ANCR 2024

Abstracts

Innhold

Session 1: Patient Care Epidemiology and Patient Reported Outcome Measures

Oral Presentations

The Use of Systemic Anti-Cancer Treatment During the Last Year of Life for Lung Cancer Patients in Norway

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Introduction
Evidence have shown that the proportion of patients receiving systemic anti-cancer treatment (SACT) at the end of life (EOL) varies significantly based on patient characteristics and geographical areas. An overaggressive use of SACT at the EOL may be an indicator of poor treatment quality. Therefore, we aim to examine SACT use at the EOL, which specific drugs were administered and at what time, by patient subgroups.

Methods
All lung cancer patients registered at the Cancer Registry of Norway who died in 2020-2022 were included. Comprehensive information about patient characteristics, diagnostics and treatment was available from the CRN and the Norwegian quality registry for lung cancer. Multivariate analyses will be performed to identify predictors of EOL-treatment.

Results
A total of 6412 patients with a lung cancer diagnosis died between 2020 and 2022, and 46.3% were females. At one year, six months, one month, and one week prior to death, 49.4%, 42.6%, 12.0% and 2.8%, respectively received SACT. Male sex, young age, advanced stage at diagnosis, shorter time since diagnosis, small cell lung cancer, symptoms present at diagnosis, and negative EGFR status experienced higher use of SACT. In addition, patients living in the Western health region were given more SACT compared to the other regions.

Conclusion
Updated results and conclusions will be presented at the conference.

Real-world Profile and Treatment Patterns of Advanced Melanoma Patients Treated with Immune Checkpoint Inhibitor (ICI) Therapy in Norway

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Background
The introduction of immune checkpoint inhibitor (ICI) therapy for cutaneous melanoma (CM), including mono- and combination therapies, took place during 2014–17 in Norway. There is limited knowledge on patient characteristics and treatment patterns for patients undergoing ICI therapy in real-world clinical practice and compared to clinical trial results.

Methods
By linking data from multiple national registries, this population-based cohort study included all adult (≥18) CM patients registered in the Cancer Registry of Norway who were treated with ipilimumab, nivolumab, pembrolizumab, or combination therapy (nivolumab and ipilimumab) during 2014-21 in Norway.

Results
Among 2083 patients receiving ICI therapy, 1193 (57.3%) initiated treatment between 2019 and 2021. The typical patient receiving first-line ICI treatment was male, had over 11 years of education and had an intermediate to high income. The median age at treatment was 68 and higher than observed in clinical trials such as CheckMate 067. The most frequent tumor location was the trunk. Nivolumab monotherapy became the most used treatment over time, with the combination therapy of ipilimumab and nivolumab emerging as the second most frequent during 2019-21. Most common second-line treatment were radiotherapy and targeted therapy, except for patients on combination therapy, where nivolumab monotherapy was preferred.

Conclusions
Patients treated in real-world clinical practice differ from patients in clinical trials. This retrospective panorama is pivotal for future studies comparing real-world treatment outcomes with results from clinical studies.

Cystectomy for Bladder Cancer in Sweden – Short-term Outcomes after Centralization

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Introduction
Radical cystectomy (RC) for bladder cancer is associated with an inherent risk of complications and even postoperative mortality. The number of hospitals performing RC has decreased in Sweden over time, and since a formal regional centralization in 2017 cystectomy care is currently provided by nine hospitals.

Material and methods
In the Swedish National Urinary Bladder Cancer Register (SNRUBC) 90-day complications after RC have been registered with high coverage since 2012. Descriptive data and short-term outcomes were compared in relation to centralization of the cystectomy care by stratifying data before (2012-2016) and after (2017-2023).

Results
Out of all 4638 cystectomies, 2738 (59%) were performed after the centralization in 2017 and onwards. The median age at RC increased from 71 (Inter Quartile Range (IQR) 65-76) to 73 (IQR 67-77) years, and the proportion of patients with comorbidity (ASA 3 or 4) increased from 32% to 37% after the centralization ($p<0.001$). The number of patients suffering from high-grade complications within 90 days of surgery corresponding to Clavien grade three were 345 (18%) and 407 (15%) and corresponding to Clavien grade four 61 (3%) and 64 (2%) before and after centralization, respectively. Reoperations within 90 days of RC decreased from 234/1900 (12%) to 208/2738 (8%) ($p<0.001$), and 90-day mortality decreased from 84/1900 (4%) to 85/2738 (3%) ($p=0.023$) before and after centralization, respectively.

Conclusion

The centralization of the cystectomy-care in Sweden may have contributed to improved outcomes after RC.

Adverse Health Outcomes (AHOs); Pad use, Intercourse Inability and Quality of Life (QoL) Three Years after Radical Prostatectomy (RP), Compared with Men in the General Population (Norms): A Study from the Cancer Registry of Norway (CRN)

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Introduction
Contemporary population-based data on AHOs is needed, comparing prostatectomized prostate cancer patients with age-similar Norms. The aim of this study was to compare pad use and intercourse inability in patients and Norms, and identify factors associated with AHOs and QoL.

Methods
At least 24 months after RP, 1513 CRN registered patients (2017-2019) and 1891 Norms responded to the EORTC-QLQ-C30 (Item#30; Global QoL, Good/ Fair: 5-7) and EPIC-26 (Item#3: Daily use of≥1 pad, Item#9: Quality of erections (Poor: ≥3), and Items#4a/12: Related moderate/big problems). Multivariable logistic regressions evaluated associations between covariates and selected outcomes.

Results
41% of the patients reported pad use, vs. 5% in Norms. Intercourse inability: 84% vs. 48%. Among pad users, 24% of patients described moderate/big problems and 25% in Norms. The prevalence of bother due to intercourse inability was 51% in patients, compared to 35% in Norms. In patients, increasing age and unilateral/ no nerve-sparing surgery were associated with increased use of pads and intercourse inability. Sexual dysfunction problems affected QoL in both groups, and urinary incontinence problems only in patients.

Conclusion
The prevalence of pad use, intercourse inability and related problems significantly differ in patients and Norms. Nerve-sparing surgery was the only modifiable variable affecting pad use and intercourse inability. Sexual dysfunction problems affected QoL in both groups, and urinary incontinence problems only in patients. The results demonstrate the added negative impact of RP on AHOs, highlighting the importance of improving nerve-sparing techniques, and the importance of separating functional aspects and problems.

Keywords: Radical prostatectomy, urinary incontinence, pad use, sexual dysfunction, quality of life

Effects of Digital Stress Management Interventions in Women with Breast Cancer: The Coping After Breast Cancer Trial

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Introduction

StressProffen™, a digital application (app)–based stress management intervention, has been of great support for cancer survivors. In this randomized controlled trial, Coping After Breast Cancer (CABC), two stress management interventions programs were created from the original StressProffen intervention: one with predominantly cognitive-behavioral therapeutic content (CBI), and one with predominantly mindfulness-based stress-management content (MBI). The aim was

to study if the CBI and MBI interventions were effective in reducing perceived stress (primary outcome) and improving health-related quality of life (HRQoL) (secondary outcome).

Method
Women with early breast cancer (BC) were enrolled 6-9 months after diagnosis and randomized to either CBI (n= 140), MBI intervention (n= 143), or to be included in a usual care control group (n=147). Outcomes were assessed at baseline and after 6 months. Between-group differences were assessed with linear regression adjusted for baseline outcome measures, using the intention-to- treat-principle with multiple imputation of missing data.

Results
Mean age was 52 (CBI&MBI) and 53 (controls). Demographics were similar between the groups. There were no significant between-group differences in perceived stress after 6 months of access to the interventions for either CBI vs. control group (-0.28 (95% CI: -1.68-1.13) or MBI vs. control group 0.49 (95% CI: 1.89-0.92). The MBI group had significantly better improvement in the HRQoL measure general health than controls (4.35 (95% CI: 0.18-8.52). A similar, non-significant improvement was seen for the CBI group compared to control.

Conclusion
In the current trial, digital stress management interventions did not reach significance in reducing stress at 6 months compared to the control group in women with early BC. However, the interventions had a positive impact on general health.

ClinicalTrials.gov identifier NCT04480203

Posters

Adjuvant Chemotherapy for Stage III Colon Cancer

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Introduction
National guidelines suggest that adjuvant chemotherapy for stage III colon cancer patients preferably should start within 4-6 weeks, and no later than 8 weeks after surgery. The standard chemotherapy regimen includes the antimetabolite fluorouracil (5-FU) given intravenously or capecitabin, which is a prodrug of 5-FU, administered orally. 5-FU or capecitabin are either given as monotherapy or in combination with the alkylating agent oxaliplatin (FOLOX/CAPOX). National guidelines recommend using either CAPOX for 3 months, FOLFOX for 3-6 months or Kapecitabin/FLV monotherapy for 6 months, depending on patient

characteristics.

Methods
The Cancer Registry of Norway (CRN) receives information on medical treatment from four different sources. The hospital administered cancer medication systems, clinical messages, hospital-prescriptions and Norwegian Patient Registry (NPR) which contains information on treatment given in the specialized health care services.

Results
Most of stage III colon cancer patients who receives adjuvant chemotherapy, receives the first dose within 8 weeks after surgery. However, the percentage of patients who receive chemotherapy within 6 weeks varies a lot between the hospital trusts. There are also large variations between the hospital trusts regards to chemotherapy regimen and duration.

Conclusions
Most of the adjuvant chemotherapy given to treat stage III colon cancer patients, are given according to the national guidelines. Variations in treatment initiation, choice of chemotherapy regimen and chemotherapy duration should be further investigated.

Regional Differences in Use of Chemotherapy for Stage I Ovarian Cancer in Norway

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Introduction
The Norwegian Gynecological Cancer Registry was created in 2013 (as a part of the Cancer Registry of Norway) and collects detailed data on treatment of ovarian cancer. Along with surgery, chemotherapy plays a central role in the treatment of ovarian cancer. The collection of clinical data from drug treatment, however, has until recently been challenging to implement. Relevant analysis for the use of drug treatment from the register's database has therefore previously not been possible to make. In 2022, the registry introduced the use of data obtained directly from the hospitals' specialist systems of drug distribution. The situation is now changed, and new opportunities have been opened both in research and for quality improvement work. We would like to present the results on drug treatment from our annual report in a poster at the ANCR 2024 in Bodø.

Methods
We have created a set of descriptive analyzes for the use of drug treatment by linking quality registry data with data from the hospital specialist systems. The result is differentiated by FIGO stages and compare the health regions of Norway.

Results
The results from last year's annual report showed that the drug treatment largely follows the national guidelines, but some variation between the health regions can be observed, especially among the FIGO stage I patients. We wish to present updated results at the ANCR.

Conclusions
Being able to use data for drug treatment is a very welcome addition to the registry. The annual report now provides a much more complete view of the treatment given to the ovarian cancer patients in Norway. The professional council of the registry is planning to implement new quality indicators for drug treatment.

Impact of COVID-19 Pandemic on Cancer Survival Between Educational Groups in Finland

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Introduction
The COVID-19 pandemic resulted in fewer applications for healthcare services and fewer confirmed cancer cases, especially in 2020. This study assessed whether the pandemic increased inequality among cancer patients, using differences in patient survival between educational level as a measure of inequality.

Methods
We compared excess mortality (EM) among cancer patients diagnosed between March 2020 and December 2020 to expected based on patients diagnosed in 2010-2019 by educational level (basic, secondary, high), sex and cancer site. We used piecewise constant excess hazard models to estimate the ratio of observed and expected EM of cancer patients (EMR) with 95% confidence intervals (CI).

Results
For all education levels and cancer sites combined, EM increased more than expected in women (EMR 1.06, 95% CI 1.00-1.11) and in men (1.05, 1.00-1.10). Significant EMRs were also found in haematological cancers in women (1.26, 1.07-1.49) and in lung cancer in men (1.10, 1.02-1.20). In women, we observed differences in EMRs between education levels. In cancer sites combined, compared to EMR 1.10 (1.01-1.19) for basic education, EMR was 0.99-fold (0.88- 1.11) for secondary and 0.85-fold (0.73-0.98) for high education. In breast cancer, compared to EMR of 1.65 (1.08-2.52) for basic education, EMR was 0.87-fold (0.48-

1.57) for secondary and 0.46-fold (0.22-0.93) for high education.

Conclusions
Excess mortality among cancer patients increased during the pandemic. The increase was similar between education levels in men, but in women, the increase was only observed in women with basic education.

Real-world Study of Survival Among Primary Metastatic Hormone Sensitive Prostate Cancer Patients who Received Systemic Treatment and Radiotherapy

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Background
Studies have demonstrated the survival benefit of systemic treatment (docetaxel or newer hormonal treatments) or radiotherapy to the prostate for metastatic hormone sensitive prostate cancer (mHSPC) patients, but no study has evaluated the outcomes of patients treated with both treatments. Nonetheless, giving both treatments has been the standard of care for mHSPC patient with low volume disease since 2018/19. We aim to describe Norwegian primary metastatic prostate cancer (mPCa) patients who received both treatments regarding specific treatments given, time to relapse treatment, quality-of-life, and survival.

Material and methods
The study cohort comprised all mPCa patients diagnosed during 2018–2021 who had received both systemic treatment within 6 months *and* radiotherapy to the prostate (≥50Gy) within 12 months of diagnosis. We applied descriptive statistics and 5-year overall survival using the Kaplan-Meier estimator.

Results
280 mPCa patients received systemic treatment and radiotherapy during the inclusion period. These patients were rather young (median age 68 years) and had a good performance status (>95% were ECOG 0-1). 58% had ISUP 5 and 92% presented with cT3/4 disease at diagnosis. Median PSA was 39 ng/mL. 5-year overall survival was 63% (95%CI: 54–71%).

Conclusion
Norwegian PCa patients who received systemic treatment and radiotherapy to the prostate had a fairly good prognosis, with a high 5-year OS of 63%. However this prolonged survival must be weighed against individual side-effects and negative changes in quality-of-life due to the treatment and PROMs from these patients will be evaluated.

The Direction of Patient Reported Measures in Swedish Cancer Care – An Overview

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Introduction
Patient Reported Measures (PRMs) offer structured ways of measuring self-assessed function, symptoms, health related quality of life as well as experiences from health care. Swedish authorities have emphasized the importance of patient participation, including PRMs, by economic incentives and policy changes. This aligns with the growing global emphasis on the patient's perspective and creates a foundation for improvements in Swedish cancer care.

Present state
Inclusion of PRMs in national quality registers complements clinical parameters with a patient perspective and started in a larger scale approximately 10 years ago. Since then, both the number of questionnaires used and the interest in the area has increased. The tool Individual Patient Overview facilitates the use of PRMs alongside clinical parameters such as treatment regimens and lab results, benefiting both patient and health care practitioners. In addition, a national survey including patients investigated for cancer has shown great promise in identifying areas of improvement as well as highlighting functions important for patient satisfaction.

Challenges
Potential hurdles to address are the usage of different IT-solutions, challenges to implement new routines in a pressured environment, proper visualization, and usage of data.

Summary
With one foot in the clinic and the other in cancer registers, the national working group for patient reported measures within the confederation of regional cancer centers, facilitates implementation of PRMs in Swedish cancer care. PRMs are important components in a person-centred, individualized care as well as a powerful basis for health care development and research.

Associations Between Lifestyle Factors and Health-related Quality of Life in Breast Cancer Patients and Controls

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Aim
Women with breast cancer (BC) have lower health-related quality of life (HRQoL) than women without BC. With increased life expectancy it is important to evaluate modifiable actions to improve HRQoL. The aim was to examine the association between alcohol use, physical activity (PA), and body mass index (BMI) and HRQoL in women with and without BC.

Methods
In a nationwide study, HRQoL was assessed with EORTC QLQ-C30 in 4279 women newly diagnosed with BC and 2911 age-matched controls during 2020-22. Alcohol was grouped according to number of units pr. month: No intake, low (1-12), intermediate (13-23) and high intake (≥24). PA was categorized into five levels (inactive to >4 times pr. week). BMI was calculated from self-reported height and weight. Data were analyzed with linear regression adjusted for age, stadium (for BC), education, alcohol use, PA level and BMI and presented as effect size (ES). ES ≥10 was considered clinically relevant.

Results
A dose-response association was observed between levels of PA above being inactive, and better gQoL and social functioning and less fatigue. ES ≥10 was seen for PA ≥1/week for cases and >4/week for controls. Drinking 1-≥ 24 units of alcohol per month had positive impact on global QoL, social functioning, and fatigue scores in cases (ES<5) and controls (ES<9). Obesity had a stronger impact on gQoL in controls -6.9 (95% CI: -9.0, -4.7) than cases (-2.4 (95% CI: - 4.2, -0.63).

Conclusions
Higher level of PA was associated with higher levels of gQoL and social functioning and less fatigue in BC cases and controls, showing promise for PA as an important modifiable factor to improve HRQoL in women with and without BC.

Session 2: Coding and Registration of Cancer

Oral Presentations

Clinical Quality Indicators and Development Targets in Clinical Quality Improvement

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Introduction
Clinical quality registries contribute to monitoring and improvement of clinical care with the use of clinical quality indicators. These measures define the agreed objectives and initiatives for improvement and the desired direction of change. Indicators can have defined standards or development targets.

Methods
We used the experience of the 27 Danish clinical quality registries in cancer and cancer screening to describe the use of indicators and development targets. and discuss the best use of quality indicators and development targets in clinical quality improvement.

Results
Good clinical quality indicators measure processes or outcomes that are critical for clinical quality in an area of health care, and which express a potential for improvement. A further characteristic of the good indicator is actionability, where the indicator points directly to a care process that can be modified to improve clinical quality.
Development targets for quality indicators can be set as minimum standards which are “red lines” that define a threshold of unacceptable low quality of care, or as aspirational ”green lines” that define the desired, high level of quality.

Discussion
In Denmark, we are advocating the use of indicator sets that consist of the two or three most important process indicators, and we recommend the use of ambitious (but realistic) “green line” development targets. We are preparing a review process for the indicators and development targets for all the 80 clinical databases in Denmark.

TNM Stage in the Nordic Cancer Registries 2004-2016: Registration and Availability

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Introduction
Stage is an important predictor of cancer survival. TNM stage is constructed for solid tumours from tumour size (T), nodal involvement (N), and distant metastasis (M), and categorized into stages 0-I, II, II and IV. TNM staging is imperative in cancer diagnosis and management and of high value in cancer surveillance. We examined the availability of TNM staging data, alongside trends in stage distribution and survival, across the Nordic countries.

Methods
TNM information for 26 cancer sites was acquired from cancer registries in Denmark, Norway, Sweden, and Iceland during 2004-2016. We examined availability, comparability, and distribution of TNM stage in three periods, 2004-2008, 2009-2013, and 2014-2016, applying a previously validated algorithm of 'N0M0 for NXMX'. To evaluate quality in registration of TNM staging across the study countries, we examined TNM stage-specific one-year relative survival for cancers of colon, rectum, lung, breast, and kidney.

Results
Denmark, Sweden, and Iceland exhibited available TNM stage proportions of 75-95%, while proportions were lower in Norway. Proportions increased in Sweden during the study period, whereas a decline was observed in Denmark. Differences in one-year survival were considerably more pronounced between TNM stages than between study countries. Groups with missing TNM stage exhibited larger variation in survival.

Conclusion
Our findings highlight that stage recording is performed similarly in the Nordic countries, and with high availability in most countries. Standardized, high-quality registration and reporting of TNM are essential, given its pivotal role in monitoring and comparison of cancer survival trends in the Nordic countries.

Register-based Trace Back of Death Certificates in the Swedish Cancer Register: An Approach to Estimating Death Certificate Initiated Cancer Cases, 2005-2022

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Introduction
The Swedish Cancer Register does not use death certificate notifications to trace non-reported cancer cases. The lack of death certificate initiated (DCI) cancer registrations has raised concerns regarding the completeness of the Swedish Cancer Register, as most other cancer registries identify a non-negligible proportion of cases from death certificates. To estimate the impact of the lack of DCI cases, we performed a register-based trace back of cancers recorded on death certificates.

Methods
Cancers recorded in the Cause of Death Register 2005–2022 were traced for a potential match in the Swedish Cancer Register 1997– 2022. Non-matched cases were further traced in the National Patient Register (NPR) 1997–2022 and, if identified, classified as DCIs. Non- matched cases were classified as DCOs (Death Certificate Only). The number and proportion of DCIs were calculated overall, over time, by cancer site and age (>80, 80+).

Results
The proportion of DCIs decreased over time. The average proportion of DCIs 2014–2022 was 4.8%, compared with 6.4% during 2005–2013. Proportions of DCIs were higher in ages 80+ (12.3%) than in <80 (2.7%). Large proportions of DCIs were identified for cancer in bone and cartilage (13.8%), the digestive system (12%), respiratory system (11.9%) and central nervous system (10.6%), with marked differences between age groups. The largest decrease in DCIs over time was found for pancreatic and liver cancer.

Conclusions
The proportions of DCIs estimated by this approach has decreased over time, but with remaining marked differences in magnitude by cancer site and age at diagnosis.

Validation of Data Quality in the Swedish National Penile Cancer Register

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Introduction
The national penile cancer register (NPECR) in Sweden was initiated in year 2000 and currently contains approximately 3900 men diagnosed with penile cancer. The aim of this study was to validate the register's quality by assessing completeness, timeliness, comparability, and validity.

Material and Methods
Completeness was assessed by cross-linkage to the Swedish Cancer Register. Timeliness, defined as time from date of diagnosis to reporting in the register, was calculated.

Comparability was evaluated by reviewing coding routines and comparing data collected in the NPECR with national and international guidelines. To assess validity, 375 men with penile cancer registered from the six national regional centers in Sweden 2017-2020 were included in the study and their medical records were reviewed for re-abstraction. The exact agreement regarding 31 selected variables between the original data in the NPECR and the re- abstracted data was compared.

Results
Completeness was high (93%). Timeliness was in median 4.6 (Inter Quartile Range (IQR) 2.6-8.8) months. Comparability was good, as the coding routines and the forms for registration complied with penile cancer guidelines. Overall, the validity was high. The majority of variables showed an exact agreement exceeding 90%.

Conclusions
The data quality in the NPECR, to our knowledge the largest prospective national penile cancer register, is high with respect to completeness, comparability, and validity. This strengthens previously published studies based on the NPECR. The NPECR should be regarded as a reliable source for continuous work with penile cancer guidelines, performing population-based research, and national public health decisions.

Structured Electronic Health Records for Clinical Practice and Clinical Registry

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Introduction
Structured electronic health records are a priority area both through national guidelines from the Ministry of Health and Care Services and Regional Health Authorities. This can affect health record to be a better tool for clinicians by making the information transparent and available for reuse in daily clinical work, and for management, quality improvement and research.

Methods
The urologists at the University Hospital of North Norway, Tromsø has initiated a task for creating a new structured report for prostate cancer. A collaborative project was established between clinicians, public administration, suppliers, and the Cancer Registry. Through a close interdisciplinary collaboration, a solution architecture was created for transferring data from the electronic records directly to the Cancer Registry. The close collaboration with clinicians was crucial to getting a customized product at both ends.

Results
Health record documents were prepared for day clinic consultations and multidisciplinary meetings. In addition, a form for assessment of prostate cancer was created, like what clinician's report to the Cancer Registry's electronic reporting service (KREMT). The form reuses data that was already stored in the health records. Calculations also show that the median □me from the date of diagnosis to the date of receipt of the assessment form in the Cancer Registry of Norway has gone from 140 to 10 days.

Conclusion
The project has shown that close interdisciplinary collaboration is crucial, especially between clinician and technical developer. The structured health records for prostate cancer have functionality that makes every day clinical life easier, and high-quality data for the Cancer Registry.

Posters

Quality Register for Lung Cancer

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Introduction
No national quality registers for cancer exist in Finland. However, the need for reporting and analysing cancer care in evaluation of health care services is recognized, but there´s lack of a uniform, clear goal and definition.

The Finnish Cancer Registry (FCR) together with the Finnish Institute for Health and Welfare (THL) and Finnish Cancer Center (FICAN) are conducting a research project to develop the first quality indicators for cancer quality registers by exploring implementation of and outcomes of cancer treatment in Finland.

Methods
We are piloting the quality register with lung cancer. All incident lung cancers (ICD10 codes C33-34) from 1998-2022 will be retrieved from the FCR, and information on treatments and hospital stays from the Care Register for Health Care. Clinical experts will be consulted for defining quality indicators. Later information on reimbursements for medicine expenses and prescriptions will also be used.

We provide a summary of the quality of cancer treatment related information registered to the Care Register for Health Care and analyse the implementation of lung cancer care by time and region and outcomes in terms of survival of lung cancer patients.

Results
Preliminary results on lung cancer treatment (surgery, radiotherapy, and medication) will be reported in the ANCR meeting in August 2024.

Conclusions
With this research project we can evaluate if the existing national registers are suitable basis for a lung cancer quality register and later to be expanded to other solid cancers.

SNOMED CT as Finnish National Reference Terminology in Pathologic Anatomy Diagnosis

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Introduction
SNOMED II has been used for pathologic anatomy diagnoses (PAD) in Finnish pathology laboratories since the1980s. Lack of coordination has caused per-laboratory dialects. In order to harmonize PAD coding, SNOMED CT was chosen as the tool.

The goal was to replace the existing PAD coding by SNOMED CT. An essential requirement was to support existing laboratory systems and secondary users like the Finnish Cancer Registry (FCR) which rely on SNOMED II code structure.

Methods
The five Finnish university hospital pathology laboratories, FCR and laboratory information system vendors were involved in the development of reference terminology led by the Finnish Institute for Health and Welfare (THL).

Cumulated diagnosis data from the five laboratories during 2014-2020 (8,6 million reports) formed the original database. Original harmonization in 2018 was followed by work of 15 pathology subspecialist groups. THL published the first version of reference terminology in November 2022.

Results
The reference set includes SNOMED CT identifications, as well as legacy concepts and terms. Legacy codes consist of two parts: a SNOMED II -like code and a SNOMED CT identifier. The legacy codes of neoplasms were synchronized with ICD-O-3.2 codes.

The current version includes 4562 active concepts and 12573 descriptions. It is in use in one university hospital and three central hospital laboratories. FCR accepts cancer data delivery in the form of SNOMED CT reference set.

Conclusions
Including legacy concept and term codes was essential for usability of SNOMED CT in pathology reference terminology. It is also needed for secondary use of terminology.

Updated Subtyping of Lung Adenocarcinoma

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Introduction
The relative proportions and survival differs between the main lung cancer types – small cell, squamous cell and adenocarcinoma. Adenocarcinoma rates are rising globally. From 1985- 1994 the proportion of adenocarcinomas increased from 16% to 37% by 2015-2021 in Finland. The WHO classification of lung cancer has changed and subtypes of adenocarcinomas are more specific. We analyzed if adenocarcinoma subtypes can be found from histological pathology specimen reports.

Methods
We used pathology reports from 2019-2023 with the ICD-O-3 code M8140/3. The number of cases was 2713, of which 752 (28%) were randomly selected for further manual reading. All contained full answer text. The type of reports (plain text, synoptic report), type of specimen (resection, biopsy) and the changes or improvement of diagnoses were evaluated. The subtypes of adenocarcinoma were classified according to WHO Classification of Thoracic Tumours 5th edition.

Results
207/752 (28 %) cases of Adenocarcinoma NOS diagnoses were changed or they got a more specific subtype of adenocarcinoma. Four cases weren´t adenocarcinomas and one case was not lung cancer. Almost half (46 %) of the remaining 202 cases were Acinar adenocarcinoma, 15% Lepidic adenocarcinoma, 15% Solid adenocarcinoma NOS and 10% Papillary adenocarcinoma, NOS. 107/202 (53%) of the reports contained synoptic reporting.

Conclusions
Analysis of pathologist's report can improve the quality of Cancer Registry data compared to PAD. Harmonization of the pathologic answers will be part of a quality project of lung cancer in Finland.

Calculation of BCC Incidence Based on Pathology Reports

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Introduction
Cutaneous Basal cell carcinoma (BCC) is not reported in statistics from the Cancer Registry of Norway (CRN), and the national incidence is unknown. The CRN receive a copy of the pathology report for all cases with proven malignancy, which is a fundamental basis for registration of cancer in Norway. The reports for BCC, however, do not undergo any quality assurance and are not registered in the CRN incidence database. This study aims to calculate the incidence of BCC

during 2012–2022 using uncoded pathology reports.

Methods
We identified BCC cases using morphology codes registered on the pathology reports. We counted the first report per person. To validate the approach, the same method was applied to identify melanoma cases, which were compared to the published statistics based on the standard rules for registration. Age-standardized (European standard) incidence rates were calculated for both melanoma and BCC.

Results
Based on pathology reports the melanoma incidence for the period 2012–2022 was 43 and 48 per 100,000 for women and men, respectively. When using quality assured melanoma counts, the rates were slightly lower (38 for women and 44 per 100,000 for men). The BCC incidence was 147 per 100,000 for both sexes.

Conclusion
The correspondence between melanoma incidence rates based on pathology reports and published counts were good, indicating that BCC incidence can be estimated based on uncoded pathology reports. However, to ensure precise estimation, we need to understand causes of the small discrepancy in the melanoma rates.

Session 3: Early Diagnosis and Screening

Oral Presentations

Screen-detected and Interval Breast Cancer: Temporal Trends and Risk Factors from a Swedish Population-based Cohort, 1990-2019

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Introduction
To investigate the temporal trends of incidence and proportion of screen-detected breast cancer (SDC) and interval cancer (IC), and identify factors specifically associated with IC.

Methods

This population-level cohort included all cancer-free women residing in Stockholm, Sweden during 1990-2019. The 454,306 eligible women were followed up until the diagnoses of breast cancer (BC), or censored at other cancers, emigration or death. Incidence of BC, SDC, and IC were investigated by calendar year during 1990-2019, along with proportion of SDC and IC among screened BC patients. Risk associated with general factors and specific family cancer history was estimated using time-to-event analyses, with directly compared odds ratios between SDC and IC using logistic regression.

Results

During 17.6 million person-years of follow-up, 24,290 women were diagnosed with BC, among which 9,562 were SDC and 4,096 IC. Trends of BC, SDC, and IC incidence were upwards during 1990-2019, while the proportion of IC among BC patients was around 30%. Factors associated with IC include older age at first birth, higher education, recent HRT use, and family BC history, with the effects of most factors attenuated after adjusting for mammographic density while family BC history remaining constant. Novel factors for IC identified include family history of specific BC subtypes including IC (HR 2.92), hereditary breast and cancer syndrome (1.21-1.45), colorectal (1.11), and testicular cancers (1.82), and specifically ER-negative family history for ER-negative IC (2.99).

Conclusions

IC has not been reduced under current screening, and risk-based screening considering IC-specific risk factors is needed.

Should Residents with a Negative Colonoscopy in FIT-based Screening be Quarantined from Screening?

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Introduction

Since implementation of the Danish Bowel Screening Program in 2014, participant with a positive faecal immunochemical test (FIT) screening, but a subsequent negative colonoscopy (NC), has been quarantined from the screening program for 8 years. However, the evidence for this

quarantine is limited. We estimated the CRC risk after a NC and comparing it to a general unscreened population.

Methods
Using nationwide registers, we compared screening participants with a NC to random selected unscreened controls from birth cohorts 9 years younger (ratio 1:28). Controls were assigned a pseudo-colonoscopy date similar to the NCs, just 9 years prior. Outcome measures were cases pr. 10.000 person years and relative risk (RR) of CRC using the pseudo value approach.

Results
We included 29.936 with a NC and 842.096 controls with a median follow-up time of 5.8 and 5.7 years, respectively. At 8 years' follow-up the overall adjusted RR of CRC was 0.75 (0.64;0.86) for the NC-group compared to controls. Women below 60 and women in the 70's did not have a lower risk compared to controls (RR 1.41 (0.99;2.02) and RR 0.97 (0.72;1.30). A reduction was found among men and women in the 60's (0.65 (0.48;0.88) and 0.64 (0.45;0.92)) and men above 70 years (0.63 (0.46;0.87))

Conclusions
While the overall RR was lower, it might not justify 8 years of quarantine. Women and younger age groups might not receive the benefit of screening with current guidelines. Transfer of evidence from non-FIT screening to FIT screening should be done carefully.

Cost-effectiveness of Organized Risk-based Screening for Breast Cancer in Finland

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Introduction
In Finland, all women aged 50–69 are invited to biennial screening for breast cancer. Current European guidelines recommend screening in ages 45–49 and 70–74 conditional upon, inter alia, demonstrated context-specific cost-effectiveness. Screening strategies (i.e., starting and stopping ages and intensity of screening) tailored to different risk profiles of screening participants, could reallocate some resources from low-risk participants to more frequent screening in high-risk participants which, in turn, could improve the overall benefit-to-harm ratio of screening. Dense breast tissue and a high polygenic risk score (PRS), the latter incorporating the aggregated impact of multiple genes of varying breast cancer susceptibility into a single measure, are strongly associated with an increased risk for breast cancer.

Methods
The cost-effectiveness of different screening strategies stratified on breast density and PRS, will be evaluated against the current national screening strategy, using a decision- analytic

microsimulation model adapted to the tumor classification system used by the Finnish Cancer Registry. The strategies are superimposed onto a natural history model, where individual observations are assigned unique risk profiles sampled from population distributions of breast density and PRS, which determine their natural disease progression trajectories. Strategies' costs and Quality-Adjusted Life Years, aggregated over a lifetime horizon for all observations simulated through the model, allow for comparison through incremental cost-effectiveness ratios. The analysis will be conducted from a societal perspective, including direct and indirect healthcare- and nonhealthcare costs, using a discount rate of 3%. Sensitivity analyses will be performed to assess individual parameter-, decision- and structural uncertainty.

Coverage of Mammography Imaging In and Outside an Organized Breast Cancer Screening Program – Variation by Age and Sociodemographic Groups

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Introduction
In recent decades, attendance to organized breast cancer screening has been decreasing in many countries. This could be partly due to an increase in the use of opportunistic screening. The aim of this study was to assess the long-term coverage of imaging in and outside the screening program in Finland. For the more recent years, we also compared the use of imaging services across age, socioeconomic status, education, native language, and region.

Methods
Our initial data consisted of 2.3 million women aged 30–89 years and residing in Finland in 1999–2018. Data on the organized breast cancer screening program was drawn from the Finnish Cancer Registry, and supplemented with mammograms and ultrasounds performed outside the program, with over 90% coverage.

Results
Among the screening-target-aged women (50–69), a clear decline in the overall imaging coverage was observed during the follow-up (from 89% to 85%). The use of outside imaging became slightly more frequent, but was not large enough to make up for the overall decrease. There were large differences in overall coverage between sociodemographic groups, with age-adjusted coverages ranging from 66% (95% CI = 65–67%) in non-native speakers to 91% (95% CI = 91–92%) in lower-level employees. Substantial coverage differences were also found between different language groups.

Conclusions
Understanding the differences in service use between sociodemographic groups can inform targeted interventions to improve screening coverage and promote better healthcare equity.

Integrating Intensive Smoking Cessation with Lung Cancer Screening – a Randomized Pilot Study in Finland and Hungary

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Introduction
Screening with low-dose computed tomography (LDCT) has been shown to reduce lung cancer mortality among heavy smokers. There is also some evidence that smoking cessation interventions delivered alongside screening are likely to provide benefits at reasonable costs. Nonetheless, few studies have so far assessed the incremental benefits of smoking cessation counseling in the context of routine screening. We will build-up a small-scale, randomized pilot in Finland and Hungary to justify and evaluate the integration of smoking cessation with population-based LDCT-screening.

Methods
The pilot target population (n=2400) consists of men and women aged 50-74 years, who are active smokers and have smoked >15 cigarettes/day more than 25 years or >10 cigarettes/day more than 30 years. The target population is individually (1:1) randomized to intervention and control groups. In the intervention group, LDCT is offered at baseline and year 2, and active counselling on smoking cessation is given in each screening session and via a smoking cessation app. The control group receives active counseling on smoking cessation in the same way as the intervention group, and is screened by LDCT either at baseline or year 2. The study period is 2025-2028.

Results
The final design and follow-up procedures, the smoking cessation methods, and the feasibility of the study protocol in two countries with different health care settings will be discussed in the meeting.

Conclusions
Understanding the challenges related to lung cancer screening among heavy smokers enables to provide practices that may help to reduce lung cancer mortality in Europe.

Colorectal Cancer Incidence and Mortality after Negative Colonoscopy Screening: A Cohort Study

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Introduction
Individuals with a negative colonoscopy screening (NCS), are recommended for rescreening at 10-years.

Methods
We prospectively examined colorectal cancer (CRC) incidence and mortality according to NCS status in the three cohorts, the Nurses' Health Study (NHS), NHS II, and Health Professionals Follow-up Study, followed from 1988/1991 to 2020. Additionally, we assessed CRC risk according to a risk score (0-12), based on major demographic and lifestyle risk factors. We used Cox regression to calculate hazard ratios (HR) and 95% confidence intervals (CI) for incidence and mortality of CRC.

Results
A total of 195 453 participants, with a median age of 44-years at baseline and 81% females, were followed for a median of 12-years. Among 81 151 individuals with NCS and 114 302 without

endoscopy, we documented 394 and 2 229 CRC cases, and 165 and 637 CRC deaths, respectively. NCS was consistently associated with lower CRC incidence and mortality for 20-years, with the multivariable HR (95% CI) of 0.51 (0.44, 0.58) and 0.56 (0.46, 0.70), respectively. Among individuals with NCS, those with an intermediate and low risk (risk score 6-7 and 0-5, respectively) reached the same 10-year cumulative incidence of CRC (0.78%) as the high-risk individuals (risk score 8-12), at 16 and 25-years after initial screening, respectively.

Conclusions
Rescreening intervals after a NCS may be extended beyond the currently recommended 10-years, particularly for individuals with a low-risk profile. Our results showed the importance of considering known CRC risk factors when making recommendations for colonoscopy rescreening.

How do Socioeconomic Factors Affect the Longitudinal Adherence to Colonoscopy Surveillance in the Danish FIT-based Colorectal Cancer Screening Program

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Introduction
Individuals with low socioeconomic position (SEP) have lower participation rates in colorectal cancer screening and first colonoscopy follow-up. Adherence to longitudinal follow-up and colonoscopy surveillance is not monitored in full. This study aimed to investigate socioeconomic predictors for longitudinal non-adherence to follow-up after colorectal cancer screening.

Methods
This register-based study included FIT-positive individuals screened from March 2014 to end of 2017 and followed them during surveillance until death, emigration, or end of follow-up, i.e. June 2022.
Non-adherence was evaluated in accordance with national guidelines. Socioeconomic predictors were defined using individual-level register data on occupation, education, ethnicity, civil status and income. Regression analyses were adjusted for comorbidities, age and sex.

Results
We included 81.978 individuals with a positive FIT test. After adjustments, socioeconomic factors for longitudinal non-adherence to follow-up were; non-Danish origin; RR 1.16 (95%CI: 1.07;1.25) and individuals living alone RR 1.15 (95%CI: 1.10;1.19). Sub-analyses revealed i) number of comorbidities, ii) type 2 diabetes and iii) presence of psychiatric disease to be strong predictors for non-adherence to longitudinal follow-up. In addition, non-recommended colonoscopy activity after

a normal index-colonoscopy was more frequent among unemployed individuals.

Conclusion
Ongoing efforts to increase screening participation among residents with lower SEP must be followed by awareness of their longitudinal adherence to follow-up. As comorbidities seem to play a significant role and chronic disease tend to pile up in these groups, screening check-ups may be important when these patients are in contact with the health care system for treatment or control of their chronic disease.

Posters

Personalized Risk-based Breast Cancer Screening

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Introduction

International moves to consider personalized risk-based breast cancer screening in which a woman's risk of breast cancer determines the frequency and modalities of mammography screening have emerged. However, women with a higher risk for breast cancer do not necessarily have the same effect of mammography screening as women with a lower risk. Socioeconomic factors seem to be associated with breast density, the risk of developing cancer, the stage when diagnosed, and mortality. The evidence of the effect of mammography across socioeconomic status is inconsistent and the studies behind it have methodological issues. Thus, this study aims to compare the effect of mammography screening across socioeconomic status.

Methods

Screening was introduced in Funen County in 1993, whereas it was only introduced in a huge part of Denmark (restDK) in 2008. All women aged 50-69 years invited to mammography screening in Funen between 1993-2007 were included, as well as a comparable cohort of women living in restDK who had never been invited to mammography screening. Kaplan Meyer plots showed the mortality rates for each SES groups in the screening (Funen) and non-screening areas (restDK). A Cox proportional hazard model was used to test if the effect of mammography screening was similar for all SES-group.

Results and conclusion

We included 85.498 women from the screened areas and 731.587 women from the non-screened areas. We are currently analyzing data and validating results. The final results will be presented at the symposium.

Protection of a Negative Colonoscopy in the Finnish Randomized Health Service Study in 2004–2016: Emphasis on Differences by Sex

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Introduction
The burden due to colorectal cancer (CRC) can be lowered by biennial stool-based screening including a diagnostic colonoscopy for test positives. A meticulous colonoscopy with a negative result has been reported to protect from CRC for up to ten years. Several programs therefore invite persons with a previous negative colonoscopy only after a long exclusion period. This period is the same for men and women even if the performance and effectiveness of CRC screening are known to differ by sex. We assessed here the sex-specific protection of a negative colonoscopy against CRC in stool-based screening.

Methods
We used individual colonoscopy data from a Finnish population-based randomized screening health service study run from 2004 to 2016 with follow-up to the end of 2019. A colonoscopy was negative if no lesions, polyps, or more severe findings were detected. We compared the age- and sex-specific risk of CRC in the negative colonoscopy population (n=6,776) to that in the control population (n=233,000) using standardized incidence ratios (SIR).

Results
Among men, a negative colonoscopy protects against CRC throughout the follow-up (0.5–2, 2-6, 6+ years). Even six years or more after the negative colonoscopy, the SIR of CRC was 0.33 (95% CI 0.12–0.71) compared to the control population. Among women, however, a negative colonoscopy did not protect against CRC in any follow-up period.

Conclusions
Our results suggest that protection after a negative colonoscopy differs by sex. This should be taken into account in the exclusion period of the recently launched Finnish CRC screening.

Quality Manuals for Organising National Cancer Screening Programmes in Finland

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Introduction

The national cancer screening programmes in Finland, for cervical, breast and colorectal cancer, have been shown to be effective. However, the performance of screening varies between regions and population groups, which may be partly due to differences in screening practices.

After the health and social services reform in Finland, implemented in January 2023, the responsibility for organising screenings was transferred from 309 municipalities to 22 wellbeing services counties. During the preparation of the reform The National Cancer Screening Steering Group and the Finnish Cancer Registry (FCR) agreed on establishing quality manuals for detailed guidance on how to run well-performing screening programmes.

Methods

The expert groups of each screening programme, established within the Steering Group, have been working on the quality manuals since 2022. The group members are health care professionals, screening experts, and epidemiologists of university hospitals, the FCR and the national cancer center.

Results

The quality manuals will be published in April 2024. The manuals set the evidence based, practical guidance, and quality assurance requirements needed for quality cancer screening.

Conclusions

The manuals allow cancer screening to be carried out uniformly across the country, thus possibly levelling out the regional variations in the screening performance. Indicators of regional differences will by monitored attentively by the FCR.

The manuals will be introduced via webinars and newsletters to public health leaders, screening stakeholders and wellbeing services counties, which are responsible for implementing these guidelines. The manuals will be updated over time in order to guarantee quality screening in the future.

Socioeconomic Disparities in Yield of Advanced Neoplasia from Screening with Biennial Faecal Immunochemical Testing in Relation to Primary Colonoscopy

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Introduction

It is well documented that the uptake of organised colorectal cancer (CRC) screening is lower in lower socioeconomic groups. On the other hand, for attendees in stool- based testing, higher proportions of test positives in lower socioeconomic groups have been observed. It remains unclear to what extent socioeconomic inequality in the screening uptake influences the diagnostic yield.

Methods

Sixty-year-olds were randomly recruited from the Swedish population between March, 2014, and March, 2020, and invited to either faecal immunochemical testing (FIT) two years apart (n = 60,137) or once-only primary colonoscopy (PCOL; n=30,400). By linkage to Statistics Sweden's registries, we obtained socioeconomic data. In each defined socioeconomic group, we estimated the cumulative yield of advanced neoplasia (AN) in each screening arm (intention-to- screen analysis). We predicted the probability of exceeding the yield in the PCOL arm after a third round of FIT: Pr{AN_FIT3>AN_PCOL}.

Results

In the lowest income group, the yield of AN was 1.63% (95% confidence interval [CI]: 1.35–1.93%) after two rounds of FIT, in relation to 1.93% (95% CI: 1.49–2.40%) in the PCOL arm. We predicted Pr{AN_FIT3>AN_PCOL} = 0.86. In the highest income group, we found a more pronounced yield gap between the two screening strategies, 2.32% (95% CI: 2.15–2.49%) versus 3.71% (95% CI: 3.41–4.02), and a very low Pr{AN_FIT3>AN_PCOL} (= 0.02).

Conclusions

Yields of AN from FIT 2 years apart and PCOL, respectively, were poorer, but differed lesser, in lower socioeconomic groups. The results are valuable for evaluations of health equity in organised CRC screening.

Improving Cervical Screening Algorithms using HPV Genotyping - A Twenty-year Cohort Follow-up

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Introduction

Human papillomavirus (HPV) screening test has replaced the traditional cytology screening in many countries. HPV screening is more sensitive but less specific than cytology screening, as HPV test cannot distinguish between progressive and non-progressive HPV infections.

HPV genotyping as a triage for a positive HPV test could increase the specificity of HPV screening. How to optimally manage different HPV types in a screening program is not currently known. This study aims to provide type-specific long-term risks for HSIL and cervical cancer (HSIL+) in different age groups.

Methods

We utilized the Finnish HPV screening trial cohort with over 115,000 archived Hybrid Capture 2 (HC2) samples. We genotyped around 6,000 samples positive for HPV by HC2 using polymerase chain reaction (PCR) and combined results with individual-level data from multiple registries during up to 20 years of follow-up. We will calculate genotype- and age-group-specific cumulative incidences for HSIL+ using the Aalen-Johansen estimator.

Results

Preliminary results based on the genotyping of 2574 samples showed that around 30 % HC2-positive samples were negative in HPV genotyping. The proportion of samples HC2-positive but PCR-negative increased with age and decreased with increasing cytological abnormality. Full data and long-term risks will be presented at the ANCR.

Conclusions

This study will show how HPV typing performs as a triage test for positive HPV test in a population-based cervical cancer screening. Information from this study will help creating new Finnish quality manuals and clinical current care guidelines as well as EU wide quality assurance guidelines for cervical cancer screening.

Tumour Growth Models of Breast Cancer for Analysing Mammography Screening Register Data and for Evaluating Early Detection

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Introduction

Continuous tumour growth models have been proposed as an alternative to multi-state models for analysing mammography screening and breast cancer register data, with aims to gain understanding of the roles of breast cancer risk factors in cancer progression and detection, and to assess impacts of early detection of breast cancer. These models use random effects and growth functions to model the (latent) growth in the size of tumours.

Methods

We develop estimation procedures for fitting tumour growth models to incident cases and to cohorts. Here we report an analysis of incident invasive breast cancer patients diagnosed 2001-2008, aged 50-71, in the Stockholm-Gotland region of Sweden. Information on patients consisted of tumour size at detection, mode of detection (screening/symptomatically) and dates of screens attended before diagnosis. Patient records were retrieved from the Regional Breast Cancer Quality Register and screening histories were obtained from the mammography screening database of the Regional Cancer Centre. We also report a small simulation study using our estimated models which investigates implications of making changes to the Swedish screening programme.

Results

We estimate tumour growth rate distributions and show that our model-based expected incidence of interval breast cancers aligns with observed patterns in our study and with estimates from a program administered by the Cancer Registry of Norway. Our methodology allows us to estimate the distribution of tumour sizes at the most recent screening for interval cancers.

Conclusions

Estimation of breast cancer tumour growth models may help to provide insights into the effectiveness of population-based mammography screening for breast cancer.

Session 4: Causes and Risk Factors

Oral Presentations

Risk of Breast Cancer among Women with Hyper- and Hypothyroidism: Results from a Large Nationwide Cohort Study

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Objective
An association between thyroid disorders and breast cancer is plausible as thyroid hormones are regulated by the hypothalamic-pituitary axis, which also regulates estrogen and other sex hormones that are known to affect breast cancer development. However, previous epidemiological studies have showed conflicting results and have various methodological limitations. In this population-based cohort study including 1 058 887 women born in Denmark between 1960 and 1997, we investigated the association between hyper- and hypothyroidism and breast cancer.

Methods
Hyper- and hypothyroidism diagnoses, cancer diagnoses, covariates, migration, and vital status were obtained from Danish national registers. Hazard ratios (HR) and 95% confidence intervals (CIs) for breast cancer overall and for histological subtypes were calculated based on adjusted cox proportional hazard regression models.

Results
Altogether, 21 706 women developed hypothyroidism and 47 719 women developed hyperthyroidism during a median follow-up of 18.5 years where 15 681 women were diagnosed

with breast cancer. Overall, no marked associations between hyperthyroidism, hypothyroidism and breast cancer were observed. In analyses stratified for menopausal status however, hyperthyroidism was associated with an increased breast cancer risk among postmenopausal women (HR: 1.28, 95% CI: 1.06–1.53) while hypothyroidism was associated with a decreased risk among premenopausal women (HR: 0.83, 95% CI: 0.73– 0.93). The results for ductal and lobular breast cancer resembled those observed for breast cancer overall.

Conclusions
Our results points towards an association between thyroid function level and breast cancer risk as hyperthyroidism increases the risk among postmenopausal women while hypothyroidism decreases the risk among premenopausal women.

Exposure to Fibres and Risk of Pleural Mesothelioma in the Norwegian Offshore Petroleum Workers Cohort

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Introduction
Pleural mesothelioma is a rare respiratory cancer, mainly caused by inhalation of asbestos fibres. Other inorganic fibres are also suggested risk factors. We aimed to investigate the association between pleural mesothelioma and exposure to asbestos or refractory ceramic fibres (RCF) among male Norwegian offshore petroleum workers.

Methods
Among 25 347 men in the Norwegian Offshore Petroleum Workers (NOPW) cohort (1965– 1998), 43 pleural mesothelioma cases were identified through the Cancer Registry of Norway (1999– 2022). A case-cohort study was conducted with 2095 randomly drawn non-cases from the cohort.

Asbestos and RCF exposures were assessed with expert-made job-exposure matrices (JEMs). Weighted Cox regression was used to estimate hazard ratios (HRs) and 95% confidence intervals (CIs), adjusted for age at baseline and pre-offshore employment with likely asbestos exposure.

Results
A positive trend for pleural mesothelioma was found for average intensity of asbestos exposure (P-trend=0.026) and for duration in offshore jobs with high asbestos exposure (P-trend=0.020). Pre-offshore asbestos exposure (vs. no such exposure) was associated with increased risk of pleural mesothelioma (HR=2.06, 95% CI: 1.11–3.81). Only offshore workers with no pre-offshore asbestos exposure had an increasing risk of pleural mesothelioma with increasing average intensity of offshore asbestos exposure (P-trend=0.001). No associations were found between RCF and pleural mesothelioma.

Conclusions
Associations between JEM-based offshore asbestos exposure and pleural mesothelioma were confirmed in the NOPW cohort. Pleural mesothelioma risk was also associated with asbestos exposure before work in the offshore petroleum industry.

A Population-based Cohort Study on Changes in Lung and Bladder Cancer Incidence among Non-Western Immigrant Men

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Introduction
Smoking is the most important determinant of cancer burden, being responsible for 23% of the cancers in men in Finland. Current smoking significantly increases the risk of all cancers, especially for lung and bladder cancer in men. The prevalence of smoking has decreased remarkably during the past decades, especially in men. However, immigrant men more frequently report current smoking.

Methods
We studied the incidence of lung and bladder cancer among non-Western immigrant men and compared these to corresponding figures in the non-immigrant male population in Finland in 2000–2017. Additional analyses took into account the duration of residence and age at immigration. The study utilised data from national registries, and multivariate Poisson regression models were used to model the relative differences in incidence as rate ratios (RR).

Results
Our results show that men born in Russia and Eastern Europe have significantly higher lung cancer incidence rates and men born in Middle East and North Africa have significantly higher

bladder cancer incidence rates than non-immigrant men. Additionally, the risk of bladder cancer among immigrant men increase with the duration of stay.

Conclusions
Increased migration calls for a better understanding of the migrants' cancer risk and the change in risk patterns over time. The study identified immigrant groups that, because of high lung and bladder cancer incidence, should be targeted for smoking prevention and cessation programs.

The Effect of Diabetes and its Complications on the Risk of Colorectal Cancer

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Introduction
The prevalence of type 2 diabetes (T2D) has increased worldwide during the 21st century. The known risk factors for T2D and colorectal cancers (CRC) are partially similar. The aim of this study is to estimate the association between T2D and the incidence of primary CRC, and the impact of diabetic complications on the risk of CRC.

Methods
We linked exposure data on T2D by severity (presence or absence of complications), obesity and alcohol related disorders from Care Register for Health Care and CRC cases from the Finnish Cancer Registry to a random sample of 2.5 million Finnish individuals that were followed from 2000 to 2017. To account for the cumulative burden of exposures, we employed a multi- state model where transition rates to CRC were modelled with Poisson regression, adjusted for age, calendar period, sex, obesity and alcohol related disorders.

Results
The preliminary results show that individuals diagnosed with T2D were at a higher risk of CRC (HR 1.26, 95% CI 1.20-1.32). Those whose diabetes was non-complicated had a smaller risk of CRC than those who had experienced diabetes related complications after 10 years since the initial T2D diagnosis (1.20, 1.00-1.44, p=0.048). Men with diabetic nephropathy had a significantly higher risk of CRC (1.51, 1.23-1.86) than other diabetic men.

Conclusions
Our findings support earlier research that T2D is associated with an elevated risk of CRC, while also indicating that the risk of CRC depends on the severity of the T2D.

Cost of Breast Cancer Treatment Attributable to Modifiable Risk Factors in Finland

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Introduction
The key cancer risk factors were responsible for 28% of breast cancer cases diagnosed in Finland over the past 40 years. The average cost of breast cancer treatment in specialized health care is almost €30,000 per patient. The aim of this study is to estimate the cost of breast cancer treatment attributable to the key risk factors in Finland.

Methods
The pooled data of METCA project (Prospective METa Cohort Study of Cancer Burden in Finland) combines eight health studies conducted in Finland in 1972-2015. The data included 121,500 women diagnosed with 3203 breast cancers. We estimated the population attributable fractions and the costs of breast cancer treatment attributable to alcohol consumption, smoking, overweight, physical inactivity, nulliparity and education by using age and stage specific information on the costs of treatment in specialized health care.

Results
The average annual number of women diagnosed with breast cancer in Finland in 2004-2013 was 4200, and the cost of treatment of women diagnosed per year was €125 million in the first 10 years after diagnosis. According to the preliminary results, the attributable cost of treatment per year was €10.9 million for alcohol consumption, €8.9 million for smoking, €4.9 million for physical activity and €1.8 million for overweight/obesity. The costs attributable to education and nulliparity were €23.3 and €20.4 million per year, respectively.

Conclusions
Substantial savings in the cost of cancer treatment would have been achieved, if breast cancers caused by the key modifiable risk factors had been prevented.

Rheumatoid Arthritis and the Risk of Common Cancers

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Introduction

Evidence on the relationship between rheumatoid arthritis (RA) and the subsequent cancer risk remains insufficient. We evaluated the overall association between RA and the risk of site-specific cancers, and by RA serotype and time since RA diagnosis.

Methods
Study participants (N=2,484,529) were randomly sampled from the Finnish population information system. Data on RA diagnoses were collected from the hospital care registry and information on cancers were retrieved from the cancer registry.
We estimated RA-associated hazard ratios (HRs) for 23 different cancers or cancer subtypes, using a Poisson regression model with piecewise constant hazards, adjusted for age, sex, and calendar period.

Results
RA was associated with an increased risk of lung cancer (HR 1.39, 95% confidence interval 1.28-1.50), lymphoid malignancies (1.33, 1.20-1.47), kidney cancer (1.23, 1.07-1.42), myeloid malignancies (1.22, 1.03-1.46) and pancreatic cancer (1.16, 1.03-1.31), in the period 1+ years after RA diagnosis. Conversely, RA was associated with decreased risks of female breast cancer (0.82, 0.77-0.88) and endometrial cancer (0.82, 0.70-0.95).
The RA-associated increase in lung cancer risk was greater in men than women (interaction by sex p=0.005) and declined with increasing time since RA diagnosis (p<=0.001), while the elevated risk of pancreatic cancer was largely confined to women (p=0.034).
All statistically significant associations were for seropositive or unspecified serotype RA.

Conclusions
Our findings provide further support for an association of RA with several common cancers, most notably lung cancer and lymphoid malignancies as well as novel evidence for a reduction in the risk of endometrial cancer for which existing evidence is sparse. The fact that the associations were largely confined to seropositive rather than seronegative RA may be important for elucidating the mechanism by which RA affects cancer risk.

Acknowledgements
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A Substantial Proportion of the Association between Alcohol Consumption and Colorectal Carcinogenesis is Mediated by the Gut Microbiome

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Introduction
Alcohol consumption is one of the major risk factors of colorectal cancer (CRC). However, the mechanisms underlying this relationship are not fully understood, particularly the role of gut microbes. We aimed to study associations between alcohol intake, gut microbiome and colorectal lesions among colorectal screening participants enrolled in the CRCbiome study.

Methods
Fecal immunochemical test positive participants, aged 55-77 years, were included in this cross-sectional study. Intake of alcohol was assessed using a validated, semi-quantitative food frequency questionnaire. Integrating with shotgun metagenome based taxonomic and functional profiles, we studied associations with advanced screen-detected colorectal lesions (advanced adenoma, advances serrated lesion or CRC).

Results
Of 1,468 participants, 414 were diagnosed with advanced colorectal lesions. Alcohol intake was positively associated with advanced lesions in a dose response manner (p_{trend}=0.008), with odds ratio of 1.09 (95% confidence interval, 1.00, 1.19) per 10 g/day increase. The association was stronger in women than men ($p_{interaction}$=0.040). Compared to the non-consumers, those consuming alcohol were characterized by a distinct microbial profile, manifested as modest, but consistent, shifts in α- and β-diversity, and differentially abundant bacteria. A data- driven microbial alcohol-association score was positively associated with advanced lesions (p_{trend}<0.001). A causal mediation analysis showed that 28% of the association between alcohol intake and advanced lesions was mediated via this score.

Conclusions
Positive associations were observed between alcohol consumption and advanced colorectal lesions, particularly in women. Alcohol consumption was associated with a distinct microbial profile, which partly explains the association between alcohol intake and advanced colorectal lesions.

Posters

Epidemiology of Mastocytosis: A Population-based Study (Sweden)

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Introduction

Mastocytosis is a disease characterized by accumulation of aberrant mast cells and mediator-related symptoms and is divided into systemic mastocytosis (SM) and cutaneous mastocytosis (CM). Because of scarcity of data and underreporting, the epidemiology of mastocytosis remains incompletely understood.

Methods

We conducted a matched cohort study to estimate the incidence, prevalence, overall survival (OS) and comorbidity burden in adult mastocytosis patients identified in Swedish population-based registries. Individuals (≥ 20 years of age) diagnosed with mastocytosis between 2001 and 2018 were identified in National Patient Register (NPR) and/or the Swedish Cancer Register (SCR). For each case five randomly selected mastocytosis-free comparators matched on age, sex, and county of residence were chosen from the Population Register. The Kaplan-Meier method was used to assess OS. Based on information in the Patient Register, concomitant disease at baseline was assessed by use of the Charlson Comorbidity Index.

Results

We identified 2,040 adults with a mastocytosis diagnosis yielding an annual incidence of 1.56 per 100,000 (95% CI 1.29-1.87) and a prevalence of 23.9 per 100,000 (95% CI 22.8-25.0). Compared to comparators, the comorbidity burden was higher, and the OS lower, in individuals with mastocytosis.

Conclusion

We found a higher incidence and prevalence of mastocytosis compared to assessments in other settings and confirmed that the prognosis generally is favorable. Our results also highlight the need of improved reporting and subclassification of mastocytosis, and a better understanding of factors underlying a high comorbidity burden, including cancer, in patients with mastocytosis.

Increase in Breast Cancer Incidence in Iceland 1980 – 2020: Understanding the Trends - Research Proposal

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Introduction

Breast cancer incidence in Iceland has been on the rise for recent decades. Simultaneously, the prevalence of many common risk factors for breast cancer have been increasing, and population-based breast cancer screening started in 1987. The primary aim of the upcoming project is to investigate the association of screening, hormonal-and lifestyle- related risk factors with the incidence of breast cancer over a 40-year period. One of the risk factors for breast cancer is use of menopausal hormonal treatment (MHT), which was highly prevalent around the turn of the century, and it´s use is currently on the rise again in Iceland. As MHT has a complex balance of benefits and harms and its effects on cancer mortality are conflicting, the secondary aim will be to estimate relative risk of cancer death and breast cancer-specific death by MHT usage.

Methods

Information on breast cancer risk factors will mainly be obtained from the Cancer Detection Cohort of the Icelandic Cancer Society. We will calculate population attributable fractions (PAFs) for breast cancer risk factors in 10-year periods from 1980 – 2020. Age- period-cohort modelling will be used to estimate the contribution of breast cancer screening on the incidence, in relation to overdiagnosis. Nested case-control format and conditional logistic regression will be used to estimate the relative risk of cancer death associated with the use of MHT.

Results/conclusions

Improved understanding of the contribution of risk factors to breast cancer incidence and mortality is of great importance for future breast cancer prevention strategies.

Histologically verified vulvar lichen sclerosus and the risk of non vulvar cancer: a nationwide cohort study

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Introduction

Vulvar lichen sclerosus (VLS) is a chronic inflammatory mucocutaneous disease known to be associated with human papillomavirus-independent vulvar squamous cell carcinoma. Evidence on the association with other types of cancer, however, is sparce.

Methods

We conducted a large nationwide cohort study examining the incidence of non-vulvar cancers among women with biopsy-verified VLS compared with the general female population. By using the nationwide Pathology Registry, we identified all women in Denmark with a biopsy-verified VLS diagnosis during 1978–2019 (n=16,921). The cohort was followed up in the Danish Cancer Registry until 2022 for a subsequent non-vulvar cancer diagnosis. Standardized incidence ratios (SIRs) were computed with 95% confidence intervals (CIs) as relative risk estimates of all specific non-vulvar cancer sites.

Results

Compared with general female population rates, women with biopsy-verified VLS had decreased rates of several non-vulvar cancers, including HPV-related cancers (combined estimate: SIR=0.5; 95% CI: 0.3–0.7), and lung (SIR=0.6; 95% CI: 0.5–0.7), liver (SIR=0.5; 95% CI: 0.2–0.9), and thyroid

cancer (SIR=0.5; 95% CI: 0.3–0.9). The decreased SIRs tended to sustain throughout the follow-up period following the VLS diagnosis.

Conclusions

This large nationwide cohort study shows that women with biopsy-verified VLS may have a long-term reduced risk of developing HPV-related (cervical, vaginal, oropharyngeal, and anal) and smoking-associated cancers (lung, liver, and cervical) as well as thyroid cancer. Future studies focusing on the mechanisms behind the decreased cancer risk are needed.

Healthcare Budget Impact Analysis of Introducing Human Papilloma Virus Vaccination in Connection to Cervical Intraepithelial Neoplasia Treatment in Sweden

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Introduction
Women with cervical intraepithelial neoplasia grade 2 or greater (CIN 2+) are at risk of recurrence, which needs to be treated and is associated with risk of late miscarriages and pre-term births and long-term risk of cervical cancer. Adjuvant vaccination against human papilloma virus (HPV) appears to reduce CIN 2+ recurrence and hence is likely to prevent its long-term consequences. Our aim was to evaluate costs associated with introducing HPV vaccination in connection to surgical treatment of CIN 2+, from a healthcare perspective in a Swedish regional setting (1.9 million inhabitants). Costs are presented in year 2023 SEK (11.53 SEK = 1 EUR).

Methods
Costs of vaccine doses and extra visits, and cost offsets from avoided CIN 2+ relapses were estimated over a five-year period. Sensitivity analyses included levels of compliance, demography, vaccine price and other unit costs of healthcare resources, and vaccination effectiveness scenarios.

Results
Introduction of vaccination requires SEK 2.30 million of additional healthcare budget for vaccinating 963 women annually, though declining to 2.1 million in year 5 due to costs offset from avoided CIN 2+ relapses and its treatment.

Conclusions
Introduction of HPV vaccination upon CIN 2+ treatment requires a minor healthcare budget increase of SEK 2.5 million annually, decreasing to SEK 2.1 million after five years.

Janus Serum Bank as 'Time Machine' to Explore Connection Between Exposure to 'Forever Chemicals' and Cancer

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The goal of this research program is to identify patients with high kidney and testicular cancer susceptibility due to their exposure history to Per- and polyfluoroalkyl substances (PFAS) or premorbid status, potentially enabling screening and early detection of cancer. PFAS are a persistent, bio-accumulating group of chemicals widely used in industrial and consumer products. Since the half-lives of PFAS in human serum are on the order of years, studying associations between PFAS exposure and cancer requires follow-up data over many years. Despite increasing evidence for cancer- related effects of PFAS in recent studies, additional international efforts to validate and add to these observations are needed. In this project, we will utilize the Janus Serum Bank (JSB) for a nested case-control study to assess the risk of kidney and testicular cancer. With 318,628 blood samples and 25-50 years of follow-up time, and excellent linkage to disease history, the JSB provides a unique opportunity to correlate historic PFAS serum concentrations with diagnoses of cancer occurring later in life. In addition to this "Time Machine", we will generate new data about PFAS levels for the JSB and link it to existing cancer data. We will analyse the data by using both statistical models and mechanism-based pharmacodynamic models in a synergistic way. The results from our project will guide the European Chemical Agency in the evaluation and revision of existing restrictions on PFAS, thus limiting potential health hazards.

Session 5: Epidemiological and Biostatistical Methods

Oral Presentations

A Practical Approach to Fitting Cancer Survival Models when Data can't Move Across Borders

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Introduction
International collaborative research enables exploration of differences in cancer incidence, mortality, and survival. With increasing difficulty in moving data across borders, international comparisons become more challenging, particularly when analyses require fitting survival models as individual level data is usually required. Although separate analyses can be performed in each country, a consequence is analyses are often restricted to being descriptive and/or more simplistic than if data were combined.
For common cancer sites data is often large enough for separate models for each country. We describe a framework where separate models are fitted and only software model objects, containing no individual data, are shared.

Methods
A flexible parametric relative survival model is fitted in each country and the model object saved (a Stata .sterfile). This contains parameter estimates, variances, and additional details of the model fitted, but crucially no individual data.

Results
The model object files enable calculation of various useful estimates and contrasts, including predictions for specific covariate patterns and standardized estimates. We show how relative survival, crude probabilities, loss in life expectancy and avoidable deaths can be presented and compared between countries. We also show how reference adjusted measures are easily obtained.

Conclusions
We have described a framework enabling presentation of more complex estimates when data cannot be shared. The main issue is ensuring data cleaning and coding is consistent. The approach will not work for fitting models jointly to all countries where data needs to be combined or a full federated learning approach adopted.

Synthetic Data Generation for External Control Arms

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Background
An external control arm based on health registry data can serve as an alternative comparator in single-arm drug development studies that lack comparison to the experimental treatment. However, accessing such observational healthcare data is a lengthy and intricate application process, delaying drug approval studies and access to novel treatments. We examine if synthetic data can serve as a proxy for the original control arm data by providing the same research outcomes while reducing the risk of information disclosure.

Methods
The external control arm benchmark includes data from Norwegian health registers. It consists of a limited patient pool with high-cardinality features. These particular data characteristics make it harder for synthetic data to mimic the statistical patterns of the original population without disclosing information that is specific to original data subjects. We propose a data generalization procedure to address this challenge while also being able to preserve the original data structure.

Results
We compare various synthetic data generation algorithms in numerical experiments, focusing on the utility of the synthetic data to support the conclusions drawn from the original data, and analysing the risk of sensitive information disclosure. Our results indicate that data generalization enhance both data utility and privacy. Moreover, the generator algorithms demonstrate the ability to generate synthetic data of high utility without compromising the confidentiality of the original data.

Conclusion
Our finding suggests that synthetic external control arms could serve as a viable alternative to observational data in drug development studies, while reducing the risk of revealing sensitive information.

When You got Nothing but Time ---

Bayesian Latent Regression for Progressive Disease with Selectively Observed Outcomes

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Introduction
European colorectal cancer (CRC) screening programmes typically invoke biphasic testing protocol: the screened persons go through an initial faecal test, from which positives are directed to further investigation in colonoscopy. With the testing protocol being sub-100\% sensitive, false negatives cause problems when predicting existence of a prevalent asymptomatic disease. The asymptomatic cancers prevalent at the time of a false negative typically become symptomatic and detected some time after the initial test. Yet, even when the cancer emerges relatively fast after a negative initial test, it might not have been prevalent at the time of the test. This makes optimization of the programme difficult.

Methods
We propose a Bayesian regression model for latent outcomes with accelerated failure rates for late-observed events. The relationship between covariates, disease prevalence, test result and eventual detection time of cancer are presented as directed acyclic graph that defines the conditional distributions for each variable. In our model, the covariates affect the cancer prevalence, cancer prevalence affects screening test result, and both prevalence and test result affect the detection time. Positive initial test accelerates time to detection.

Results
As results, we show how different screening histories and other covariates affect the prevalence of cancer. We also analyse different risk-profiles for screened persons, evaluating possibilities for risk-stratified protocols. Concrete results will be available at the time of symposium.

Conclusion
Efficient risk-stratification in cancer screening can benefit from improved statistical methods.

Prediction of Cancer Incidence and Prevalence in Iceland up to the Year 2040

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Introduction
A large increase in new cancer cases is predicted worldwide, mainly because of ageing populations. The age distribution of the Icelandic population is different from the other Nordic

countries. The purpose of this study was to predict the number of new cancer cases as well as cancer prevalence in Iceland in the year 2040.

Materials and methods
Number of cancer cases predicted in year 2040 were based on constant rate from 2018-2022 and on populational projections for the year 2040, retrieved from Statistics Iceland. Nordpred- method from NORDCAN was specifically used for lung cancer to account for changes in risk. The most recent population predictions from Nordic Co-operation was used for comparing predictions between the Nordic countries. Three different methods were used to estimate the number of survivors in 2040 in Iceland.

Results
In 2040, a 57% increase in yearly average number of new cancer was predicted in Iceland, or a total of 2,903 cases compared with 2018-2022. This increase is higher than in other Nordic countries (Norway 41%, Sweden 24%, Denmark 23%, Finland 21%). In 2022, the number of cancer survivors in Iceland was around 17,500 and was predicted to be between 24,500 and 31,000 in 2040.

Conclusion
The main reason for the predicted increase of cancer cases and survivors is the ageing of one of Iceland‘s largest generations, and improvements in cancer care. This increase in the number of cancer patients and improved survival will raise the demand for healthcare and calls for novelty in preventive strategies.

Keywords: Cancer, population, prediction, incidence, prevalence, survivors

Posters

Permissioned Blockchain-based Framework for Ranking Synthetic Data Generators

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Background

The increasing reliance on synthetic data has underscored the need for a robust evaluation framework, given the variety of synthetic data generators available. In this research, we introduce a novel evaluation framework for ranking synthetic data generators.

Methods
Our framework integrates context-sensitive assessments, robust accountability mechanisms, thorough auditability processes, and a commitment to enhanced transparency. Leveraging permissioned blockchain technology, our framework represents an advancement in the state-of-the-art of synthetic data evaluation. Additionally, our framework is designed to be resilient against threats such as repudiation, collusion, and poisoning attacks.

Results
Through comprehensive experiments, including comparisons with a baseline ranking solution, our framework demonstrates efficacy in providing nuanced rankings that consider both desirable and undesirable properties.

Conclusions
Our framework serves as a valuable tool for selecting optimal synthetic data generators for specific needs and ensuring compliance with data protection principles.

Federated Learning Using OMOP Modelling of Health Data for Elevating Colorectal Cancer Care in the Nordic Countries (FLORENCE)

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Introduction
Colorectal cancer is the second most common cancer in Norway, considering both genders. Surgical removal of the tumor is considered curative for most patients. One in four colorectal cancer patients (CRC) experience post-operative complications, with an equal proportion faced with cancer recurrence. Both with implications for quality-of-life, survival and health economy. Risk stratifying and improving CRC patients with poor health prior to surgery has been shown to

reduce complications post-operatively. Better utilization of registry and hospital data can provide clinicians iin pre-operative risk prior to surgery enabling prehabilitation and ensure that the patient is in an optimal shape, which reduces the risk of post-operative complications.
Florence is a collaboration between the Cancer Registry of Norway, Center for Surgical Science, Oslo University Hospital, Lund University, and Technical University of Denmark.

Methods
The OMOP Common Data Model, a generic method for standardising the structure and content of observational health data, will be used to harmonize registry data across data partners. Federated learning will be established using Vantage6 technology. The data is collected from the Cancer Registry of Norway and Norwegian Registry for gastrointestinal Surgery (Norgast).

Results
Data from ~30 000 colorectal cancer patients that has undergone surgery has been harmonized to OMOP. In parallel Vantage6 has been tested with synthetic data to set up the infrastructure needed for federated learning.

Conclusions
The project is underway to reach its aim to lay the foundation for a decision-support tool that can improve the treatment of colorectal cancer patients.

An Illustration to the Prediction of Breast Cancer High- risk Families Through a Swedish Registry Data

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Introduction:
Typically, models predicting the risk of breast cancer development incorporate subject-specific covariates known as the most significant risk factors as- sociated with the disease [1, 2]. To identify the highest-risk families more effectively, integrating family-specific frailty risk and covariates can help to elucidate the breast cancer dynamics and improve risk prediction accuracy.

Methods
We develop and compare three family-specific frailty risk models, where the frailty risk is latent and shared among the members, against three subject- specific family history models, inspired by the existing literature. Family history can be measured through the indicator (0/1) of having observed at least one breast cancer case in the family. In particular, we consider both Univariate and Multi-variate Lehmann Cure-Rate models. We validate the models through a simulation study. To illustrate our methods, we rely on the Multi-Generational Swedish Breast Cancer registry data. The area under

the ROC curve (AUC) and Harrell's Concor- dance index are used to assess the risk prediction accuracy.

Results

Among the six models, the Multivariate frailty model is the best in risk prediction accuracy: it coherently predicts the risk for the 96% of families, and accurately classifies the 95% of families when the top 5% is the highest-risk group.

Conclusions

The Multivariate frailty model emerges to be the best in both eluci- dating the breast cancer dynamics and increasing the accuracy in risk prediction.

Keywords: Breast cancer, Family history, Risk prediction, Survival analysis.

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Session 6: Surveillance and Survival from Cancer

Oral Presentations

Tumour Characteristics and Prognosis in Women with Breast Cancer Diagnosed during Pregnancy and Two Years after Delivery

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Introduction
We investigated whether women with breast cancer diagnosed during pregnancy (PrBC) or within two years of delivery (PPBC) have worse clinicopathologic features and survival than women diagnosed not near pregnancy.

Methods
A nationwide cohort of women diagnosed with invasive breast cancer 1992- 2018 at ages 18-44 years was identified in the Swedish Cancer Register with clinical data from Breast Cancer Quality Registers. Women with PrBC or PPBC were matched 1:2 by age and year to comparators diagnosed not near pregnancy. Clinicopathologic features including stage, grade, and surrogate subtypes were compared. Cox regression estimated hazard ratios (HR) with 95% confidence intervals (CI) for breast cancer mortality.

Results
A total of 1,430 women had PrBC and PPBC (181 during pregnancy, 499 during the 1st and 750 during the 2nd year after delivery). Women with PrBC or PPBC diagnosed in first year after delivery had a significantly higher proportion of luminal HER2 positive, HER2 positive and triple-negative tumours, and more advanced stage at diagnosis compared to comparators. Hazard ratios were increased in women diagnosed during pregnancy and within one year after delivery. After adjustment for age, year, parity, country of birth, hospital region, subtype and stage, only women diagnosed during the 2nd trimester had a worse prognosis (HR: 1.8, 95% CI 1.0-3.2).

Conclusions
The poorer survival in women with PrBC and PPBC is mainly driven by adverse tumour factors. However, the worse prognosis in women diagnosed in 2nd trimester could reflect difficulties to provide optimal treatment during ongoing pregnancy.

Urinary Tract Infections and Bladder Cancer Mortality in a Nationwide Cohort Study

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Background
Urinary tract infections (UTI), typically caused by bacterial invasion of the urinary tract, are among the most common bacterial infections in humans. Bladder cancer (BC) is the 10th most diagnosed cancer worldwide and, similar to UTIs, can manifest with haematuria, urgency, and dysuria. UTIs have previously been associated with the development of BC, but literature on the link with survival of bladder cancer patients is limited. Therefore, this study aims to investigate possible association between UTIs and bladder cancer specific mortality (BCSM).

Material and Method
For this retrospectively defined cohort study, we used prospectively collected data from Swedish population and health registers. Patients diagnosed with urothelial bladder cancer during 2006–2014 were identified from the Swedish Cancer Register (n = 16,669) and followed until 31 December 2015. Cox regression was used to evaluate the association of UTIs prior to cancer diagnosis, identified from the National Patient Register, with BCSM identified from the Cause of Death Register, while controlling for socio-demographic factors, tumour characteristics, and comorbidity.

Results
Overall, previous UTIs (n=2,354) were associated with higher BCSM rate in unadjusted [HR 2.08 (1.91- 2.26)] and adjusted models [HR 1.42 (1.30-1.55)]. Further, association were stronger for patients diagnosed with UTI more than once both within two years before BC diagnosis [HR 1.72 (1.45-2.05)] and over more than two years before BC diagnosis [HR 1.63 (1.34-1.99)].

Conclusion
UTIs were associated with higher BCSM, especially in patients with multiple UTIs prior to bladder cancer diagnosis.

Ovarian Cancer Survival by Histotype and Residual Disease Status after Surgery: Results from the Norwegian Clinical Registry for Gynecological Cancer

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Introduction
Ovarian cancer survival is known to be poorer when residual disease (RD) remains after cytoreductive surgery. Less is known about the prognostic effect of RD by histotype. Achieving < 1cm RD is often considered optimal debulking, with few studies evaluating other RD thresholds.

Methods

Using data from the Norwegian Clinical Registry for Gynecological Cancer, we studied 1849 women who underwent cytoreductive surgery for stage III-IV invasive epithelial ovarian cancer during 2013-2022. Using flexible parametric models, we compared excess mortality by histotype and RD. We predicted three-year relative survival across continuous RD diameter using restricted cubic splines.

Results
Across all histotypes, the excess hazard ratio (EHR) for RD versus no RD was 2.62 (95% confidence interval: 2.27–3.01). There was no significant heterogeneity by histotype, although the EHR for RD was greatest for mucinous (EHR=6.45; 1.79–23.25) and carcinosarcoma (EHR=3.43; 1.72– 6.87) histotypes. In finer categories of RD, women with 0.1–0.4 cm RD had 2-fold higher mortality risk (EHR=2.09; 1.63–2.68), and in all other categories, from 0.5–0.9 cm upwards, approximately 3- fold higher risk. Three-year relative survival did not vary significantly across continuous RD diameter for high-grade serous (p=0.72) or EOC overall (p=0.17). Non-high-grade serous histotypes had a tendency towards better survival with < 0.5 cm RD.

Conclusions
We did not observe any survival threshold around 1cm RD. Rather, our data suggested a threshold around < 0.5 cm for non-high-grade serous histotypes and no threshold for high-grade serous tumours. Achieving no residual disease gave the best survival outcomes.

Real World Survival for Patients with Advanced Non-small Cell Lung Cancer Treated with Pembrolizumab as Single Agent or in Combination with Chemotherapy

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Introduction
First line treatment of non-small cell lung cancer (NSCLC) with high PD-L1 expression (≥50%) involves immune checkpoint inhibitors (ICIs), as monotherapy or in combination with chemotherapy. However, the added benefit of chemotherapy in this context lacks direct comparison in head-to-head trials. We compared these two ICI treatment modalities overall and within relevant patient subgroups.

Methods

Our study comprised all advanced NSCLC patients initiating anti-cancer treatment in 2017-21 in Norway. Clinical characteristics and treatment information was retrieved from Norwegian health registries. We included individuals with adenocarcinoma, who received first line treatment with the ICI pembrolizumab as monotherapy (n=312) or in combination with chemotherapy (n=93). Overall survival (OS) was assessed using Cox regression. We studied early (6 month), and long-term survival adjusted for and stratified by sex, age, stage, PD-L1 expression, and performance status (PS).

Results
Median OS was longer (22.6 months) for patients treated with combination therapy versus monotherapy (14.2 months). Patients receiving combination therapy had a lower risk of early death than patients receiving monotherapy (HR=0.42, 95%CI=0.23-0.76). Combination therapy was particularly favorable in females, patients with PS 0-1 and patients with stage IVB disease; the benefits were strongest in the first 6 months after treatment initiation.

Conclusion
We observed improved or comparable survival for combination therapy over monotherapy in most clinical scenarios. This suggests a potential treatment advantage for ICI combination therapy in certain populations, however, it is important to further identify patient subgroups that do not respond to monotherapy and could benefit from the intensified combination treatment.

Survival Disparities in Colorectal Cancer: Investigating the Role of Stage at Diagnosis through Mediation Analysis

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Introduction
Colorectal cancer (CRC) survival varies across socioeconomic groups. However, although survival differences are well-documented, their underlying determinants remain unclear. We utilised mediation analysis into relative survival to investigate the role of stage at diagnosis in the survival differences between socioeconomic groups.

Methods
Data included all adults with a first-time diagnosis of colon or rectal cancers in Sweden between 2008 and 2021. Socioeconomic position was conceptualised using a household-based income indicator to allocate patients in income quartiles. By applying causal mediation analysis to the relative survival framework, we partitioned the total relative survival differences into that due to stage (indirect effect) and the remaining differences (direct effect). The analysis was done separately for colon and rectal cancers using flexible parametric models.

Results
For colon cancer, the absolute difference between the highest-income and lowest-income groups

remained above 5%. The equivalent differences were larger for rectal cancer and remained above 9%. Preliminary results show that stage at diagnosis explains only a small proportion of the total differences in relative survival between income groups for colon cancer. However, for rectal cancer, a large proportion of the total relative survival differences is driven by differences at the stage at diagnosis.

Conclusions
Understanding which factors drive cancer survival differences is important and it can lead to a reduction of inequalities by targeting the most affected groups with relevant interventions. For instance, if survival differences are driven by differences in stage at diagnosis, health policies could be implemented to encourage earlier detection in groups with worse survival.

Beta-blockers and Epithelial Ovarian Cancer Survival: A Norwegian Population-based Cohort Study

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Introduction
Cancer diagnosis and therapy may cause stress to the body. Preclinical studies have shown that stress hormones can promote cancer progression by interacting with β- adrenergic receptors, and that β-blockers can inhibit these effects and improve prognosis. We assessed if use of β-blockers was associated with survival in a large nationwide cohort of women with epithelial ovarian cancer (EOC).

Methods
All women aged ≥40 years who underwent surgery for EOC in 2004–2018 in Norway were identified through the Cancer Registry of Norway. Multivariable Cox models adjusted for several sociodemographic and health factors were used to estimate the hazard ratios (HRs) and 95% confidence intervals (CIs) for the association between peri-diagnostic use of β- blockers (≥1 filled prescription within four months prior to diagnosis) and survival. The difference in overall survival time by use of β-blockers was estimated as the difference in restricted mean survival time (RMST) at five years after diagnosis using flexible parametric survival models.

Results

A total of 2988 women with EOC were included. Starting at diagnosis, median follow- up was 3.6 years. Compared to no use, β-blocker use was associated with longer cause- specific survival (HR=0.83,95%CI:0.69–1.00) and overall survival (HR=0.84,95%CI:0.71– 0.99). On average, in the first five years after diagnosis, users of β-blocker lived 1.8 months longer than non-users (difference in RMST=1.8,95%CI:0.1–3.5). In an additional analysis, we evaluated the association between post-diagnostic use of β-blockers and survival, and we found similar results.

Conclusion
Use of β-blockers was associated with longer survival following a diagnosis of EOC.

Cancer Incidence and Stage During the COVID-19 Pandemic 2020 and 2021: A Nordic Study

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Introduction
The COVID-19 pandemic had profound impact on healthcare in the Nordic countries. We aimed to compare cancer incidence rates and stage during 2020 and 2021 to pre-pandemic rates.

Methods
We used quality assured cancer incidence data from national cancer registries in Denmark,

Finland, Iceland, Norway and Sweden from 2017 to 2021. Using Poisson regression, we estimated incidence rate ratios (IRR) with 95% confidence intervals (CI) in 2020 and 2021 compared to 2017-2019.

Results

Cancer incidence rates declined in all Nordic countries during the first pandemic wave (Q2 2020) ranging from -20.8% (Sweden) to -7.5% (Iceland), which was significant in all countries but Iceland. In Sweden, Denmark and Finland, cancer rates also declined in the second pandemic wave (Q1 2021), which was significant in Sweden (-7.0%, IRR: 0.93, 95% CI 0.91-0.95) and borderline significant in Finland (-2.8%, IRR: 0.97, 0.95-1.00) and Denmark (-2.6%, IRR: 0.97, 0.95-1.00). These associations remained after adjustment for age and sex. In 2020, annual breast cancer incidence rates declined across all countries except Iceland, especially for stage I breast cancer. Prostate cancer rates declined in Sweden and Finland, while melanoma declined in Finland and Iceland, colon cancer in Denmark and Iceland, and rectal cancer in Denmark and Sweden. During 2021, there was some indication of catch-up of the declines in 2020.

Conclusions

Cancer incidence rates declined in 2020-2021 across all Nordic countries, with the largest reductions in Sweden. The shift in breast cancer stage can likely be attributed to reduced screening activities and lower attendance.

Excess Mortality Among Cancer Patients Increased During Covid-19 in Nordic Countries

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Background
During initial phase of the Covid -19 pandemic, the number of reported cancer cases declined in all Nordic counties reflecting hesitancy to seek health care and a lowered diagnostic activity, potentially causing delays in in cancer diagnosis. All Nordic countries (Denmark, Finland, Iceland, Sweden and Norway) had some pandemic mitigating restrictions in place in 2020.

Methods
We compared one-year excess mortality (EM) among cancer patients diagnosed between March 2020 and December 2020 to that expected based on patients diagnosed in 2011-2019. We used flexible parametric relative survival models where EM was defined as the difference between total mortality in patients and that in the national population. We report percent change between the observed and expected EM of cancer patients and the difference in relative survival (RS) by country, age, sex and tumour site.

Results
Excess mortality of cancer patients increased during the pandemic in all Nordic countries except Iceland. The highest increase was among male patients in Sweden (12%; 95% CI 7%- 18%), corresponding to 1.5% reduction in one-year RS from 86.8% to 85.3%. Among women, the highest increase in EM was 11% in both Denmark (5%-17%) and Norway (4%- 18%), and RS was reduced by 1.4% from 85.4% to 84% and by 1.3% from 86.3% to 85.0%, respectively. In male patients aged 75 or older in Sweden the EM increased 13% (5%-21%). The most pronounced increase in site-specific EM was found for liver cancer with an increase of 9.7% (2.9%-16.6%) in Finnish men and 8.0% (2.2%-13.8%) in Swedish women.

Conclusion
We found higher excess mortality as well as decreased 1-year relative survival in Nordic cancer patients (except Iceland) diagnosed during the pandemic in 2020 which coincided with restrictions and potential delays in seeking healthcare.

Gleason Score Extraction for Predicting Survival of Prostate Cancer Patients

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Introduction
Regular expression-based extraction of Gleason scores (GSs) from pathology reports has been studied mostly in the context of simple manifestations in text such as 4+4=8. The method developed by Miettinen et al. extracts also complex GS manifestations with 93% recall and 98%

precision. We aim to present the use of the programme, coverage of GS and results in terms of GS specific survival among prostate cancer patients.

Methods
Pathology reports of new prostate cancers diagnosed between 2001 and 2021 (N 100729) were retrieved from the Finnish Cancer Registry. Gleason scores were extracted using the expression-based text mining programme. Five-year relative survival was estimated using Pohar Perme net survival and choosing the highest Gleason score within 4 months from diagnosis of prostate cancer among 31280 patients diagnosed in 2016-2021.

Results
In the beginning of the study period, we could extract Gleason scores only in a small proportion (20-30%) of cases. From year 2016 on at least one Gleason score was extracted in more than 85% of cases. We found that prostate cancers with Gleason 3+3 and 3+4 had the highest 5-year relative survival, both over 100%. Thereafter survival decreased according to increasing Gleason score-values, and the lowest survival was among Gleason 5+5 with 40.9%.

Conclusions
Gleason scores can be extracted based on full pathology report texts available from year 2015 on at the FCR. Based on relative survival, the Gleason scores indicate adequately the aggressiveness of prostate cancers and can be used as predictors of patient survival.

Posters

Income Disparities in Loss in Life Expectancy after Colon and Rectal Cancers: A Swedish Register-based Study

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Background
Differences in the prognosis after colorectal cancer (CRC) by socioeconomic position (SEP) have been reported previously, however, most studies focused on survival differences at a particular

time since diagnosis. The purpose of this study was to quantify the lifetime impact of CRC and its variation by SEP, using individualised income to conceptualise SEP.

Methods
Data included all adults with a first-time diagnosis of colon or rectal cancers in Sweden between 2008-2021. The analysis was done separately for colon and rectal cancers using flexible parametric survival models. For each cancer and income group, we estimated the life expectancy in the absence of cancer, the life expectancy in the presence of cancer, as well as the difference between these two, so-called loss in life expectancy (LLE).

Results
We found large income disparities in life expectancy after a cancer diagnosis, with more than 30% of their remaining life expectancy lost across all ages. Higher income resulted in more years lost. For example, 40-year-old females with colon cancer lost 17.64 years (i.e., 37% of their life) if in the highest and 13.68 years (i.e., 32%) if in the lowest income group. Rectal cancer resulted in higher LLE compared to colon cancer. Males lost a larger proportion of their lives.

Conclusion
Further research is required to improve our understanding of how the survival differences across SEP arise. Based on the number of colon and rectal cancer diagnoses in 2021, the number of years lost was in total 24,669 and 12,105 years, respectively.

Mind the Gap: Loss in Overall and Quality-adjusted Life Expectancy for Patients with Chronic Phase Chronic Myeloid Leukemia. Data from the Swedish CML Register

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Introduction
The introduction of tyrosine kinase inhibitors (TKIs) has considerably improved the life expectancy (LE) for chronic myeloid leukemia (CML) patients. Evaluating health-related quality of life within the treatment pathway remains crucial.

Methods
Using data from the Swedish CML register, we included 1,010 chronic phase (CP) CML adult patients diagnosed 2007 to 2017, with follow-up until 2018. We developed a multistate model to estimate the loss in LE (LLE) and loss in quality-adjusted life expectancy (LQALE) for the patient population compared to the general population, along with the respective proportions of losses relative to the general population.

Results
CP-CML patients of all studied ages and both sexes were consistently estimated to have reduced LE. Similar or larger losses were observed for QALE. The maximum LLE was 4.4 years (CP-CML LE: 27.4 years vs. general population LE: 31.8 years) for females diagnosed at age 55 years, with LQALE of 8.9 quality-adjusted life years (QALYs) (CP-CML QALE: 19.2 QALYs vs. general population QALE: 28.1 QALYs). Across all ages, the proportions of LLE ranged from 7% to 19%, and the proportions of LQALE were 29% to 37%.

Conclusions
Despite major therapeutic improvements in LE, our results show that there is still loss in LE and a substantial loss in QALE for CP-CML patients. Future treatment strategies will hopefully provide an avenue to improve patient outcomes.

Stage-specific Survival Among Men with Prostate Cancer in the Nordic Countries 2004-2016: The NORDCAN Survival Studies

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Introduction
Prostate cancer survival varies between the Nordic countries, potentially reflecting variation in the

distribution of stages at diagnosis. To highlight variation in diagnostic intensity of prostate cancer, we outlined the differences in stage distributions at diagnosis across the Nordic countries. Specifically, we evaluated whether the variation in cancer survival could be attributed to differences in stage at diagnosis.

Methods
In this population-based cohort study, we identified 243,893 men diagnosed with prostate cancer from 2004 to 2016 in Denmark, Iceland, Norway, and Sweden. Country-specific stage distributions at diagnosis were obtained from the NORDCAN survival database. Relative survival and 95% confidence intervals (CI) were estimated using the Pohar-Perme estimator. Stage-standardized relative survival was estimated by applying pre-weighting based on the stage distribution of the entire Nordic cohort.

Results
The stage distribution of prostate cancer varied between the Nordic countries with the highest proportion of early-stage (0-I) in Sweden and highest proportion of advanced-stage (IV) in Denmark. After adjusting for differences in stage distribution (i.e., stage-standardization), the 5-year relative survival improved in Denmark and Norway, increasing from 83.9% (95% CI, 83.2-84.6%) and 91.4% (95% CI, 90.8-92.0%) to 87.3 (95% CI, 86.5-88.2%) and 93.4% (95% CI, 92.8-94.1%), respectively. Conversely, the adjusted 5-year relative survival declined in Sweden from 90.6% (95% CI, 90.3-91.0%) to 88.5% (95% CI, 88.0-89.1%).

Conclusions
The observed variations in prostate cancer survival between the Nordic countries can be largely attributed to differences in stage distribution at diagnosis. This leaves only minor potential for other factors, e.g., therapeutic approaches, to explain the disparities.

Trends in Estrogen and Human Epidermal Growth Factor Receptor 2 in Breast Cancer Patients in Denmark

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Introduction

Subtyping is crucial in breast cancer treatment and has been done in Denmark for the estrogen receptor (ER) and human epidermal growth factor receptor 2 (HER2) in almost all patients since 1989 and 2007, respectively. However, trends in combined ER and HER2 status remain unknown in Denmark.

Methods
We collected data on all Danish women diagnosed with breast cancer between 2000 and 2022 from the Danish Breast Cancer Group (DBCG) database, including age at diagnosis, ER and HER2

status, tumor size, tumor grade, lymph node status, and menopause status. We calculated the crude incidence rate for 10-year age groups and 10-year birth cohorts.

Results
Due to the incomplete registration of HER2, we shortened the period from 2010 to 2022. About 58,000 women had breast cancer, divided on receptor status: 73.7% ER+/HER2-, 8.8% ER+/HER2+, 4.4% ER-/HER2+, 10.4% ER-/HER2-, and 2.6% unknown. The incidence of breast cancer was increasing in the 80+ group, driven by an increase in the ER+/HER2- subtype and, primarily, in patients who only had a biopsy. The incidence was stable in the age groups under 50 with regard to the different subtypes.

Conclusions
The incidence of breast cancer in women over 80 is increasing, which might be due to more healthy elders and better treatment options. The ER+/HER2- subtype is driving the increase. In patients under 50, the incidence and subtypes remain stable.

Screening Among Breast Cancer Survivors

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Background
Currently breast cancer survivors are invited to mammography screening shortly after end of treatment, even though, there is no evidence on how much mammography screening reduces breast cancer survivors' risk of dying from breast cancer. The aim of this study is to estimate how much mammography screening reduced breast cancer mortality among breast cancer survivors.

Methods
We used historical data, from a period where mammography screening was not nationwide, enabling comparison of invited survivors in Funen (study group) with non-invited survivors in other regions (control group). In this historical period, breast cancer survivors was invited to mammography screening 5-10 years after their diagnosis. The control population was given pseudo-invitation dates following the distribution of the study population invitation dates.

Results

The study and control groups comprise 1929 invited breast cancer survivors and 15,692 non-invited survivors, respectively. Of those, 369 died from breast cancer after the first invitation to screening and 3566 after the first pseudo-invitation date. Hazard ratio for invited versus not invited was 0.89 (95%CI: 0.80-1). The relative risk among women actually participating in mammography screening was 0.56 (95%CI: 0.35-0.77).

Conclusions
Our study shows that breast cancer survivors reduce their risk of dying from breast cancer significantly by participating in mammography screening 5-10 years after their diagnosis.

Esophageal and Gastric Cancer Incidence and Mortality Trends in Norway

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Introduction
Esophageal and gastric cancer accounts for nearly 1.5 million new cases and 1.1 million deaths annually worldwide. The incidence of these cancers is rising rapidly in western populations but varies between morphological types. Here we aim to provide national trends in incidence and mortality of esophageal and gastric cancers in Norway, separately for adenocarcinoma (AC) and squamous cell carcinoma (SCC).

Methods
We extracted information about all esophageal (C15) and gastric cancer (C16) patients diagnosed 1971–2022 from the Cancer Registry of Norway. We calculated age-standardized (European standard population) rates and performed a join-point regression analysis to examine trends in incidence and mortality. Changing trends were measured by annual percent change and weighted average APC over the study period. Separate analyses were conducted by sex, age group, stage at diagnosis, and diagnosis periods.

Results

During 1971–2022, the incidence of esophageal AC cancer increased, whereas the SCC incidence had a decreasing trend, although trends differed between sex and age groups. The highest incidence and mortality rates and most pronounced rate increase over time were seen in men and ages ≥70 years. In contrast, the incidence and mortality of gastric AC cancer decreased after 1985, although upper gastric AC cancer (C16.0-C16-4) showed a different pattern with an increase in trends from 1985-2005, followed by a flatening trend.

Conclusion: The incidence and mortality of esophageal and upper gastric cancer have increased in Norway, due to an increase in AC histological type. The trends are most pronounced in men and older ages.

Progress Against Lung Cancer, Denmark, 2008-2022

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Introduction
There has been marked progress against lung cancer in Denmark. To gain further insight into the different aspects of the improvement, we examined the stage specific incidence rates, stage specific survival, and mortality rates.

Methods
We used information from the Danish Lung Cancer Registry on date of diagnosis and clinical stage to calculate age-standardised incidence rates and patient survival by sex, period and stage. Information about age-standardised lung cancer specific mortality rates by sex and period was extracted from The Danish Health Data Authority.

Results
The decrease in incidence rates was due to reduction in the rates of advanced stages. Secondly there was a gradual increase in survival across all stages and thirdly the mortality rates gradually decreased over time.

Conclusion
The improvements in survival and mortality from lung cancer was due to decreasing incidence rates of advanced cancer and improvement in survival at all stages of the disease.
Keywords: stage; incidence; survival, mortality.