0%
Østfold	100.0%	99.7%	99.7%	100.0%	100.0%	99.7%
Nordland	100.0%	99.1%	99.1%	98.6%	98.6%	98.6%
Trøndelag	99.8%	100.0%	98.9%	99.3%	99.3%	99.1%
Oppland	99.0%	99.5%	97.9%	99.5%	99.5%	99.5%
Møre og R	99.6%	99.6%	99.3%	99.3%	99.3%	99.3%
Sogn og F	100.0%	100.0%	98.6%	100.0%	98.6%	98.6%
Vestfold	100.0%	100.0%	99.2%	99.2%	99.2%	99.2%
Hedmark	99.4%	100.0%	98.7%	100.0%	100.0%	100.0%
Akershus Øst	99.8%	100.0%	99.4%	100.0%	100.0%	100.0%
Vestre Viken	99.8%	99.8%	99.2%	99.5%	98.8%	99.0%
Fonna	100.0%	100.0%	98.1%	99.4%	99.4%	99.4%
Innlandet	100.0%	100.0%	98.7%	100.0%	100.0%	100.0%
Total	99.8%	99.8%	99.1%	99.4%	99.2%	99.2%

Interval cancer						
	Tumor diameter	Histologic grade	Lymph node status	ER	PR	HER2
Rogaland	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Hordaland	100.0%	98.3%	100.0%	100.0%	100.0%	100.0%
Oslo	99.3%	100.0%	99.3%	98.6%	98.6%	98.6%
Telemark	98.3%	98.3%	100.0%	98.3%	98.3%	98.3%
Agder	100.0%	100.0%	100.0%	98.8%	98.8%	98.8%
Troms og F	98.4%	100.0%	100.0%	98.4%	98.4%	98.4%
Østfold	100.0%	100.0%	100.0%	98.2%	98.2%	98.2%
Nordland	100.0%	100.0%	100.0%	98.6%	98.6%	98.6%
Trøndelag	98.4%	98.4%	98.4%	100.0%	100.0%	100.0%
Oppland	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Møre og R	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Sogn og F	100.0%	100.0%	100.0%	96.2%	96.2%	96.2%
Vestfold	100.0%	100.0%	98.5%	100.0%	100.0%	100.0%
Hedmark	96.9%	98.4%	98.4%	96.9%	96.9%	96.9%
Akershus Øst	100.0%	100.0%	98.1%	100.0%	100.0%	100.0%
Vestre Viken	99.2%	99.2%	98.4%	100.0%	99.2%	99.2%
Fonna	100.0%	100.0%	100.0%	95.5%	95.5%	95.5%
Total	99.4%	99.6%	99.3%	99.1%	99.0%	99.0%

8. Mammographic features

Mammographic screening aims to detect breast cancer before symptoms occur. Early detection requires high image quality and experienced radiologists able to recognize both typical and subtle signs of malignancy. Screen-detected cancers may appear as clusters of calcifications or spiculated masses, but also as less specific findings such as architectural distortion, asymmetry, or density with calcification.

At the assessment, radiologists record the mammographic feature that prompted recall. The program-specific categories based on BI-RADS include asymmetric density, architectural distortion, circumscribed mass, spiculated mass, calcification alone, density with calcification, axillary lymph node, and other findings (92, 93).

Figure 8.1 shows the distribution of mammographic features in 2021–2025 for all recalls, recalls with a benign biopsy, DCIS, and invasive screen-detected breast cancer. The distribution was broadly stable over time in all four groups. Masses accounted for 40–50% of all recalls and close to 60% of recalls with benign biopsy. Masses accounted for about 10% of invasive screen-detected cancers. Calcification alone were the dominant feature for DCIS, accounting for about 80% of cases, whereas spiculated masses was the most common feature for invasive screen-detected breast cancer, accounting for about 50% of cases.

Because the distribution of mammographic features was broadly stable during 2021–2025, data from the five-year period were combined in Table 8.1. The reported distribution varied substantially between screening areas. Among all recalls, the proportion of masses ranged from 7% in Sogn og Fjordane to 54% in Hedmark. Asymmetry ranged from 8%

in Rogaland to 64% in Sogn og Fjordane, while calcification alone ranged from 11% in Østfold to 30% in Hordaland.

Among recalls resulting in biopsy with a benign outcome, masses were the most frequently reported feature overall, accounting for 56% of cases. The particularly large differences observed for some screening areas, most notably Sogn og Fjordane, suggest substantial variation in the interpretation or registration of mammographic feature categories. Area-specific comparisons should therefore be interpreted primarily as indicators of reporting practice rather than as evidence of true differences in radiologic presentation.

Among invasive screen-detected cancers, spiculated masses were the most frequently reported feature, accounting for 51% of cases. The proportion ranged from 7% in Sogn og Fjordane to 66% in Telemark. Asymmetry was reported for 13%, calcification alone for 12%, and density with calcification for 6% of invasive cancers. Since the number of invasive cancers was limited in several screening areas, area-specific estimates should be interpreted with caution.

Mammographic features of DCIS are not presented by screening area because the number of cases was too low for reliable stratification. Overall, approximately 83% of DCIS cases were classified as calcification alone.

Overall, mammographic features were stable over the most recent five-year period but varied considerably between screening areas. This variation should be interpreted with caution, as it may reflect differences in registration practice as well as differences in case mix. Standardized reporting of mammographic features remains important for quality assurance and for studies of radiologic-pathologic correlation in BreastScreen Norway.

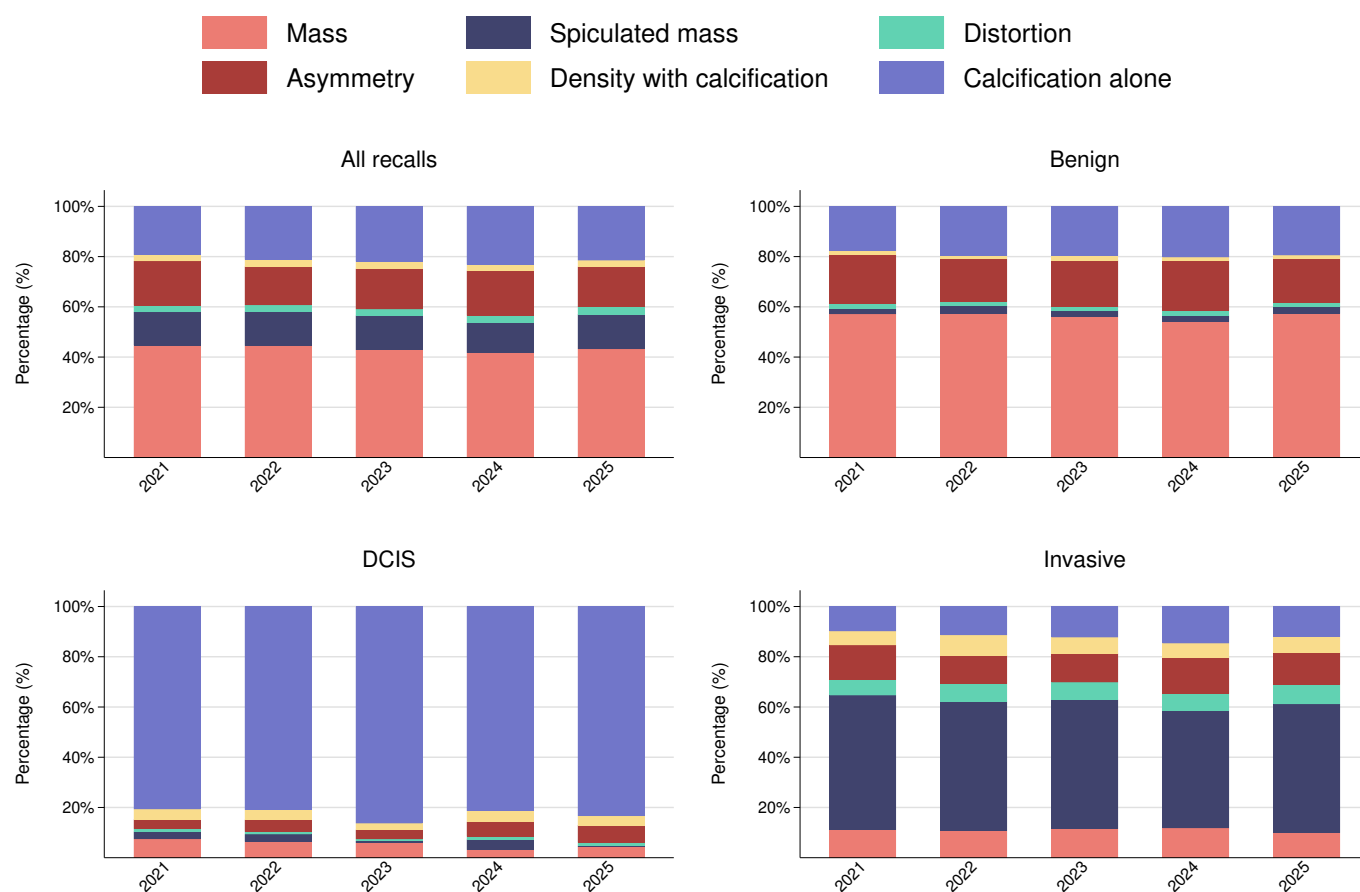


Figure 8.1: Distribution (%) of mammographic features leading to recalls (upper left panel), recall with a benign biopsy (upper right panel), recall resulting in a diagnosis of DCIS (lower left panel) and recall resulting in a diagnosis of invasive screen-detected breast cancer (lower right panel) in BreastScreen Norway, by screening year, 2021-2025.

Table 8.1: Mammographic features for all recalls (upper table), recalls resulting in a biopsy with benign outcome (middle table) and recalls resulting in a biopsy with invasive screen-detected breast cancers (lower table) in BreastScreen Norway, 2021-2025, by screening area.

All recalls Screening area	Mass		Spiculated mass		Distortion		Asymmetry		Density w calc.		Calcification alone	
	n	%	n	%	n	%	n	%	n	%	n	%
Rogaland	813	49.9%	234	14.4%	45	2.8%	122	7.5%	28	1.7%	388	23.8%
Hordaland	1,104	41.4%	270	10.1%	49	1.8%	351	13.2%	89	3.3%	802	30.1%
Oslo	1,690	52.6%	341	10.6%	35	1.1%	396	12.3%	86	2.7%	667	20.7%
Telemark	255	43.5%	154	26.3%	17	2.9%	61	10.4%	13	2.2%	86	14.7%
Agder	777	40.6%	216	11.3%	56	2.9%	432	22.6%	37	1.9%	396	20.7%
Troms og F	562	44.0%	228	17.8%	45	3.5%	149	11.7%	39	3.1%	255	20.0%
Østfold	558	40.1%	264	19.0%	23	1.7%	341	24.5%	60	4.3%	146	10.5%
Nordland	493	51.9%	109	11.5%	59	6.2%	86	9.1%	34	3.6%	168	17.7%
Trøndelag	538	38.4%	235	16.8%	57	4.1%	220	15.7%	26	1.9%	325	23.2%
Oppland	305	50.0%	77	12.6%	13	2.1%	62	10.2%	29	4.8%	124	20.3%
Møre og R	629	46.8%	106	7.9%	44	3.3%	343	25.5%	19	1.4%	202	15.0%
Sogn og F	23	6.9%	11	3.3%	10	3.0%	215	64.4%	7	2.1%	68	20.4%
Vestfold	522	42.6%	158	12.9%	41	3.3%	276	22.5%	32	2.6%	196	16.0%
Hedmark	308	54.3%	59	10.4%	21	3.7%	92	16.2%	12	2.1%	75	13.2%
Akershus Øst	813	33.2%	464	19.0%	62	2.5%	516	21.1%	89	3.6%	502	20.5%
Vestre Viken	1,272	44.3%	349	12.2%	85	3.0%	316	11.0%	61	2.1%	788	27.4%
Fonna	283	34.5%	86	10.5%	31	3.8%	203	24.7%	27	3.3%	191	23.3%
Innlandet	358	47.2%	74	9.8%	28	3.7%	121	16.0%	8	1.1%	169	22.3%
Total	11,303	43.5%	3,435	13.2%	721	2.8%	4,302	16.5%	696	2.7%	5,548	21.3%
Benign												
Rogaland	774	67.7%	25	2.2%	16	1.4%	68	5.9%	13	1.1%	248	21.7%
Hordaland	1,047	51.8%	28	1.4%	21	1.0%	297	14.7%	40	2.0%	590	29.2%
Oslo	1,628	64.3%	32	1.3%	15	0.6%	354	14.0%	28	1.1%	476	18.8%
Telemark	237	69.1%	22	6.4%	4	1.2%	45	13.1%	2	0.6%	33	9.6%
Agder	763	49.8%	36	2.3%	32	2.1%	385	25.1%	17	1.1%	300	19.6%
Troms og F	548	54.8%	91	9.1%	29	2.9%	132	13.2%	25	2.5%	175	17.5%
Østfold	534	54.5%	38	3.9%	11	1.1%	306	31.3%	23	2.3%	67	6.8%
Nordland	452	67.9%	17	2.6%	16	2.4%	53	8.0%	16	2.4%	112	16.8%
Trøndelag	523	57.0%	19	2.1%	21	2.3%	156	17.0%	8	0.9%	191	20.8%
Oppland	291	65.5%	10	2.3%	6	1.4%	41	9.2%	9	2.0%	87	19.6%
Møre og R	597	59.6%	8	0.8%	9	0.9%	259	25.9%	10	1.0%	118	11.8%
Sogn og F	22	8.9%	6	2.4%	4	1.6%	164	66.4%	5	2.0%	46	18.6%
Vestfold	502	55.4%	8	0.9%	28	3.1%	235	25.9%	6	0.7%	127	14.0%
Hedmark	296	65.3%	3	0.7%	11	2.4%	85	18.8%	6	1.3%	52	11.5%
Akershus Øst	797	44.3%	141	7.8%	33	1.8%	462	25.7%	33	1.8%	333	18.5%
Vestre Viken	1,250	58.9%	22	1.0%	46	2.2%	266	12.5%	22	1.0%	516	24.3%
Fonna	273	44.5%	4	0.7%	12	2.0%	177	28.8%	16	2.6%	132	21.5%
Innlandet	343	59.5%	7	1.2%	10	1.7%	90	15.6%	3	0.5%	123	21.4%
Total	10,877	56.4%	517	2.7%	324	1.7%	3,575	18.5%	282	1.5%	3,726	19.3%
Invasive cancer												
Rogaland	45	11.2%	214	53.5%	28	7.0%	51	12.8%	16	4.0%	46	11.5%
Hordaland	72	13.3%	249	46.1%	28	5.2%	61	11.3%	45	8.3%	85	15.7%
Oslo	84	14.0%	312	52.1%	22	3.7%	48	8.0%	53	8.8%	80	13.4%
Telemark	16	8.0%	131	65.8%	13	6.5%	16	8.0%	8	4.0%	15	7.5%
Agder	30	9.2%	182	55.8%	24	7.4%	47	14.4%	16	4.9%	27	8.3%
Troms og F	31	12.4%	137	55.0%	17	6.8%	18	7.2%	12	4.8%	34	13.7%
Østfold	35	9.6%	225	61.6%	11	3.0%	37	10.1%	33	9.0%	24	6.6%
Nordland	46	18.5%	90	36.3%	41	16.5%	33	13.3%	14	5.6%	24	9.7%
Trøndelag	37	8.9%	213	51.0%	36	8.6%	63	15.1%	17	4.1%	52	12.4%
Oppland	17	11.6%	67	45.9%	7	4.8%	25	17.1%	16	11.0%	14	9.6%
Møre og R	36	12.2%	98	33.3%	34	11.6%	82	27.9%	10	3.4%	34	11.6%
Sogn og F	1	1.3%	5	6.7%	6	8.0%	51	68.0%	3	4.0%	9	12.0%
Vestfold	30	10.8%	149	53.8%	14	5.1%	33	11.9%	23	8.3%	28	10.1%
Hedmark	20	17.9%	57	50.9%	12	10.7%	8	7.1%	6	5.4%	9	8.0%
Akershus Øst	55	9.5%	328	56.7%	28	4.8%	56	9.7%	48	8.3%	63	10.9%
Vestre Viken	43	7.1%	327	54.2%	42	7.0%	48	8.0%	37	6.1%	106	17.6%
Fonna	14	8.4%	80	47.9%	19	11.4%	24	14.4%	7	4.2%	23	13.8%
Innlandet	22	13.8%	69	43.4%	17	10.7%	30	18.9%	5	3.1%	16	10.1%
Total	634	11.0%	2,933	51.0%	399	6.9%	731	12.7%	369	6.4%	689	12.0%

9. Future perspectives

Thirty years after its introduction, BreastScreen Norway is an established component of breast cancer control in Norway (4, 14). The program has contributed to earlier detection of breast cancer, reduced breast cancer mortality, and generated extensive experience through quality assurance, evaluation, and research (1, 13, 94, 95). At the same time, advances in technology, improved understanding of breast cancer and mammographic screening, and increasing opportunities for artificial intelligence (AI), risk stratification, and automation have created opportunities for further improvement (96, 97). The challenge is no longer whether organized screening should be offered, but how it can be delivered with higher quality, greater precision, and more efficient use of resources (98).

The future age range of BreastScreen Norway is currently under consideration by the Norwegian Directorate of Health. Depending on the outcome, this work may result in the most substantial change to the program since nationwide implementation in 2005. Changes in eligibility will have implications for workforce requirements and service capacity.

The future of BreastScreen Norway depends on attracting and retaining skilled radiographers and breast radiologists (99, 100). AI may substantially change mammographic screening. While AI has the potential to reduce screen-reading workload, its most important contribution may be improved cancer detection (higher rate of screen-detected cancer and lower rate of interval cancer) and overall screening performance (101–112). Implementation should therefore be driven by clinical benefit rather than workforce considerations alone. Before AI is introduced in routine screening, robust systems for quality assurance, performance monitoring, and continuous evaluation must be established. These systems should build on evidence from prospective and retrospective studies, knowledge generated through ongoing evaluations, and experience gained during implementation in clinical practice.

Although risk-based screening has the potential to improve the balance between benefits, harms, and resource use (113), evidence supporting implementation in routine screening remains limited (114–117). BreastScreen Norway should therefore contribute to generating the evidence needed through prospective studies and evaluation before wider adoption is considered. The maturity of the evidence differs across these approaches, and implementation should therefore be guided by expected health benefit, resource

requirements, and feasibility (99, 100, 113). The potential of AI-support and risk-based screening should be assessed not only by their ability to improve cancer detection, but also by their impact on false-positive findings, overdiagnosis, resource use, and the overall balance between benefits and harms (118–120).

Women invited to BreastScreen Norway represent a diverse population with different socioeconomic backgrounds and variations in health literacy, language skills, cultural perspectives, and information needs (121). Ensuring that all women have a genuine opportunity to make an informed choice will therefore require communication strategies that reach and engage different groups within the target population (11). Future efforts should focus on developing and evaluating information tailored to different needs, preferences, and communication channels, while maintaining consistent and evidence-based messages (11). The need for effective communication may become even greater as AI-supported screen reading and more personalized screening strategies are introduced, requiring women to understand different screening pathways, recommendations, and levels of risk (122). Public trust requires transparent decision-making, independent evaluation, and clear communication.

Future developments in BreastScreen Norway require digital infrastructure that supports implementation and evaluation of new screening strategies and enables rapid evaluation of changes in screening practice and outcomes at both local and national levels. Integrated IT systems should facilitate monitoring of screening performance, implementation of AI, evaluation of risk-based screening, and timely feedback for quality improvement. Access to complete, structured, and high-quality data will be essential for ensuring that future changes are evidence-based, effective, and safe.

The coming years may bring changes in the target population, AI-supported interpretation, and more personalized screening strategies. These developments should not be presented as inevitable or assessed in isolation: they compete for workforce, infrastructure, and funding and may interact in ways that alter the balance between benefits and harms. Future decision-making processes should therefore be evidence-based and transparent. BreastScreen Norway should continue to build on evidence-based practice, equitable access, competence among professionals, informed choice, continuous quality improvement, and systematic monitoring of benefits, harms, and resource use.

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