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The 29th Norwegian Conference on Epidemiology
Modern epidemiology, methods, and education
Trondheim, 15th-16th November 2023

The Norwegian Epidemiological Association (NOFE), and the local organizing committee for the NOFE 2023 conference warmly welcomes you to Trondheim and the 29th NOFE conference.

Over two days, this conference will cover the topics "Modern epidemiology, methods and education" with plenary sessions and panel discussions. A big thank you to Matthew Fox (Boston University), Marko Lukic, PhD (UiT), Prof. Anne Kjersti Daltveit (UiB), Prof. Tone Kristin Omsland (UiO), Prof. Geir Aamodt (NMBU), Prof. Johan Håkon Bjørngaard (NTNU), Børge Lillebo (NTNU) and Melanie Rae Simpson (NTNU) for your contributions.

In addition, nearly 70 participants will present abstracts of the most recent research in a variety of epidemiological fields in parallel and poster presentations. Dear presenters, thank you for completing the conference program by updating us on modern research, and to moderators, for facilitating fruitful discussions.

Our aim is that all participants at the conference gain a greater understanding of epidemiology methods and education, insight into new research and find cooperative opportunities.

Enjoy the conference!

The NOFE Board
&
The organizing committee for the NOFE 2023 conference

Kristin Hestmann Vinjerui, Anne Lovise Nordstoga, Eivind Schjelderup Skarpsno, Lin Jiang, Mats Flaaten and Kirsti Wahlberg

The 29th Norwegian Conference on Epidemiology
Trondheim, 15th-16th November 2023

Abstracts

A: Epidemiological methods

A1

Causal modelling of long term outcomes following compulsory inpatient and outpatient mental health care using Norwegian registry data: presentation of a Controversies in Psychiatry research project

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Introduction: Compulsory mental health care remains a controversial practice. The many difficulties in performing randomised controlled trials on the topic means there is limited evidence to support its effectiveness. For ethical and legal reasons, compulsory mental health care should only be used when necessary. Yet, geographical variations, which can indicate both overuse and underuse, have been documented.

Aims: To address the question whether compulsory mental health care results in superior, worse or equivalent outcomes for patients, this project will use registry-based longitudinal data to examine the effect of compulsory inpatient and outpatient care on multiple outcomes, including suicide and overall mortality; emergency care/injuries; crime and victimisation; and participation in the labour force and welfare dependency.

Methods: We will obtain data from nine registries for the period 2010-2025 on all persons in contact with specialist mental health or addiction services in Norway in 2015–2016, and an equally sized group from the general population (N ≈ 600 000). By using the natural variation in health providers' preference for compulsory care as a source of quasi-randomisation we will estimate causal effects of compulsory care on short- and long-term trajectories.

Conclusions: This project will provide valuable insights for service providers and policy makers in facilitating high quality clinical care pathways for a high-risk population group.

A2

Constrained longitudinal analysis of repeated measurements in an RCT: How to handle subgroups

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In a randomized controlled trial (RCT) with measurements of the outcome variable at baseline and one or more later time points, a linear mixed effects regression model can be suited. In general, including a strong predictor of the outcome in an RCT as a covariate can improve substantially the precision of the estimated treatment effect. The baseline value of the outcome variable is usually a strong predictor of the outcome at a later time point. In an RCT with repeated measurements, this can be handled by including the baseline value as part of the outcome variable in a linear mixed model, and excluding a main effect of the treatment variable at baseline, rather than including the baseline as a covariate. Many researchers are not aware of this. For example, if the outcome variable is measured at time 0 and two later time points, it is modelled as

$$Y_{ij} = \beta_0 + \beta_1 t_1 + \beta_2 t_2 + \beta_3 t_1 x + \beta_4 t_2 x + A_j + \varepsilon_{ij},$$

where t_i is an indicator variable equal to 1 at time i, x is an indicator for the treatment group, A_j is the random effect of participant j, and ε_{ij} is the residual term. We assume that the baseline measurement was done before, or blinded for, randomization, so we can assume that there are no systematic differences between the groups at baseline. This way of handling the baseline value is called constrained longitudinal analysis by Coffman et al. (*BMJ Open* 2016, e013096).

In an RCT, it may be relevant perform a moderation analysis to investigate whether certain subgroups of patients have more benefit of the treatment than others. In a constrained longitudinal analysis, this can be handled by including the three-way interaction between treatment, time and subgroup, while excluding the two way interaction between subgroup and treatment at baseline. This approach will be illustrated in a secondary analysis of a large RCT.

A3

The influence of body mass index (BMI) on the risk of long-term sick leave using offspring BMI as an instrumental variable

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Aims: Examine the causal effect of BMI on the risk of cause-specific and all-cause long-term sick leave. To address reverse causality, we i) explored if BMI in offspring is a suitable instrument for parental BMI and ii) examined the causal effect of BMI on the risk of cause-specific and all-cause long-term sick leave, using offspring as instrument.

Methods: The analyses were based on a total of 16,945 parent-offspring pairs from HUNT3, HUNT4, YoungHUNT3 and YoungHUNT4. BMI were transformed into standard deviation scores (SDS) of BMI specific to age, sex, and HUNT wave. We used registry data from the Norwegian Labour and Welfare Administration on cause-specific sick leave, including musculoskeletal and mental disorders. Conventional estimates for parental risk of long-term sick leave per SDS of own BMI and offspring BMI were estimated separately, expressed as the hazard ratio (HR) using Cox regression with parental age as the time axis. The average causal effect of BMI on sick leave in the parents was estimated using the instrumental variable ratio method, with offspring BMI as an instrument for parental BMI.

Results: We will present results from conventional estimates between parental BMI and risk of both cause-specific and all-cause sick leave, associations between offspring BMI and parental sick leave, and results from instrumental variable analyses.

A4

Estimating causal effects of treatment strategies on multi-state outcome processes: with application to opioid use after traumatic injury

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Many research questions concern the treatment effects of exposures on outcomes best described as a multi-state process. For example, one can be interested in the effects of opioid saving strategies, such as the use non-steroidal anti-inflammatory drugs (NSAIDs) on long-term opioid prescriptions, under competing risk from other events in physical trauma patients after discharge from the hospital. Many standard problems can be studied in a multi-state model framework, such as time-to-first-event, recurrent events, and competing events, and several statistical estimands have been suggested. However, the causal interpretations of these estimands, and the conditions that are required for identification, have yet to be fully formalized. Here we use a formal framework for causal inference to formulate several causal estimands in settings where the outcome of interest can be represented by a discrete-time multi-state process. We formulate the necessary conditions and give detailed proofs for the identification of these estimates under a number of different interventions. We use causal directed acyclic graphs and single-world intervention graphs to illustrate necessary identification conditions. Finally, we use proposed estimators based on inverse probability of censoring weighting and the g-formula to compute and compare the effect of different treatment strategies based on NSAID use on opioid prescriptions after traumatic injury in an application to observational data from the Norwegian Trauma Registry and other linked population-wide health registries.

A5

Investigating the relationship of serum 25-hydroxyvitamin D with blood pressure and hypertension risk in The HUNT Study: Using traditional observational and Mendelian randomization approaches

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Background: Traditional observational studies suggested inverse relationship between vitamin D levels and systolic blood pressure (SBP), diastolic blood pressure (DBP) or hypertension risk. Mendelian randomization (MR) analysis using genetic variants as instruments for vitamin D levels may clarify the nature of the associations.

Aims: To study the potential causal associations between serum 25-hydroxyvitamin D (25(OH)D) levels and SBP, DBP or hypertension using observational and MR approaches in the Trøndelag Health (HUNT) Study.

Methods: We investigated the cross-sectional relationship between serum (25(OH)D) and blood pressure or hypertension among a random sample of the HUNT2 population (n=5854, mean age=49.3 years). We also assessed their prospective relationships among 3592 participants of the random sample who were followed up from HUNT2 to HUNT3 over 11 years. We further performed a one-sample MR study with 86,324 participants in the HUNT Study. An externally weighted genetic risk score based on 19 serum 25(OH)D-associated genetic variants was used as instrument and a two-stage method was applied to evaluate potential causal associations. In addition, we conducted two-sample MR analyses using publicly available data.

Results: In the cross-sectional analyses, a 25 nmol/L increase in serum 25(OH)D was associated with a 1.73 mmHg decrease in SBP (95 % CI -2.46 to -1.01), a 0.91 mmHg decrease in DBP (95% CI -1.35 to -0.47) and 19% lower prevalence of hypertension (odds ratio 0.81, 95% CI 0.74 to 0.90) after adjusting for potential confounders. However, all the associations disappeared in the prospective analyses. The MR estimates, corresponding to a 25 nmol/L increase in 25(OH)D, were -0.11 mmHg (95% CI -0.86 to 0.63) for SBP, 0.04 mmHg (95% CI -0.42 to 0.50) for DBP and odds ratio 1.04 (95% CI 0.94 to 1.15) for hypertension. The results obtained from summary data methods in HUNT and two-sample MR approach supported our findings from the one-sample MR analysis.

Conclusions: Our study showed no evidence for a causal association between serum 25(OH)D levels and blood pressure or risk of hypertension.

B: Infection epidemiology and clinical dental epidemiology

B1

The distribution of HPV genotypes in cervical cancer and high-grade precancerous lesions at pre-vaccine baseline in Norway

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Introduction: Human Papillomavirus (HPV) causes almost all cervical cancers and precancerous lesions. In Norway, the HPV vaccine has been offered free of charge to all 12-year-old girls since 2009. Since 2017, archived tissue samples from all women with cervical cancer, and a subset of high-grade precancerous lesions, are HPV genotyped at the Norwegian HPV reference laboratory at Akershus University Hospital as part of the national surveillance programme for HPV vaccine, run by the Norwegian Institute of Public Health.

Aims: To describe the HPV genotype distribution in cervical cancer and precancerous lesions in Norway among mostly unvaccinated women.

Methods: Information regarding HPV-positive samples are registered in the Norwegian Surveillance System for Communicable Diseases. We analysed data on women with cervical cancer and high-grade precancerous lesions in the years 2017-2020. Data contained PCR test results on 37 HPV genotypes, as well as morphology and age. Morphology was classified as cervical intraepithelial neoplasia grade 2 or 3 (CIN2/3), adenocarcinoma in situ (ACIS) or invasive cervical cancer (ICC). We calculated the prevalence of positive results for each HPV genotype.

Results: 2505 CIN2/3 cases, 599 ACIS cases and 1082 ICC cases were tested for HPV. HPV-16 and/or HPV-18 were detected in 49% of CIN2/3 cases, 81% of ACIS cases and 70% of ICC cases. The 8 most common types found in ICC (in descending order) were: HPV-16 (52%), -18 (18%), -45 (6%), -33 (5%), -31 (4%), -52 (2%), -73 (1%) and -39 (1%). The 8 most common types found in ACIS were: HPV-18 (51%), -16 (36%), -31 (8%), -45 (6%), -52 (2%), -51 (2%), -33 (2%) and -39 (1%). The 8 most prevalent types found in CIN2/3 were: HPV-16 (41%), -31 (18%), -33 (10%), -18 (9%), -52 (8%), -58 (5%), -45 (4%) and -51 (4%). Infections with more than one HPV genotype were more common in CIN2/3 (19%) and ACIS (19%) compared to ICC (4%).

Conclusions: We present for the first time, a nationwide overview of HPV genotypes in cancerous and high-grade precancerous cervical lesions in Norway. The systematic surveillance of HPV genotypes in cervical lesions will substantiate vaccine policy and facilitate post-vaccination monitoring.

B2

Sepsis incidence, case fatality and trends in Norway from 2008 through 2021

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Introduction: Sepsis is caused by a dysregulated host immune response to infection. While most studies report an increasing incidence in the last decades, the recent Global of Disease Study reports a 37% reduction from 1990 to 2017.

Aims: To estimate temporal trends in incidence rate (IR) and case fatality during from 2008 to 2021, and to assess possible shifts in these trends during the COVID-19 pandemic.

Methods: All Norwegian hospitals 2008–2021. Patients ≥18 year with a International Classification of Diseases 10th revision code for sepsis retrieved from The Norwegian Patient Registry. Annual age-standardized IRs with 95% CIs. Poisson regression was used to estimate changes in IRs across time, and logistic regression was used to estimate ORs for in-hospital death.

Results: Among 12.619.803 adult hospitalizations, a total of 317.705 (2.5%) hospitalizations in 222.832 (70.0%) unique patients met the sepsis criteria. The overall age-standardized IR of a first sepsis admission was 246/100 000 (95% CI 245 to 247), whereas the age-standardized IR of all sepsis admissions was 352/100 000 (95% CI 351 to 354). In the period 2009–2019, the annual IR for a first sepsis episode was stable (IR ratio (IRR) per year, 0.999; 95% CI 0.994 to 1.004), whereas for recurrent sepsis the IR increased (annual IRR, 1.048; 95% CI 1.037 to 1.059). During the COVID-19 pandemic, the IRR for a first sepsis was 0.877 (95% CI 0.829 to 0.927) in 2020 and 0.929 (95% CI 0.870 to 0.992) in 2021, and for all sepsis it was 0.870 (95% CI 0.810 to 0.935) in 2020 and 0.908 (95% CI 0.840 to 0.980) in 2021, compared with the previous 11-year period. Case fatality among first sepsis admissions declined in the period 2009–2019 (annual OR 0.954 (95% CI 0.950 to 0.958)), whereas case fatality increased during the COVID-19 pandemic in 2020 (OR 1.061 (95% CI 1.001 to 1.124) and in 2021 (OR 1.164 (95% CI 1.098 to 1.233)).

Conclusions: The overall IR of sepsis increased from 2009 to 2019, due to an increasing IR of recurrent sepsis, and indicates that sepsis awareness with updated guidelines and education must continue.

B3

Association of the immune system activation markers kynurenine-to-tryptophan ratio (KTR) and neopterin with periodontitis

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Introduction: Tryptophan degradation to kynurenine (as measured by the kynurenine-to-tryptophan ratio, KTR) and neopterin in serum/plasma are established markers of immune system activation. Higher levels of these biomarkers correlate with incidence and severity of various diseases, including CVD and cancer. Periodontitis is a chronic multifactorial inflammatory disease of the tissues supporting the tooth, affecting 20-50% of the global adult population. A few studies have demonstrated an association between these biomarkers and periodontitis. However, they were cross-sectional in design, including a few participants and/or were not adjusted for factors that influence periodontitis.

Aims: We aimed at exploring the potential association between plasma levels of Neopterin and KTR and periodontitis status measured about 20 years later among community-dwelling adults residing in Hordaland County, Norway.

Methods: This study included 1298 individuals born in 1950-1951. KTR and neopterin were measured in their blood samples during participation in the Hordaland Health Study, 1997-1999 (HUSK 2). Periodontal status (classified in the analyses as 'no', 'mild', 'moderate' or 'severe' periodontitis) was evaluated as part of a comprehensive oral health examination during participation in HUSK-Tannhelse, 2020-2022. The association between biomarkers and periodontitis was explored using ordered logistic regression analyses, adjusted for age, sex, education, BMI, smoking, and diabetes. We conducted two sets of analyses; i) with biomarker categories (in quartiles) and ii) for one SD increase in the log-transformed values as continuous variable and reported odds ratios (OR) and corresponding 95% confidence intervals (CI).

Results: KTR: Compared to the 1st quartile, the 2nd (OR=1.48; 95% CI: 1.04–2.10) and 3rd (OR=1.73; 95% CI: 1.22–2.47) quartiles showed higher odds of periodontitis while the odds among individuals in the 4th quartile were not statistically significantly different (OR=1.34; 95% CI:0.94–1.91). Neopterin: We observed no statistically significant differences in the odds of periodontitis associated with 2nd (OR=0.98; 95%CI: 0.69–1.39), 3rd (OR=1.04; 95% CI: 0.73–1.47), or 4th (OR=1.19; 95%CI: 0.84–1.69) quartile of neopterin compared to the 1st quartile.

Conclusion: The association between KTR and periodontitis displayed a dose-dependent, inverted U-shape, while we observed no association between neopterin levels and periodontitis.

B4

Are oral anaerobic bacteria a causal factor in both cardiovascular disease and certain cancers?

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Introduction: We have shown in our research in the Oslo II study of 12 ½ years and 17 ½ years follow-up that low levels of antibodies to the oral anaerobic bacteria *Tannerella forsythia* predicts both cardiovascular disease mortality (CVD) and bladder cancer incidence, and *Treponema denticola* predicts colon and bladder cancer incidence.

Aim: To discuss the association between oral health, CVD and cancer.

Methods: This literature review presents observational, microbiological, and pathological findings, and oral health conditions linked to CVD and cancer incidence.

Results: Oral anaerobic bacteria break down periodontal tissue and alveolar bone in the oral cavity, which gives the bacteria access to the circulation and the potential to spread throughout the body. The immune system handles them to varying degrees. Oral health has been measured in studies by the number of tooth extractions, chronic periodontitis, caries, and immunological analyses of the level of antibodies to oral bacteria. Pathological findings have been bacterial DNA identified in coronary artery cells, coronary artery walls, atheroma, and calcific heart valves. With regard to cancer, these bacteria have been identified in cancer specimens. Whether this is a random finding is not entirely clear. Registry studies have shown that there is an increased occurrence of CVD and cancer before or after these disease events in a number of people. These observations are in accordance with our findings on oral anaerobic bacteria.

Conclusions: Much research of varying evidence levels such as prospective cohorts, cross-sectional studies, case-cohort studies and randomized controlled trials have shown results of association and cause between oral infections to CVD and cancer.

C: Reproductive epidemiology

C1

Sex hormones and risk of lung and colorectal cancers in women: a two-sample Mendelian randomization study

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Background: The roles of sex hormones such as estradiol, testosterone, and sex hormone-binding globulin (SHBG) in the etiology of lung and colorectal cancers, among the most common cancers in women after breast cancer, are unclear.

Objective: This two-sample Mendelian randomization (MR) study evaluated potential causal associations of endogenous estradiol, testosterone and SHBG with risk of lung and colorectal cancers in women of European ancestry: in the Trøndelag Health (HUNT) Study in Norway, the International Lung Cancer Consortium (ILCCO) and FinnGen, respectively.

Methods: From publicly available data of genome-wide association studies (GWASs) on sex hormones, we derived genetic instruments specific to women for endogenous estradiol, bioavailable testosterone, total testosterone and SHBG. Summary statistics for the associations of sex hormones variants with lung and colorectal cancers were generated in 36,631 women from the HUNT Study. We performed additional MR analyses using the associations in the ILCCO and FinnGen data.

Results: There was suggestive evidence of genetically predicted 1-standard deviation increase in total testosterone levels being associated with a lower risk of lung non-adenocarcinoma (hazard ratio (HR) 0.60, 95% CI 0.37–0.98) in the HUNT Study. However, this was not confirmed by using data from the ILCCO. Genetic predisposition to estradiol levels, bioavailable testosterone levels and SHBG levels were not associated with lung or colorectal cancer.

Conclusion: We did not find convincing evidence to support a causal role of sex hormones on risk of lung and colorectal cancers in women of European ancestry.

C2

Pregnancies and Childbirths in Norwegian Military Women

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Introduction: There is a paucity of knowledge on how military exposures could potentially affect women's reproductive health. In Norway, women have been allowed to work in the military since 1976. Since 2015, all women born after 1 January 1997 are mandated by law to participate in military screening and must attend military service if the Armed Forces so requires. In 2021, one third of all soldiers in first-time military service and 13 % of the Armed Forces military staff, were women. As an increasing number of women seek military careers, the need to conduct studies to examine potential effects on reproductive health increases.

Aims: The Norwegian Armed Forces Health Registry (NAFHR) aims to evaluate potential effects of military exposures on women's reproductive health.

Methods: Using the NAFHR, we have identified military women born 1950-2004 who have served as active duty personnel or conducted first-time military service. Data was linked to the Medical Birth Registry of Norway (MBRN) by the women's unique, 11-digit personal identification number. Women who attended military screening but did not do military service and civilian women who are registered in the MBRN but not registered in the NAFHR will be used as controls. Specifically, we will look into whether military women experienced different perinatal outcomes compared to their peers, including preeclampsia, gestational diabetes mellitus, congenital malformations, birthweights and gestational lengths.

Results: The cohort consists of 78,872 women: 35,873 military women and 42,999 women who were screened for military service but have not (yet) served. A total of 22,418 were registered in the MBRN having 41,109 records, indicating pregnancies lasting 12 or more weeks.

Conclusions: This work will document maternal pregnancy and infant outcomes among all military women in Norway born between 1950 and 2004. The planned studies will answer a range of questions about reproductive health in military women and provide knowledge about whether or not military service is associated with increased risks for selected adverse outcomes related to pregnancy and childbirths.

C3

Grand-grand parity and hormone dependent cancers

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Introduction: For decades the cancers of breast, ovary and endometrium in women have been related to fertility and named hormone dependent cancers. Today, most cohort studies have few women with many children due to the low fertility in most western countries since the depression in the 1930-ies. By using historical data from the Norwegian 1960 Census the analyses have reasonable statistical power for analyses of grand-grand parity within the same study.

Aim: To study the curvilinear relationships between parity and incidence of cancer in the breast, ovary and endometrium with focus on women with 10 or more children.

Material: The 1960 Census in Norway was used for the creation of unique personal identifier or birth number. All persons were interviewed by civil servants at home giving information on number of children in the current marriage. Information on parity was linked to information on time of death and time of diagnosis of one of the three hormone dependent cancers. The study comprised 385 816 women with 16 095 breast, 3 827 ovarian and 3 834 endometrial cancers. Logit models were used for estimating the curvilinear shape of the relationship between parity and incidence.

Results: There was no relationship between age-specific mortality rates and parity (not shown). Figure 1illustrates the observed rates for each cancer site from 1 till 15 children. The estimated curves are shown for all three cancers. In a logit model the reduction in probability was 10.5% for breast cancer, 13.3% for ovarian cancer and 10.9% for endometrial cancer with only minor changes in higher order effects (figures). Similar analyses for the non-hormonal cervical cancer showed no effect of parity (not shown).

Discussion: We have shown that the protective effect of pregnancies has a linear relationship for all the three hormone dependent cancers extended to around 15 children. The biology for explaining the similarities of the curves is challenging.

C4

Association between number of births, age at first birth and atrial fibrillation: the HUNT Study

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Introduction: Parity and age at first birth are well-established risk factors for maternal cardiovascular disease (CVD), but less is known about the associations of these factors with risk for atrial fibrillation (AF).

Aims: To study the associations of parity and age at first birth with risk of AF.

Methods: We linked information from the Norwegian HUNT Study, the Medical Birth Registry of Norway and validated hospital records for 23,830 women who were ≥45 years of age. Using Cox-proportional hazards regression, we calculated adjusted hazard ratios (HR) and 95% confidence intervals (95% CI) for the associations between parity, age at first birth and AF. We adjusted education status, smoking ever, and height for age at first birth, and additionally adjusted surgical menopause, and oral contraceptive use for parity.

Results: A total of 21,693 parous and 2,137 nulliparous women were followed for a median of 12.8 years and 1,437 (6.0%) participants developed AF. Compared with women with 2 births, women with ≥4 births had a 21% higher rate of AF (HR 1.21, 95% CI 1.06-1.39). Among parous women, younger age at first birth (< 20 years) was associated with a higher rate of AF compared with women 20-29 years old at first birth (HR 1.20, 95% CI 1.03-1.40).

Conclusions: Higher parity and younger age at first birth were associated with higher rate of AF.

C5

Perinatal mortality among pregnant undocumented migrants in Norway 1999-2020: a register-based population study

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Introduction: Irregular legal status (i.e. being undocumented) have consequences for migrants' access to and use of primary and antenatal care, which could affect health outcomes. Difficult living conditions and substandard care may in particular have serious consequences for pregnant women and their offspring's health. The risk of perinatal mortality among migrants with regular legal status (documented migrants) compared to Norwegian born residents (non-migrants) varies, depending on country of origin. However, undocumented migrants are usually not included in health surveys, which means that their risk of perinatal mortality is unknown. Using population register data from the Medical Birth Registry of Norway (MBRN) and comparing perinatal outcomes by legal status could help in determining the impact of pre- and post-migration factors on perinatal outcomes.

Aims: To compare perinatal outcomes in pregnant undocumented migrants to documented migrants and non-migrants using data from MBRN.

Methods: All women 18-49 years of age who gave singleton births registered in the MBRN during 1999-2020 were included. Women were categorized into groups based on whether they had a Norwegian identity number, and whether they were born in Norway or not. The main outcome was perinatal death; death of a fetus or neonate being alive at the start of gestational week 22 up to seven days after birth. We used log-binominal regression to estimate associations between legal status and perinatal mortality. Direct standardization was used to adjust for maternal region of birth.

Results: We found 5856 undocumented migrant women giving birth over the study period representing 0.5% of all births in Norway in this period. Undocumented migrants had a 6 times higher risk of perinatal death compared to non-migrants: relative risk (RR) 6.17 (95% CI 5.29−7.20). When comparing to documented migrants the RR was 4.17 (95% CI 3.51–4.93) of perinatal death. Undocumented migrants also had an increased risk of preterm birth, RR of 1.53 (95% CI 1.40−1.68) compared to non-migrants and RR 1.47 (95% CI 1.33−1.62) compared to documented migrants.

Conclusions: Undocumented migrants had a much higher risk of perinatal mortality compared to both non-migrants and documented migrants.

D: Pharmacoepidemiology

D1

Prenatal antidepressant trajectories and progression of clinical stages in the development of non-psychotic mental disorders in the offspring

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Introduction: Whether different intensity of antidepressant exposure during pregnancy negatively affects offspring risk for developing non-psychotic mental disorders such as depression, anxiety or eating disorders, remains unknown.

Aims: To determine the association between prenatal antidepressant trajectories and offspring risk for being diagnosed with unipolar depression, anxiety, eating disorders, of for filling antidepressant prescriptions up to adolescence. The study also aims to assess transitions probabilities across these clinical stages according to prenatal antidepressant exposure.

Methods: We used data from the Norwegian Mother, Father and Child Cohort Study (MoBa) linked to the Medical Birth Registry of Norway, the Patient Registry, the Drug Register of Norway, and the MoBaGenetics. We included 6,934 pregnancy-child dyads within women with pre-pregnancy depression, anxiety, and/or eating disorders. We clustered prenatal antidepressant exposure using K-means methods, using weekly intervals of exposure assessment during pregnancy (42 periods). We fitted modified Poisson and multi-state Cox regression modelling to compute relative risks (RR) and hazard ratios (HR). Measured confounding was taken into account using the overlap Weighting based on the propensity score.

Results: The population included 5,939 pregnancies unexposed to antidepressant before and during pregnancy, and four antidepressant trajectories: Discontinuers before pregnancy (n=190), Early discontinuers in pregnancy (n=269), Late discontinuers in pregnancy (n=419), and Continuers throughout pregnancy (n=117). After accounting for measured confounding, children born to late discontinuers had a small increased risk for anxiety disorders (weighted RR: 1.59, 95% CI: 1.20-2.11) than unexposed. This risk was not evident when discontinuers before pregnancy acted as comparator. Children born to women continuing antidepressant throughout pregnancy did not present an elevated risk for all investigated outcomes compared to discontinuers.

Conclusion: In a population of children born to mothers with pre-pregnancy mental illness, different intensity of antidepressant exposure during pregnancy was not associated with substantial increased risk for childhood non-psychotic mental disorders.

D2

Drug-wide prospective study associates thirty-one drug classes with the risk of Parkinson's disease

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Introduction: Parkinson's disease (PD) is a common neurodegenerative disorder among older people. The existing treatment options affect only specific symptoms but cannot slow down or reverse the disease progression. This is partly due to a long prodromal period of PD, up to 15 years, when the diagnosis cannot be stated but the degeneration of the brain already started. Observing which drugs PD patients take before being diagnosed and contrasting that with the use of drugs in controls can help identify this disease earlier.

Aims: To identify drugs that can: (i) be repurposed as new treatment for PD, and (ii) give new insight into the disease pathogenesis.

Methods: We used the entire Norwegian Prescription Database (NorPD) with >600 mill prescriptions collected by any Norwegian citizen during 2004-2019. The prescriptions were grouped by the ATC code level 2 (therapeutic subgroup) and investigated separately for association with PD diagnosis. We used Cox regression with time-varying exposure, age as the time scale, and adjusted for sex and education. We report hazard ratios (HR) and 95% confidence intervals (CI). Additionally, we conducted sensitivity analyses for exposure definition, as well as time-lagged and dose-response analyses.

Results: We identified thirty-one drug groups associated with risk change of developing PD, where 10 drug classes were linked to lower risk, while 21 drug classes – to higher risk. Specifically, we found lower risk of developing PD after the use of renin-angiotensin system drugs (HR = 0.92, 95% CI: 0.89–0.95), corticosteroids for systemic use (HR = 0.88, 95% CI: 0.84–0.93), vaccines (HR = 0.89, 95% CI: 0.82–0.96), and antibacterials for systemic use (HR = 0.95, 95% CI: 0.92–0.98). These associations, apart from vaccines, remained significant even when shifting the PD diagnosis date up to 10 years back, as well as when considering increasing dose.

Conclusions: Our hypothesis-free search revealed associations between use of many drugs and change in risk of PD. This can be used to identify potential patients earlier, giving them better chance to slow down disease. Moreover, the drugs linked to lower risk of PD can be good candidates for repurposing as new treatment options.

D3

The medication-based Rx-Risk Comorbidity Index and risk of hip fracture. A nationwide NOREPOS cohort study

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Introduction: A wide range of medical conditions are associated with an increased hip fracture risk. However, few previous studies have assessed overall morbidity at the individual level with respect to future risk of hip fracture.

Aims: We aimed to examine the prospective association between a validated morbidity measure, the medication-based Rx-Risk Comorbidity Index (Rx-Risk), and the risk of first hip fracture, and to investigate whether this association differed by age and sex.

Methods: In this registry-based cohort study, the population at risk was defined as individuals ≥51 years old who retrieved at least one prescription from an outpatient pharmacy from 2005-2016. For each calendar year, Rx-Risk was calculated based on dispensed medications and their strength of association with one-year mortality, using individual-level data from the Norwegian Prescription Database and Statistics Norway. Information on hospital-treated first hip fractures from 2006-2017 was provided from the nationwide NOREPOS hip fracture database. A negative binomial model was applied to obtain incidence rate ratios (IRRs) for hip fracture with Rx-Risk category as a time-dependent exposure.

Results: A total of 94,101 first hip fractures occurred from 2006-2017. Individual Rx-Risk values ranged from -8 to 54 and were combined into seven categories ranging from ≤0 (reference) to >25. Compared to women with Rx-Risk ≤0, women with the highest Rx-Risk (>25) had a more than sixfold increased risk of hip fracture (IRR 6.1, 95% confidence interval (CI) 5.4, 6.8). Correspondingly, women with Rx-Risk 1-5 had an IRR of 1.4 (95% CI 1.3, 1.4). Similar results were demonstrated in men. The highest incidence rate was found in the oldest women ≥80 years with Rx-Risk 21-25 (514 (95% CI: 462, 566) per 10, 000 person-years). The youngest individuals aged 51-64 years had the most pronounced relative increase in hip fracture risk with higher Rx-Risk levels.

Conclusions: In the general outpatient population, higher morbidity as measured by Rx-Risk was strongly associated with increased hip fracture risk within all categories of sex and age. Rx-Risk may serve as a useful tool for identifying individuals at high risk of hip fracture in a clinical setting and in future studies.

D4

Prenatal antidepressant exposure and body mass index trajectories up to 14 years of age in the offspring born to mothers with pre-pregnancy depression and/or anxiety

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Introduction: Whether antidepressant exposure during pregnancy negatively affect offspring body mass index (BMI) trajectories and increments over time in childhood, is unknown.

Aims: To determine sex-specific associations between prenatal antidepressant exposure and offspring BMI trajectories and acceleration of BMI from age 6 weeks to 8 years.

Methods: We used data from the Norwegian Mother, Father and Child Cohort Study (MoBa) linked to the Medical Birth Registry of Norway and the MoBaGenetics. We included 6,075 pregnancy-child dyads (singleton, liveborn) with available data on child BMI from birth up to 8 years of age, born to women with depression/anxiety prior to pregnancy who i) continued antidepressants in pregnancy (n=625); ii) discontinued treatment proximal to pregnancy (n=412); or iii) were unexposed both before and during pregnancy (n=5038). We fitted multilevel mixed-effect linear models to compute BMI mean differences overtime across antidepressant exposure groups.

Results: Children born to mothers who continued antidepressant into pregnancy had comparable childhood BMIs compared to those born to unexposed mothers or mothers who discontinued antidepressant proximal to pregnancy. Higher BMIs was observed among male offspring born to antidepressant continuers compared to discontinuers, especially among selective-serotonin-reuptake-inhibitor users and up to 3 years of age (mean difference in BMI = 0.33; 95% CI: 0.08 to 0.58 at baseline). Lower BMI was seen among female offspring and the gap became larger over time, especially between low-moderate use of antidepressant vs discontinuation during pregnancy. These findings were not affected by parental genetic liability and prematurity.

Conclusion: In a population of children born to mothers with pre-pregnancy depression/anxiety, prenatal antidepressant exposure was not associated with childhood BMI trajectories. However, this association seems to be time-dependent and sex-specific with higher BMI in male and lower BMI in female offspring born to mothers with antidepressant continuation vs discontinuation.

<center>E: Social epidemiology</center>

E1

Trends in health and sense of local belonging among older rural and urban residents from 1995 to 2019 – A linkage between the HUNT studies 2-4 and Statistics Norway

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Introduction: In the last decades, an increasing number of older Norwegians have moved from rural locations to more urbanized areas. To provide public health actions for healthy aging, population-based descriptive epidemiology is needed to better understand internal migration amongst older people and its association with health, wellbeing and local belonging.

Aims: To explore changes in health and sense of local belonging among older people and possible differences between rural and urban places in former Nord-Trøndelag county during the period 1995-2019.

Methods: Individual cross-sectional data retrieved from three surveys (in 1995-1997, 2006-2008, and 2017-2019, respectively) in the population-based Trøndelag Health Study (HUNT) linked to data from Statistics Norway. Sample characteristics of participants (70-79 years) in HUNT2 (N=7491), HUNT3 (N=5356) and HUNT4 (N=7803) stratified by rural and urban residential areas included items on general health, psychological distress (HADS-Anxiety), chronic diseases, sense of local belonging (*I feel a strong sense of community with the people who live here*), housing status (live alone or cohabiting) and fortune.

Results: In both rural and urban areas, the prevalence of participants with very good/good general health and low levels of psychological distress increased in the study period 1995-2019 (very good/good general health: 52–68% vs 54–66%, HADS-Anxiety <8: 49-72% vs 51-72% in rural and urban areas, respectively). However, the prevalence of elderly reporting chronic diseases increased in the same study period (32–40% vs. 34–42% in rural and urban areas, respectively). Furthermore, the prevalence of participants with a sense of local belonging decreased from 2006-08 to 2017-19 (87-83% vs. 79-74% for rural and urban areas respectively). At all three HUNT surveys, urban areas had a slightly higher prevalence of 70-year-olds who live alone and, on average, have higher fortune.

Conclusions: General health among the older rural and urban population has improved over the past decades, with notable differences in fortune, housing status and a sense of local belonging. between. Notably, the lowest prevalence of elderly with a sense of local belonging was among urban residents in HUNT4. The intricate interplay between health, wellbeing, sense of local belonging and living area among older people needs further investigation.

E2

Educational gradient in hip fracture incidence in Norway. The Norwegian Epidemiologic Osteoporosis Studies (NOREPOS)

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Introduction: Norway and the other Scandinavian countries have the world's highest incidence of fragility fractures. In high-income countries socioeconomic gradients are seen for several health outcomes typically associated with lifestyle risk factors, but there is limited knowledge about the significance of socioeconomic background in osteoporotic fractures.

Aims: Using attained education as an indicator of socioeconomic status, we aimed to determine if there is an educational gradient in risk of hip fracture in Norwegian men and women, and to describe the cumulative incidence of hip fractures in Norway by education level, sex, and age.

Methods: In a population-wide cohort of Norwegians aged ≥50 years identified in the Population and Housing Census 2001, information from Statistics Norway on attained education was linked to hospital-treated hip fractures 2002-2019 available in the NOREPOS hip fracture database (www.norepos.no). Relative risk of hip fracture by education level was examined in Cox proportional hazards regression with tertiary (college/university) education as reference level. We obtained the cumulative incidence of hip fracture by sex, age, and educational level from a multistate survival analysis treating incident hip fractures and all-cause deaths as competing outcomes, thus accounting for the higher life expectancy in people with higher education.

Results: The population comprised N=1,389,858 individuals with 135,938 incident hip fractures occurring during a mean observation time of 13.4 years. Compared with men who had attained tertiary education, hazard ratios (95% confidence intervals) for hip fracture were 1.44 (1.40, 1.49) in men with primary education and 1.26 (1.22, 1.29) in men with secondary education. In women, the corresponding estimates were 1.28 (1.25, 1.31) and 1.16 (1.13, 1.19). The highest overall cumulative incidence was observed in the primary education group, but the educational gradient gradually diminished with increasing age and then reversed in old age in both men and women.

Conclusions: There was a clear educational gradient in incidence of hip fracture, with a higher risk in those with lower education. Despite this, the cumulative incidence of hip fracture in old age was highest in those with higher education, due to their higher life expectancy.

E3

Education and body mass index before and after the obesity epidemic – the HUNT Study

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Background: Higher education is widely known to be associated with lower body mass index (BMI). Over the past decades, both educational attainment and average BMI has changed substantially in the population, and this might affect how educational attainment relates to BMI. We assessed the association of education and genetic propensity to education with BMI over time.

Methods: We estimated the association of attained education and a polygenic score for educational attainment with BMI measured either in the tuberculosis screening programme or HUNT1-4 among 67,136 participants in the HUNT Study. Siblings were identified based on registry data and sibling fixed effects models were used to validate the findings from the total sample.

Preliminary results: The association between registry based educational attainment and BMI was stronger in more recent times and stronger among women compared to men. Similarly, the estimated associations between genetic propensity and education were stronger in more recent times. However, among sibling we found no conclusive increase in the strength of the association over time.

Conclusion: As BMI has increased in the population, the weight difference between people with higher and lower education has increased. However, the estimated causal effect of education on BMI seems stable over time.

E4

Trends in socioeconomic inequalities in self-rated health and mental distress during four decades in a Norwegian population: the HUNT Study

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Background: It has been established over many decades that there is an educational gradient in both physical and mental health in many countries throughout the world. Reducing such inequalities has been an overarching goal of Norwegian public health policy. Although life expectancy has improved over the past couple of decades, the benefits of this development have been uneven.

Methods: This study linked decennial cross-sectional survey data from four rounds of the HUNT Study with educational registry data using personal identification numbers. The participant were inhabitants of the Trødelag country in Norway aged 30-80. Absolute and relative measures of inequality were calculated using Generalized linear models in Stata.

Results: The absolute inequalities in self-rated health and mental distress between educational groups have stayed relatively stable throughout all rounds of HUNT. Both men and women with lowest education 30-59 years were more than three times as likely to experience poor SRH and mental distress relative to those with the highest education. Men and women aged 60-80 with low education were more than two times more likely to experience poor SRH and mental distress as those of the highest education level.

Discussion: This study shows that relative inequalities in physical and mental health in the Norwegian population are still persistent despite a year-long effort to reduce these. Further knowledge about groups with a disadvantageous health situation should have implications for resource allocation in the Norwegian health care system.

<div align="center">

F: Clinical epidemiology

</div>

F1

Are prostate cancer patients in Norway just as likely as the general male population to receive guideline-recommended secondary preventative medical treatment after an acute myocardial infarction?

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Introduction: Secondary medical prevention after an acute myocardial infarction (AMI) is imperative in preventing recurrence and death. Recent studies suggest that cancer patients are less likely to receive secondary prevention. For non-metastatic prostate cancer (PCa) patients, optimisation of treatment following an AMI is increasingly important as their survival is constantly improving, and risk of cardiovascular disease (CVD) possibly increased. The objective of this study was to determine if there was an association between having a PCa diagnosis and receiving guideline-recommended secondary preventative treatment at discharge and 9-12 months after an AMI.

Methods: In this registry-based study we included data from all males 40 years and older in Norway that experienced an AMI between 2013 and 2019. The main exposure was non-metastatic PCa (diagnosed between 2004 and 2019). We used propensity score matching between the PCa and general population, matching 1:5 on age, prior AMI, stroke, heart failure, diabetes, Charlson comorbidity index and education. We analysed five separate outcomes: prescription at discharge and 9-12 months after AMI of a P2Y12-inhibitor, double antiplatelet (aspirin+P2Y12-inhibitor), statin, ACE-inhibitors/ARBs, and betablocker. We controlled for age, CVD prior to the AMI, diabetes, comorbidity index, year, education, income, and smoking in logistic regression.

Results: We included 10,376 males with AMI, 1761 (17.0%) with a prior non-metastatic PCa diagnosis. At discharge and 9-12 months, rates of secondary prevention were similar between the groups, except for lower use of betablockers in the PCa group, OR 0.86 (95% CI 0.77-0.98) at discharge and 0.87 (95% CI 0.77-0.99) at 9-12 months. For both groups there was considerable reduction in prescriptions rates of secondary prevention from discharge to 9-12 months after an AMI for all types of medications, ranging from 14.9% reduction in lipid lowering agents to 28.4% decrease in aspirin.

Conclusions: Our findings indicate that non-metastatic PCa patients received secondary preventive pharmacotherapy at similar rates to the general population, except for betablockers, which PCa patients received at a lower rate at discharge and 9-12 months after an AMI. Additionally, there was a notable decrease in prescription of secondary preventative medications within a year after an AMI for the whole population.

F2

Uveal Melanoma Incidence and Survival in Norway, 1993–2021

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Introduction: Uveal melanoma is the most common intraocular malignancy in adults. Globally, it comprises about 5% of all melanomas and accounts for 13% of all melanoma-related deaths. Little is known about the incidence and survival rates of uveal melanoma in Norway.

Aim: To provide a detailed overview of the incidence and relative survival rates of uveal melanoma in the Norwegian population. Comparisons are made between sexes, age groups, anatomic sites, size of the tumor (T category, T1-4), and health regions.

Methods: Patients with uveal melanoma diagnosed in Norway in 1993–2021 were eligible for inclusion. Data was obtained from the Cancer Registry of Norway (1993–2007) and the Norwegian Melanoma Registry (2008–2021). Incidence rates were age-adjusted using the standard European population. Age-standardized net survival estimates were obtained using the Pohar-Perme estimator.

Results: A total of 1497 patients (50% women) were diagnosed with uveal melanoma in 1993–2021. The overall age-adjusted incidence per one million person-years was 9.6 in men and 8.9 in women, respectively. An increase in incidence rates was observed over this period in patients over 50 years of age and for tumor location in the choroid, but not for ciliary body and iris. The percentage of patients with tumor stage T1 and T2, and to a lesser extent T4, increased, while T3 cases decreased. The differences in incidence between the health regions were small. Age-standardized 5-year net survival estimates (95% confidence interval) remained largely stable throughout the study period and were 83.5% (79.5-87.7%) overall for women and 75.4% (70.7-80.4%) for men. More detailed survival estimates are in progress.

Conclusion: Norway has one of the highest incidence rates of uveal melanoma in the world. The observed increase in uveal melanoma incidence has largely been driven by an increase in smaller (T1 and T2) choroidal tumors in patients over the age of 50. The steadily increasing incidence rates and the lack of improvement in survival, highlight the need for improved treatment strategies.

F3

NCD multimorbidity in Norway 2010-2020 – a NCDNOR study

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Introduction: Non-communicable diseases (NCDs) – cancer, diabetes, cardiovascular and chronic obstructive pulmonary disease, mental disorders, and hip fractures – account for a major share of the disease burden in Norway. Due to better treatment and an ageing population, the accumulation of more than one NCD (multimorbidity) is likely increasing, adding to the disease burden of patients and healthcare systems. Data on NCD multimorbidity in Norway is scarce, especially in relation to educational level, income and wealth.

Aims: To estimate the prevalence of NCD multimorbidity in Norway from 2010 to 2020 by educational level, income and wealth.

Methods: We used data from the Norwegian Prescription Database, the Norwegian Patient Registry, the Norwegian database for Control and Payment of Health Reimbursement, the Cancer Registry of Norway and the Norwegian Cause of Death Registry. The study population was everyone ≥30 years and resident in Norway in 2010. We calculated the cumulative prevalence of having ≥2 and ≥3 NCDs biannually from 2010 to 2020. Results were stratified by sex, age group, and 2010-levels of income (quartiles), wealth (quartiles) and educational level (low/medium/high), as well as combinations of income/wealth and educational level.

Results: Preliminary results show that the NCD multimorbidity (≥2 NCDs) prevalence in 2010 increased with decreasing educational level and decreasing income/wealth across all age groups, and there was a strong income gradient within each level of education. The accumulated prevalence in 2020 was as much as 4-5 times higher in those with the lowest education-income combination compared to those with the highest combination. The prevalence in the high-income-low-education group was comparable to that in the low-income-high-education group. Among elderly (age ≥70 years), wealth had a larger effect on the prevalence than income (including pensions and social security). The prevalence did not differ much between sexes. The prevalence of ≥3 NCDs was lower but followed a similar socioeconomic gradient as the prevalence of ≥2 NCDs.

Conclusions: The NCD multimorbidity prevalence in Norway followed a clear socioeconomic gradient and after 10 years of follow-up it was as much as 4-5 times higher in those with the lowest education-income combination compared to those with the highest combination.

F4

Melanoma survival by tumour thickness in Norway, 1983–2019

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Introduction: Cutaneous melanoma is the most aggressive and lethal form of skin cancer. Norway is ranked second worldwide in melanoma mortality. Tumour thickness at diagnosis is the most important prognostic factor for localized primary melanoma. Long-term trends in melanoma survival by tumour thickness is unknown in Norway.

Aim: Investigate melanoma survival trends by tumour thickness in Norway in 1983–2019, overall and by age and sex.

Methods: Data is from the Cancer Registry of Norway (1983–2007) and the Norwegian Melanoma Registry (2008–2019). Tumour thickness (mm) was categorized: T1 (≤ 1.0), T2 (>1.0-2.0), T3 (>2.0-4.0), and T4 (>4.0). Age-standardized relative survival (with 95% confidence intervals, CI) was estimated using the Pohar Perme estimator and age-standardized using the International Cancer Survival Standard weights. A mixture of the cohort and period approach was used for patients without complete follow-up in the analyses of time trends in 5- and 10-year relative survival.

Results: In total 44,917 patients (aged 15–90, 51% women) were diagnosed with a first primary melanoma in 1983–2019. Five- and 10-year relative survival increased over the period in all T categories and was lower in men than women decreasing by tumour thickness in both sexes. The 5-year relative survival (95% CI) in women with thicker (T4) melanoma increased from 0.58 (0.53, 0.64) in 1983–1999 to 0.62 (0.58, 0.66) in 2000–2019 whereas in men this value is lower and increased from 0.44 (0.4, 0.49) to 0.48 (0.45,0.52). This is work in progress and results will also include the cause-specific survival taking the competing risks into account, and comparisons of survival of melanoma with distant metastasis before and after the new treatment with immunotherapy.

Conclusion: During the study period, men had lower survival than women in all melanoma thickness categories. Patients with the thicker tumour had lowest relative survival, but in all thickness categories the relative survival had an increasing trend.

F5

Risk of ischemic stroke after outpatient invasive procedure

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Introduction: No prior study has investigated the risk of ischemic stroke following an outpatient surgery.

Aims: To assess the short-term risk of ischemic stroke after outpatient invasive procedures.

Methods: In this observational, a case-crossover study, all cases of a first ischemic stroke (ICD-10, I63) aged ≥20 years were identified from national health registers from Norway (2008-2016) and linked to their date of surgery and procedural codes. The surgical procedures were coded according to the Nordic Medico-Statistical Committee (NOMESCO) classification. Individuals who underwent procedures 0-13 days (case period) prior to the diagnosis of ischemic stroke was compared to those who were exposed 28-41 days (control period) prior to ischemic stroke. We classified each procedure as having a 'general', 'regional' or 'local' anesthesia on what is believed to be standard of care for that procedure by experts. A total of 2903 patients who underwent a procedure either during the case- or control period contributed to the analyses. Odds Ratio (OR) with 95% confidence intervals (CI) were computed using conditional logistic regression.

Results: A total of 2903 (mean age 75 years, 54.7% were male) comprised the study population. Most procedures were unassociated with invasive procedures; however, the relative risk was elevated for procedures performed under 'general/regional' anesthesia for neurological (OR 4.00, 95%CI, 0.45-35.79), vascular (OR 3.00, 95%CI: 1.19-7.56), orthopedics (OR 1.51, 95%CI, 1.08-2.11), thorax (OR, 1.44, 95% CI, 0.86-2.39), abdomen/gastrointestinal endoscopy (OR 1.29, 95%CI, 0.84-1.97) related procedures, and Ear Nose Throat and mouth procedures (OR 1.76, 95% CI, 1.17-2.63) performed under local anesthesia.

Conclusion: Apart from certain neurological and vascular procedures, most outpatient procedures were generally safe regarding the postoperative risk of ischemic stroke within the first two weeks after the outpatient surgery. Further studies are warranted to assess whether the effect is modified by cardiovascular medication or other clinical interventions.

G: Environmental and occupational epidemiology

G1

Exposure to dust and fibres and risk of pleural mesothelioma in 25,000 offshore oil industry workers

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Introduction: Pleural mesothelioma is a rare respiratory cancer, but one characterised by a poor prognosis and a tendency to occur amongst men in industrialized countries. The main etiological factor is inhaled asbestos exposure, though other sources of dust and fibres may also constitute risk factors.

Aims: We aimed to investigate the association between asbestos exposure, including other types of dust and fibres, and pleural mesothelioma among offshore petroleum workers.

Methods: We conducted a case-cohort study on 43 pleural mesothelioma cases and 2095 randomly drawn non-cases (1999–2022) in the Norwegian Offshore Petroleum Workers cohort (1965–1998) with linkage to the Cancer Registry of Norway (1953–2022). Asbestos, refractory ceramic fibres (RCF), and crystalline silica dust (CSD) exposure were assessed with expert-made job exposure matrices. Weighted Cox regression was used to estimate hazard ratios (HRs) and 95% confidence intervals (CIs) for pleural mesothelioma, adjusted for age at baseline and prior employment with potential asbestos exposure. Additional analyses with 10–30-year exposure lag periods, and a cumulative incidence analysis were also conducted.

Results: Compared to unlikely asbestos exposure, an increased hazard of pleural mesothelioma was found for workers with ≥4.2 years of employment in job categories with the highest asbestos exposure (HR=7.56, 95% CI 1.27–44; P-trend=0.030), and for workers in the highest tertile (≥1.3) of average intensity of exposure (HR=3.96, 95% CI 1.09–14; P-trend=0.033). This effect persisted with up to 20 years of exposure lag for job categories with the highest asbestos exposure (HR=10.16, 1.80–57; P-trend=0.010), and 15 years for average intensity of exposure (HR=4.28, 95% CI 1.21–15; P-trend=0.026). Cumulative incidence analysis indicated a higher probability of death among asbestos-exposed workers, compared to unlikely exposed, during follow-up. No significant associations were found for RCF and CSD, though RCF exposure indicated an increased hazard.

Conclusions: High intensity exposure to asbestos, and possibly RCF, may increase the hazard of pleural mesothelioma in offshore petroleum workers.

G2

Effect of the Norwegian Agreement on a More Inclusive Working Life on use of sick leave and pregnancy benefits among pregnant women: a cohort study

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Introduction: Potential effects of the Norwegian Agreement on a More Inclusive Working Life (IA Agreement) on pregnancy-related sickness absence (SA) have not yet been studied, although many women experience pregnancy-related SA.

Aims: The aim was to estimate the effect of the Norwegian Agreement on a More Inclusive Working Life (IA Agreement) on sickness absence (SA) and use of pregnancy benefits among pregnant women.

Methods: Women giving birth 1.12.2003-31.12.2010 (n=112,486) were observed from 6-37 gestational weeks in one of the following states: work, full SA, graded SA, pregnancy benefits, maternity leave, and other. Repeated stays were possible. Transition intensities were estimated using an inverse probability weighted Nelson-Aalen estimator, and state probabilities were calculated using the Aalen-Johansen plug-in estimator. Absolute probability differences between women in companies with and without an IA Agreement plus expected length of stay (ELOS) in days were calculated. Weights adjusted for group differences in calendar year, age, civil status, education, industry, and number of employees. 95% confidence intervals (CI) were generated using bootstrapping (1,000 repetitions).

Results: Throughout pregnancy, women in IA companies spent half a day more in work, full SA, and graded SA, respectively, and half a day less in pregnancy benefits. During the second trimester, women in IA companies had a slightly higher probability of being in work and a lower probability of full SA. Confidence intervals were wide and included zero.

Conclusions: During pregnancy, women in IA companies appeared more likely to use full and graded SA but also more likely to remain in work and less likely to use pregnancy benefits. Though this study did not find any significant effects of the IA Agreement, the results suggest IA-related measures could work best for conditions experienced in the second trimester.

G3

Indirect adjustment of smoking in occupational studies of lung cancer: a systematic review of available methods and their use

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Introduction: Smoking is potentially a major confounding factor in occupational epidemiology. However, smoking information is often not measured or available, which prompts the use of indirect adjustment methods to account for the potential impact of smoking on the association between occupational exposure and lung cancer risk.

Aims: We aimed to provide a summary of the most recent evidence on indirect adjustment methods for tobacco smoking in studies of occupational exposure-related lung cancer risk.

Methods: We conducted a systematic search in Embase, MEDLINE, and Web of Science up to 28 February 2023 for relevant studies that applied statistical methods for indirect adjustment of tobacco smoking in occupational studies of exposure-related lung cancer risk.

Results: We identified 70 studies on lung cancer in occupational settings. Of those, 17 studies fulfilled our inclusion criteria and were included in the review. There were largely six overall categories of methods for indirect adjustment of smoking; (1) standardization techniques, (2) regression on proxy variables, (3) imputation, (4) sensitivity analysis, (5) factor analysis, and (6) negative control outcome analysis to detect confounding. Most studies used a direct standardization technique or Poisson regression on proxy variables to adjust for and assess the magnitude and direction of bias from unadjusted confounding from smoking.

Conclusions: In summary, standardization techniques and regression on proxy variables may be particularly useful tools to indirectly adjust for smoking, and hence provide less biased estimates of associations between occupational exposures and lung cancer risk.

G4

Exposure to benzene and other hydrocarbons and risk of bladder cancer among male offshore petroleum workers

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Introduction: Occupational exposures constitute the second leading cause of urinary bladder cancer after tobacco smoking. Increased risks have been found in the petroleum industry, but high-quality exposure data are needed to explain these observations.

Aims: We aimed at conducting a prospective case-cohort study to examine the risk of bladder cancer among male workers in the Norwegian offshore petroleum workers (NOPW) cohort.

Methods: We analysed 189 bladder cancer cases (1999–2017) and 2,065 randomly drawn non-cases from the NOPW cohort. Cases were identified in the Cancer Registry of Norway, while work histories and lifestyle factors (1965–1998) were recorded by questionnaire at baseline (1998). Occupational petroleum-related hydrocarbon exposures were assessed by expert-developed job-exposure matrices. Hazard ratios (HRs) with 95% confidence intervals (CIs) were estimated by weighted Cox regressions, adjusted for age, tobacco smoking, education, and year of first employment, and with lagged exposures.

Results: Increased risks were found in benzene-exposed workers, either long-term exposure (≥18.8 years, HR=1.89, 95% CI: 1.14–3.13; P-trend=0.044) or high-level cumulative benzene exposure (HR=1.60, 95% CI: 0.97–2.63; P-trend=0.065), compared with the unexposed. Associations persisted with 20-year exposure lag. No associations were found with skin or inhalation exposure to crude oil, mineral oil (lubrication, hydraulics, turbines, drilling), or diesel exhaust.

Conclusions: The results suggest that exposures in the benzene fraction of the petroleum stream may be associated with increased bladder cancer risk.

G5

Return to work after hospitalization for sepsis

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Introduction: Sepsis is caused by a dysregulated host immune response to infection, with an estimated 50 million cases worldwide in 2017. Survivors of sepsis commonly experience functional impairment, but the impact of these limitations on sepsis survivors' ability to return to work (RTW) is less clear.

Aims: To investigate RTW, assess temporal trends in RTW, and evaluate patient and clinical characteristics associated with sustainable RTW (defined as ≥31 days of consecutive work) after hospitalization for sepsis.

Methods: We used internationally accepted ICD-10 codes identifying adult patients with sepsis from all Norwegian hospitals in 2010 through 2021 using the Norwegian Patient Registry. These were linked to sick-leave data from the Norwegian National Social Security System to identify patients that had been working prior to the index sepsis hospitalization. We calculated the proportion of patients returned to work at 6 months, 1 year, and 2 years and estimated temporal trends in age-standardized RTW. Clinical characteristics associated with sustainable RTW were investigated using Cox regression.

Results: Among 35.839 hospitalizations for sepsis aged 18-60 years (mean age 43.7), 12.260 (34.2%) were working prior to hospitalization and included in this study. At 6 months, 1 year, and 2 years post-discharge, 58.6%, 67.5%, and 63.4%, were working. The annual age-standardized RTW proportion at 6 months and 1 year remained stable throughout the study period, while the 2-year age-standardized RTW declined annually by 1.51% (95% CI, -2.22 to -0.79), from 70.01% (95% CI, 67.21 to 74.80) in 2010 to 57.04% (95% CI, 53.81to 60.28) in 2019. Characteristics associated with sustainable RTW were younger age, fewer comorbidities, and fewer acute organ dysfunctions during sepsis hospitalization. The probability of sustainable RTW was higher in patients with COVID-19-related sepsis (HR 1.31; 95% CI 1.15 to 1.49) than in sepsis patients and lower in ICU-patients (HR 0.56; 95% CI 0.52 to 0.60) compared to ward patients.

Conclusions: The decrease in RTW from 1 to 2 years and the temporal trend of declining RTW at 2 years needs attention, and further work facilitation efforts are needed, especially in groups that are vulnerable to not achieving sustainable RTW.

H: Reproductive epidemiology

H1

Vaginal bleeding during pregnancy and risk of cardiovascular diseases death: a register-based study in a national cohort of Norwegian mothers

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Introduction: Previous studies reported bleeding in early pregnancy is associated with an increased risk of pregnancy outcomes, but the results remain conflicted and inconclusive.

Aims: This study investigated the effect of early vaginal bleeding on cardiovascular disease (CVD) death among Norwegian mothers, while adjusting for great obstetrical syndromes (GOS) and other potential predictors.

Methods: The study population was a national cohort of 1.5 million mothers with births registered in the Medical Birth Registry of Norway during the period 1967-2020. We followed mothers from date of birth to death or December 31st, 2020, whichever occurred first. Cox analyses of proportional hazards were used to estimate the effect of bleeding between week 13 and 28 on excess of CVD death.

Results: Of 1,001,839 mothers meeting inclusion criteria, 5% reported VB in weeks (<13, 13-28, and >28) in their first three pregnancies whereas around 2% reported VB in week 13 to 28 in their first three pregnancies. The risk of CVD death was higher among mothers who had VB in 13 to 28 weeks compared to mothers who had three pregnancies without VB bleeding in the similar weeks. The estimated association, however, attenuated when adjusted for common pregnancy complications such as preeclampsia, preterm, and small-for-gestational age.

Conclusions: pregnancies complicated by VB in early pregnancies have an increased risk of CVD death.

H2

Pregnancy history at age 40 as a marker of cardiovascular risk

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Introduction: Individual pregnancy complications are associated with increased maternal risk of cardiovascular disease.

Aims: We assessed the link between a woman's total pregnancy history at age 40 and her relative risk of dying from atherosclerotic cardiovascular disease (ASCVD).

Methods: This population-based, prospective study combined several Norwegian registries covering the period 1967-2020. We identified 854 442 women born after 1944 or registered with a pregnancy in 1967 or later, and surviving to age 40. The main outcome was the time to ASCVD mortality through age 69. The exposure was a woman's number of recorded pregnancies (0, 1, 2 3, or 4) and the number of those with complications (preterm delivery <35 gestational weeks, preeclampsia, placental abruption, perinatal death and term or near-term birth weight <2700grams). Cox models provided estimates of hazard ratios across exposure categories. The group with lowest ASCVD mortality was those with three pregnancies and no complications; these served as reference group.

Results: Among women reaching age 40, risk of ASCVD mortality through age 69 increased with number of complicated pregnancies in a strong dose-response fashion, reaching 23-fold risk (95% confidence interval 10-51) for women with four complicated pregnancies. Based on pregnancy history alone, 19% of women at age 40 (including nulliparous women) had ASCVD mortality risk in the range of 2.5 to 5-fold.

Conclusions: Pregnancy history at age 40 is strongly associated with ASCVD mortality. Further research should explore how much pregnancy history at age 40 adds to established CVD risk factors in predicting CVD mortality.

H3

Does pregnancy prevent breast cancer death if the fetus is stillborn? A population-based cohort study

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Introduction: Many previous studies have shown a reduced risk of breast cancer among women who have given birth. However, it is so far unclear if these reductions in risk persist for mothers who do not have a surviving fetus.

Aims: The purpose of this study is to estimate risk in breast cancer among women while considering their history of fetal perinatal death.

Methods: Our analysis used data from the national population registry of Norway, including all women born in the country since 1950 onwards. We used the anonymized national ID number to link information to the Medical Birth Registry of Norway, including information on mothers' lifetime history of live- and stillbirths since 1967, which served as our exposure. These data were further linked to the medical cause of death registry, where we retrieved information on death attributed to breast cancer, with follow-up time until 2020, which served as our outcome.

Results: In a cohort of 1,318,216 women, 81% (N = 255,033) gave birth during the study period, with most mothers (N = 499,794) having 2 lifetime births. Among women who gave birth, 1.64% had at least one stillbirth during their lifetime. Women with one pregnancy had decreased risk of death due to breast cancer after a live birth (HR 0.84, 95%CI0.0.76-0.94) increased risk of death due to breast cancer after a stillbirth (HR 2.80, 95%CI 1.54-5.08), compared to women who never gave birth. For women with more than one pregnancy, risk was highest for those with a stillbirth as their last birth (HR 1.96, 95%CI 1.19-3.21) or with more than one stillbirth (HR 2.28, 95%CI 0.95-5.49), though women with a stillbirth in their first pregnancy remained at modestly increased risk (HR 1.38, 95%CI 1.00-1.91).

Conclusions: Giving birth may not necessarily be protective against breast cancer if the fetus does not survive. While breastfeeding is likely one factor to consider when estimating the risk of breast cancer, previous studies have shown protective effects of giving birth regardless of breastfeeding. The study suggests the need for further research on the etiological connection between pregnancy and breast cancer.

H4

Adverse pregnancy outcomes in daughters born to mothers with preeclampsia

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Introduction: Most research on intergenerational recurrences of preeclampsia has predominantly focused on individuals who were exposed to the complications in-utero. Few have explored intergenerational recurrences through those unexposed to preeclampsia in-utero.

Aims: To explore the risk of preeclampsia and other adverse pregnancy outcomes in the first singleton pregnancies of singleton-born daughters who were (1) exposed to preeclampsia in-utero and (2) unexposed to preeclampsia in-utero whose mothers were born to mothers who had preeclampsia in other pregnancies.

Methods: Using the Medical Birth Registry of Norway (1967-2020), we identified 421 776 daughters. Of these 10 859 daughters were exposed to preeclampsia in-utero (referred to as PE-affected) and 11 479 daughters were unexposed to preeclampsia in-utero whose mothers had preeclampsia in previous or subsequent pregnancies (referred to as PE-unaffected). The remaining 399 438 daughters were born to mothers who never had preeclampsia, serving as the reference group.

We examined adverse pregnancy outcomes in daughters' first pregnancies, including preeclampsia, placental abruption, stillbirth, preterm delivery, gestational hypertension and gestational diabetes mellitus. We used log-binomial regression models to calculate relative risks (RR) and 95% confidence intervals (CI) to assess the associations.

Results: Preeclampsia occurred in approximately 11% of PE-affected daughters and 8% of PE-unaffected daughters, compared to 5% of daughters of mothers who never had preeclampsia. PE-affected daughters had a significantly higher risk of preeclampsia (RR 2.4; 95% CI 2.3-2.5) than PE-unaffected daughters (RR 1.8; 95% CI 1.4-1.7). Similarly, PE-affected daughters (RR 1.9; 95% CI 1.7-2.1) faced a slightly higher risk of gestational hypertension than PE-unaffected daughters (RR 1.7; 95% CI 1.5-1.8) albeit with overlapping confidence intervals. The increased risk of gestational diabetes mellitus (1.5-fold) and preterm delivery (1.1-fold) was comparable for both PE-affected and PE-unaffected daughters. No associations were observed for stillbirth and placental abruption.

Conclusions: Maternal history of preeclampsia strongly predicts hypertensive disorders in the next generation. Furthermore, in-utero exposure amplifies these risks, potentially due to heightened genetic susceptibility (that triggered preeclampsia in their mother's pregnancy) and possibly due to fetal programming. However, the increased risks of preterm delivery and gestational diabetes mellitus highlight a familial predisposition independent of the intrauterine exposure.

I: Nutritional and lifestyle epidemiology

I1

Does lifestyle intervention reduce weight in adults? A controlled intervention study among women of Somali background in Norway.

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Background: Women of Somali background in Norway have a high prevalence of overweight and obesity, compared with women in the general Norwegian population. For lifestyle interventions to be applicable in non-Western groups of different cultures, it has been suggested to focus on behavioural change through self-efficacy and self-empowerment, be gender specific, and address different preferences in physical activity.

Aims: To assess the effect of a culturally tailored intervention package (physical activity, health, and nutrition education) among overweight and obese women of Somali background. Specific aims were changes in body weight from baseline to 12 months in the intervention group compared to the control group receiving usual care.

Methods: An interventional study design compared with a control group among women of Somali background with a body mass index ≥ 27.0 kg/m^2. The intervention group was offered 24 sessions over 12 weeks. The health topics were designed as group discussions and the participants were introduced to different forms of physical activity and included in designing the group activity sessions.

Results: The overall participation rate was 59.8%. In the final analysis, 41 people were included in the intervention group and 60 in the control group. The mean difference in weight change adjusted for baseline was -1.5 kg (95% confidence interval -2.96–0.06, p=0.06) in the intervention group versus the control group. The mean difference in weight change adjusted for baseline and the possible confounding effects of age, education, marital status, number of children in the household and length of Norwegian residency was -1.9 kg (95% confidence interval -3.65– -0.13, p=0.04) in the intervention group versus the control group.

Conclusion: This culturally tailored intervention study for women of Somali background had a modest effect on weight loss after 12 months. Adopting a similar culturally sensitive approach may improve body weight in this immigrant group. Further studies are needed to discover if this method can be transferred to other immigrant groups and gender.

I2

Social inequality in prevalence of NCD risk factors: The Tromsø Study 2015-2016

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Introduction: To better understand the disparities in the burden of non-communicable diseases (NCDs), it is essential to examine the social distribution of preceding behavioural risk factors and associated biological risk factors. Attained level of education is an important predictor of NCD morbidity and mortality and serves as an indicator of circumstances that influence health behaviours throughout the life course.

Aims: Our aim was to examine associations between educational level and prevalence of leading behavioural and biological risk factors for NCDs in a high-income country.

Methods: We used data from questionnaires, blood samples and clinical examinations in the seventh survey (2015-2016) of the population-based Tromsø Study in Tromsø, Norway (n=21,069, 53% women). In women and men, we explored the associations between educational level (primary, secondary, short- and long tertiary) and indicators of NCD risk factors; daily smoking, physical inactivity (sedentary in leisure time), insufficient fruit/vegetable intake (<5 units/day), harmful use of alcohol (>10 grams/day in women or >20 grams/day in men), obesity (body mass index $\geq$30 kg/m^2), hypertension (blood pressure $\geq$140/90 mmHg or use of blood pressure medication), hypercholesterolemia (serum total cholesterol $\geq$5.0 mmol/L or use of lipid-lowering medication), and intermediate hyperglycaemia (HbA1c 6.0-6.4 % and no self-reported diabetes or use of antidiabetic medication). Results are expressed as odds ratios for having the NCD risk factor per unit decrease in educational level, with 95% confidence intervals.

Results: Overall, the associations between educational level and risk factors were not different in women and men, and for simplicity we present the results in women only. We observed statistically significant associations between lower levels of attained education and higher odds of daily smoking (1.69; 1.60-1.78), physical inactivity (1.38; 1.31-1.46), fruit/vegetable intake (1.54; 1.43-1.66), hypertension (1.25; 1.20-1.30), obesity (1.23; 1.18-1.29), intermediate hyperglycaemia (1.12; 1.06-1.19), and hypercholesterolemia (1.07; 1.03-1.12). The odds of harmful alcohol use were reduced by decreasing levels of education (0.75; 0.72-0.78).

Conclusions: We found statistically significant educational gradients in all leading NCD risk factors within a Norwegian general population. All risk factors increased in prevalence at lower educational levels, except for harmful alcohol use, which increased at higher educational levels.

I3

Long-term alcohol consumption trajectories and associated factors in adult women. A comprehensive analysis of the Norwegian Women and Cancer Study 1991–2011

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Introduction: With an increasing proportion of women drinking alcohol in Norway, it is essential to understand their alcohol consumption trajectories.

Aims: To identify the long-term trajectories of total alcohol and alcohol-specific beverages consumption in adult Norwegian women and how these relate to education, lifestyle, and health-related factors.

Methods: A random sample of women from the national population register of Norway were recruited by the Norwegian Women and Cancer (NOWAC) study. During the 1991–2011 women aged 31–70 years (N=76 398) self–reported their alcohol consumption by completing two to three questionnaires which were sent on average six years apart. Group–based trajectory model was used to identify the long–term alcohol consumption trajectories. Multinomial regression models were used to fit the odds ratios (OR) of the associations between several factors and the trajectory's membership. Analysis was stratified in two subcohorts based on age at baseline: women aged 31–49 years and women aged 50–70 years.

Results: Five different trajectories of total alcohol consumption were identified among two subcohorts: non-drinker stable (12.5–23.6%), low stable (66.3–60.1%), light increasing or unstable (17.8–12.1%), moderate to high or light to high (2.8–2.7%), and high to moderate or moderate decreasing (0.6–1.4%). These trajectories were resembled by those of wine consumption. Trajectories of beer, spirits/liqueurs remained constant with some minor changes. Women who sustained or increased their total alcohol consumption showed higher ORs for higher education levels, self–rated health, former or current smoking status, and a body mass index (BMI) below 25 kg/m^2. Physical activity level and history of comorbidities showed only weak to moderate associations with alcohol consumption trajectories. Across the subcohorts and alcohol–specific beverages some distinct associations were observed.

Conclusions: Most women (65%) sustained their alcohol consumption into light levels, while approximately 2.7% showed pronounced increases which tented to occur during age 48–54 and 62–65 years. Education levels, smoking, self–rated health, and BMI appeared to be important factors influencing drinking trajectories in terms of alcohol amount, trajectory trends, and beverage choices. These factors need consideration in public health and intervention strategies.

I4

Clustering and trajectories of key noncommunicable disease risk factors in Norway – the NCDNOR project

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Introduction: Noncommunicable diseases (NCDs) are a leading cause of premature death globally and have common preventable risk factors. In Norway, the NCDNOR-project aims at establishing new knowledge in the prevention of NCDs by combining information from national registries with data from population-based health studies.

Aims: To harmonize data on key NCD risk factors from Norwegian health examination studies and to describe clustering of risk factors and long-term risk factor trajectories.

Methods: Data on NCD risk factors from the Norwegian Counties Study, the Age 40 Program Oslo, the Age 40 Program, the Trøndelag Health Studies (HUNT1–HUNT4/HUNT4ST) the Tromsø Study (Tromsø4–Tromsø7) and the Cohort of Norway (CONOR) studies were harmonized and analyzed using intersection diagrams, latent class analysis and latent class mixed models.

Results: The harmonized study sample consisted of 808,732 individuals (1,197,158 participations). Two-thirds were exposed to ≥1 NCD risk factor (daily smoking, physical inactivity, obesity, hypertension, hypercholesterolaemia or hypertriglyceridaemia). In individuals exposed to ≥2 risk factors (24%), we identified five distinct clusters, all characterized by fewer years of education and lower income compared to individuals exposed to <2 risk factors. We identified distinct long-term trajectories of smoking intensity, leisure-time physical activity, body mass index, blood pressure, and blood lipids. Individuals in the trajectories tended to differ across sex, education, and body mass index.

Conclusions: We provide important insights into the mechanisms by which NCD risk factors can occur and may help the development of interventions aimed at preventing NCDs.

I5

FarmMERGE: identifying unwell farmers so as to explore associations between farmer health and wellbeing and the health, welfare and productivity of their livestock

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Introduction: Stockmanship has the potential to affect livestock health, welfare and productivity. The extent to which farmer health and wellbeing can affect stockmanship, and further, livestock, is unknown. A method involving the merge of large, existing data is required to obtain sufficient statistical power to detect effects. But how do we define an unwell farmer? Qualitative research suggests farmers may view their own health differently to other workers. Relying on previously collected, self-reported health status may therefore also affect our ability to detect an effect.

Aims: To explore the agreement between measures of health and wellbeing from a large population survey – in particular, of subgroups of livestock farmers.

Methods: Health and wellbeing data was obtained from the Trøndelag Health Study (HUNT 4, 2017-2019). Livestock farmers were identified by obtaining a list of HUNT 4 "skilled agriculture" workers, and using this list to search the Central Coordinating Register of business entities (Brønnøysund Registersenteret) and livestock production and health databases. Once identified, the positive predictive value of the widely used HUNT 4 questionnaire item "Overall, how is your health at the moment?" relative to a number of other HUNT 4 indicators of health and wellbeing for each of the worker subgroups was determined.

Results: There were differences in reported health status by occupation group. The ability of a single survey response to capture all of the health and wellbeing characteristics that might plausbily impact on stockmanship varied substantially between farmer subtypes.

Conclusions: The FarmMERGE project will utilise more than one definition of farmer and more than one definition of "unwell" when exploring possible associations between farmer health and wellbeing and the health, welfare and productivity of their livestock. These results may also be relevant for others using survey data to explore the health and wellbeing of farmers.

J: Social epidemiology

J1

Associations between green space, perceived safety and municipal satisfaction among residents in Täby, Sweden: A NORDGREEN study

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Introduction: Safe and green living environments and neighbourhoods are highly appreciated by people. Research shows that access to green spaces has positive impacts on both health and well-being, and access to green space is also stated by the UN as a key priority for sustainable urban development.

Aims: In this study, we explored associations between access to green space, perceived safety, and municipal satisfaction in a Swedish context. We also examined if perceived safety moderates the relationship between perceived access to green space and municipal satisfaction.

Methods: We used the Citizen Survey from Täby, Sweden in our study. The survey consists of 1189 participants and was conducted in 2019 and 2020. Five different indicators of access to green space were included in the study. Four of the indicators were calculated based on land-use, land-cover maps as well as satellite images, while one indicator was based on the survey data on inhabitants' perceived access to green space. From the same survey, we also derived the variables perceived safety and municipal satisfaction. We analysed the data using regression models were gender, age, education, civil status, and country of birth were included as potential confounders. Moderation analyses were applied to investigate if safety worked as a moderator between access to green space and municipal satisfaction.

Results: The results showed no significant correlations between objective and perceived green space indicators, except for percentage of green area. We found strong and positive associations between perceived green space and both municipal satisfaction and perceived safety. Inhabitants reporting high access to green space also reported significantly higher perceived safety and municipal satisfaction than participants with less access to green space.

Conclusions: The study found associations between perceived access to neighbourhood green space and municipal satisfaction and safety. However, the main message from this study is that both objective and perceived indicators of green space access must be considered in research and planning practice. The findings can be utilized by planners and decision makers to argue for the preservation of green spaces and can guide planners in using both perceived and objective indicators in green infrastructure planning.

J2

The association between cognitive function and oral health in home dwellers and nursing home residents: The HUNT Study

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Introduction: The association between cognitive function and oral health has become increasingly relevant, considering the rapidly aging population worldwide. However, findings regarding the association have been inconclusive, with studies often failing to include dependent home-dwelling individuals.

Aims: We evaluated the relationship between cognitive function and oral health in a general Norwegian older adult population and explored the relationship among home dwellers and nursing home residents.

Methods: Analysis data comprised 2623 participants aged 70 and older from the fourth wave of the Trøndelag health study (HUNT4 70+) and the city of Trondheim (Trondheim 70+). Participants were classified into normal cognition or neurocognitive disorders (NCDs), including mild cognitive impairment and dementia diagnosed by clinical experts. Oral health was assessed using the Revised Oral Assessment Guide – Jönköping (ROAG-J). Individuals were considered as having "no oral problem" if the ROAG-J score was 0 or 1 or having "oral problem" if the score was 2 or 3. Poisson regression was used to estimate prevalence ratios (PRs) and 95% confidence intervals (CIs).

Results: The prevalence of having oral problems was 18% higher in participants with NCDs than those with normal cognition after adjusting for potential confounders (PR 1.18, 95% CI: 1.09 to 1.29). Further analysis showed a higher prevalence of having oral problems for home dwellers with NCDs (PR 1.23, 95% CI: 1.13 to 1.33), nursing home residents with NCDs (PR 1.32, 95% CI: 1.20 to 1.45) and nursing home residents with normal cognition (PR 1.33, 95% CI: 1.02 to 1.74) when compared to home dwellers with normal cognition.

Conclusions: NCDs were associated with an increased prevalence of oral problems in this Norwegian older adult population. The study implies that home dwellers with NCDs need more oral care, and nursing home residents require more oral care regardless of their cognitive function status.

J3

Mortality in women released from Norwegian prisons: A 20-year National Cohort Study

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Introduction: Women carry a disproportionally large burden of morbidity in the prison context. They are more likely than men to have chronic somatic disorders, HIV or hepatitis C, mental health problems and substance use disorders. In addition, rates of comorbid conditions and other complex health problems are high. Compared to women in the general population, women with a history of incarceration are more likely to smoke, drink and use drugs excessively; to be overweight or obese; to be overdue for cervical cancer screening; to have poor oral health; and to present with life histories involving trauma and victimization.

Aims: By describing causes of death and estimating the risk and burden of mortality compared to the general population, this study investigates how post-release mortality operates in this highly marginalized and under-researched population.

Methods: In this registry-based study of all women incarcerated in Norwegian prisons from 2000 to 2019 (N = 11 313) we calculated crude mortality rates, years of lost life; and, by using mortality in age-matched women from the general population as reference, age-standardized mortality ratios (SMRs) and years of lost life rates (ASYRs).

Results: Over a mean follow-up time of 10.4 years, at a median age of 50 years old, 9% of the population had died (n = 1005). Most deaths (80%) were premature deaths from an avoidable cause. Drug-induced causes and deaths from major non-communicable diseases (NCDs) were most frequent (both 32%). Compared with women in the general population, women released from prison were more likely to die from any cause. Trends in annual ASYRs suggest that the mortality burden associated with major NCDs has gradually replaced drug-induced causes.

Conclusions: Women released from Norwegian prisons die at a greater rate than their peers, and largely from avoidable causes. The profile of causes contributing to the substantial burden of mortality placed on this population has changed over time and has important implications for future efforts to reduce morbidity and the risk of premature death following release from prison.

J4

Trends in acute myocardial infarction among immigrant groups in Norway based on data from the NCDNOR-project

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Introduction: The incidence of acute myocardial infarction (AMI) has decreased in the Norwegian population. Immigrants born in South Asia and the Former Yugoslavia living in Norway have an increased risk of AMI compared to the Norwegian-born population. The trends in AMI incidence have not been studied among immigrant groups in Norway.

Aims: We aimed to study the trends of AMI among immigrants from South Asia and Former Yugoslavia living in Norway.

Methods: All incident AMIs were identified in people aged 35-79 years living in Norway during 1996-2019 using hospital and cause of death registry data in the NCDNOR project. A wash-out period of three years was used to identify incident events. Thus, cases were counted from 1999 onwards. We calculated yearly age standardized incidence rates using the direct standardization method and plotted their moving averages by gender and region of birth. We used Poisson regression to calculate the average annual change assuming linearity.

Preliminary results: For Norwegian-born men and women, the yearly rates revealed a steady decline throughout the study period with an average annual change of -3% in incident AMI events. For immigrants from South Asia and Former Yugoslavia, however, the rates did not show a similar decline. The AMI rates for South Asians and Former Yugoslavians were higher than for the Norwegian-born group. A linear trend based on Poisson regression was found in South Asian men with an average annual change of -1.5% (IRR for calendar year: 0.985, 95% CI 0.977-0.993). No significant trends were found in the other groups. There were few yearly cases for the immigrant groups resulting in rates with some uncertainty.

Conclusion: During 1999-2019, the high-risk ethnic groups from South Asia and Former Yugoslavia have not experienced the same beneficial decline in AMI incidence as of the Norwegian-born population.

J5

Higher education is associated with slower biological aging indexed by novel biomarker of cardiovascular aging based on electrocardiograms

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Introduction: A non-invasive, easy-to-use biomarker for cardiovascular aging based on electrocardiograms (ECG) was introduced with the help of deep learning algorithms. The resulting metric, heart delta age (HDA), calculated as a difference between the ECG-based heart age and the chronological age, was predictive of all-cause and cardiovascular disease (CVD) mortality. Thus, this biomarker has a potential to improve CVD risk assessment.

Aims: In this study we aim to assess the relationship between socioeconomic status, indexed by level of educational attainment, and heart delta age. Secondary aim is to estimate which part of this association is mediated by CVD risk factors.

Methods: The study sample consisted of 5017 participants of the Tromsø Study who took part in both Tromsø6 (2007-2008) and Tromsø7 (2015-2016) and obtained 12-lead electrocardiogram at Tromsø7. ECG-derived age was estimated using a previously developed convolutional neural network (CNN) trained on over 700,000 ECGs from the Mayo Clinic (Rochester, MN, USA). To analyse the relationship between education and HDA, total and sex specific linear regression models were employed. Causal mediation analysis (natural effects model) was used to test whether the former association is mediated by CVD risk factors measured at Tromsø6: body mass index, diastolic blood pressure, systolic blood pressure, low density lipoprotein cholesterol, high density lipoprotein cholesterol, diabetes, physical activity, and smoking. Multiple imputation was used for the statistical analysis.

Results: Our findings indicate an inverse association between education and HDA. Participants with the highest level of education (university/college for 4 or more years) had lower HDA: the beta coefficient from linear regression comparing with the primary education as a reference was -0.82 (95% CI: -1.33,-0.32) for the total sample, -1.31 (95% CI: -1.96,-0.66) for women and -0.21 (95% CI: -1.00,0.59) for men. CVD risk factors mediated 75% of the association between education and HDA among individuals with university/college education lasting less than 4 years, and 55% among individuals with university/ college education lasting more than 4 years.

Conclusions: Our study confirmed that CNN-derived biomarker of cardiovascular aging – heart delta age – shows a consistent pattern of associations with education and CVD risk factors similar to other established biomarkers of heart disease.

K: Mental health and clinical epidemiology

K1

Depression severity and life years lost

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Introduction: Previous studies have provided evidence for an increased mortality rate in major depressive disorder (MDD) compared with the general population. However, the largest epidemiological studies to date have only included individuals diagnosed with MDD in secondary health care, thus not covering the entire severity continuum of this highly heterogenous disorder.

Aims: To estimate mortality rates and life years lost across different severity levels of MDD compared with the general Norwegian population.

Methods: All Norwegians born between 1950 and 2000 were followed from 2008 to 2020. Individuals that were deceased or emigrated before 2008 were excluded from the study. The total sample included 3,4M individuals. We estimated hazard ratios (HR) for all-cause mortality with Cox proportional hazards models adjusting for sex and birth year decile. The models were stratified by levels of MDD severity indexed as 1: MDD diagnosis in primary care, 2: MDD diagnosis in out-patient clinic, and 3: MDD diagnosis in in-patient clinic. We further estimated life years lost and included treatment resistance based on prescription data as a severity measure of MDD.

Results: During follow-up, 307,779 individuals (7%) were diagnosed with MDD. Mortality in MDD was 3.3% compared to 1.9% among individuals without. The crude HR for MDD was estimated to 1.7 but increased to 1.9 after adjustment for birth year and sex. Mortality among males were approximately twice as high compared to females regardless of MDD status. Stratifications on levels of MDD severity showed that mortality was higher among MDD cases diagnosed in primary care or inpatient care. However, after adjustment for age at diagnosis, mortality was lowest in primary care, suggesting that this effect was driven by an elderly population in primary care. We will present preliminary results of life years lost and hypothesize that life years lost will follow a dose-response correlation with levels of MDD severity.

Conclusions: We hereby demonstrate that severity levels of MDD are reflected in a mortality continuum when compared with the general population. Our study further shows the usefulness of investigating health care utilization patterns in population-wide registry linkages to disentangle the heterogeneity of mental disorders such as MDD.

K2

The role of sex in presentation of ADHD symptoms in a clinical sample and the general Norwegian population

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Introduction: Individuals diagnosed with attention-deficit/hyperactivity disorder (ADHD) are found to be at the extreme end of a normal distribution of ADHD traits in the population. Although the overall prevalence of ADHD appears to be highest in males, females with ADHD typically report more impairing ADHD symptoms. The reasons for this apparent paradoxical phenomenon are poorly understood.

Aims: To investigate sex differences in ADHD symptoms between adolescents and adults with and without ADHD in three Norwegian cohorts.

Methods: We included data from the Mother, Father, and Child Cohort Study (MoBa) (N=90,554, 62.4% women), the youth@hordaland (y@h) (N= 10,257, 52.7% women), and the ADHD in Norwegian Adults (ANA) project (N=1,707, 55.1% women). The total score of self-reported Adult ADHD Self-Report Scale Screener (ASRS-6) was used as an outcome measure of ADHD symptoms. Linear regressions were used to analyse sex differences in mean levels of ASRS-6 (SD) between adults with and without self-reported ADHD diagnosis. Unstandardized regression coefficients with 95% confidence intervals (95% CI), adjusted for age, were reported.

Results: The ADHD symptoms followed a left-skewed normal distribution with a long right tail in all three cohorts independent of sex. The mean ASRS-6 scores were comparable across cohorts, but the younger women (y@h, mean age of 17.4 years) reported significantly higher levels of ADHD symptoms than the older women (MoBa/ANA controls/ANA cases, mean age of 31.7/29.3/34.1 years), overall ASRS-6 score of 10.1 (SD4.4) and 7.7 (SD3.7), respectively. We also found larger differences in mean ASRS-6 score between women with than without self-reported ADHD than in men in all three cohorts (Δwomen: b_{MoBa}=8.8 (8.7;9.0);$b_{y@h}$= 5.1 (4.0;6.2); $b_{ANA=}$ 8.6 (8.1;9.2); Δmen: b_{MoBa} 4.5 (3.7;5.2); $b_{y@h}$= 3.2 (2.1;4.2); b_{ANA}= 6.5 (5.9;7.2), respectively, all p<0.001).

Conclusions: The difference in reported ADHD symptoms between individuals with and without ADHD was greater in women than in men across several cohorts. This may support that women with ADHD experience more impairment with their ADHD symptoms than men do. Several possible explanations/interpretations will be discussed.

K3

A comprehensive exploration of comorbidity patterns between mental disorders and non-communicable somatic diseases

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Background: Individuals with mental disorders have been shown to be at increased risk for non-communicable diseases (NCD), such as cardiovascular diseases (CVDs), cancers, chronic respiratory diseases (CRD) and diabetes. At the same time, undertreatment of somatic diseases in individuals with severe mental disorders has been reported. The combination of an increased risk and undertreatment would contribute to increased mortality, which could explain why this group has not seen the decrease in mortality from NCDs observed in the general population. Disentangling these complex relationships warrants a thorough investigation including all relevant sources of health metrics.

Aim: To estimate the associations between mental disorders and somatic NCDs, using one of the hitherto most complete nationwide registry linkages of health registries.

Methods: We use a population-based cohort from Norwegian national registries including data on all individuals born in Norway with follow-up time from 2008 to 2019. We assess 4 broad types of mental disorders (psychotic, neurotic, affective and substance related disorders) and 4 categories of somatic NCDs (CVD, cancers, CRD, diabetes). We include information from primary and secondary health care, the national prescription registry, cause of death registry and sociodemographic variables. We use Cox regression models to calculate hazard ratios for pairs of mental disorders and somatic NCDs, adjusted for age, sex and stratified by socioeconomic status. Moreover, we compare comorbidity estimates with mortality estimates to assess the potential undertreatment of somatic diseases in individuals with severe mental disorders.

Results: We will present preliminary data on associations between mental disorders and groups of somatic NCDs. We hypothesize that mental disorders will be associated with the risk of developing CVD, COPD and diabetes, as previously shown. Further, we expect that the risk of these NCDs will increase with increasing severity of the mental disorders. When comparing mortality estimates with morbidity estimates, we hypothesize to find a discrepancy for the most severe mental disorders.

Conclusion: We expect that the findings will indicate a complex relationship where increased risk and undertreatment at the same time pose challenges which need to be addressed at different levels by clinicians as well as health policy makers.

K4

Studying the epidemiology of depressive disorders using central health registries in a Nordic setting – the NCDNOR project

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Introduction: Mental health problems in general and especially major depression (MD) are common and an important public health issue. To follow trends in prevalence of MD is challenging. Diagnose based general population surveys and even population-based health surveys are self-reports are costly. In Norway, however, we have regularly updated central health registries covering the total population.

Aim: to investigate how well central health registries capture MD in the population.

Methods: Two waves of two Norwegian regional population-based health surveys with self-report on mental health were linked to data from three central health registries capturing contacts with primary health care, specialized health care or prescriptions filled for antidepressants.

Results: Most responders scored low on Hopkins Symptom Checklist (HSCL) and the Hospital Anxiety and Depression Scale (HADS) with around 10% and 13 % scoring above the set cut-off, with only minor changes between the two survey times. Women scored higher than men, older scored lower than younger and a those with lower socioeconomic status reported more symptoms. Increasing score on either scale increased the probability of appearing with a diagnosis of major depression or a prescription for antidepressants in central health registries. Around 12 % of those scoring above cut-off on either scale were represented in the central health registries, more so in primary health care followed by the prescription data base and least in specialized health care. Women compared to men and younger compared to older persons were more often represented in central health registries.

Conclusion: This study indicates that despite low sensitivity of the central health registries in capturing MD, a combination of the three registries may give an indication in the prevalence of and development of MD in the general population.

K5

The Manipulation of Birth Timing and a Novel Approach to School Starting Age and ADHD

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Introduction: Children born before the cutoff date for primary school entry are often up to 11 months younger than the oldest child in their class. This is associated with poor school performance and worse mental health, including increased ADHD diagnoses. Little is known however, how this differs by socioeconomic status and whether there is a "double disadvantage" of ADHD and young relative age on school performance.

Aims: To examine the causal effect of being born after the school entry cutoff, therefore the relatively oldest, on school performance and ADHD, and the potential "double disadvantage" of ADHD and young school starting age (SSA).

Methods: Utilizing a regression discontinuity approach and Norwegian register data with exact dates of birth, I examined the causal effect of being born just before or just after January 1st on receiving a diagnosis for ADHD, anxiety, and depression as well as future school performance. Additionally, I examine how the effect of SSA varies by gender, and socioeconomic status, and the possible "double disadvantage" of young SSA and ADHD on school performance.

Results: Being born after the school entry cutoff, and therefore the relatively oldest, resulted in a 35% decreased risk of receiving an ADHD diagnosis and a 0.18 standard deviation increase in GPA. Furthermore, among girls, the additional penalty of an ADHD diagnosis on GPA for the relatively youngest was 24.4% of a standard deviation. The additional penalty for the relatively youngest students is also concentrated among those with lower educated parents.

Conclusions: This is the first study to examine the potential "double disadvantage" of both SSA and ADHD diagnosis, as well as how this varies by gender and parental education. Results show that relatively young girls experience a statistically significant additional penalty of ADHD on school performance compared to relatively older girls. Additionally, relatively young children of less educated parents experience a larger additional penalty of ADHD diagnosis on GPA than relatively young children of higher educated parents. This paper highlights an especially vulnerable group of children with both a young relative age and an ADHD diagnosis, and particularly those which are from less advantaged backgrounds.

L: Genetic, education and lifestyle

L1

External validation of prognostic and predictive gene signatures in head and neck cancer patients

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Introduction: Head and neck carcinomas (HNC) are aggressive and heterogenous tumors with a high fatality rate, raising a need for personalized treatment. Gene signatures are biomarkers that are associated with general disease prognosis ("prognostic signatures") or with disease outcomes under specific therapy ("predictive signatures"). Independent external validation of signatures is needed before clinical use.

Aims: We aimed to validate two prognostic and three predictive gene signatures in a large cohort of HNC patients where data was prospectively collected from multiple institutions across Europe.

Methods: A total of 1097 HNC patients were recruited over 20 years and RNA was extracted from the primary tumor of each patient prior to treatment. Patients were followed for up to 20 years with clinical outcomes recorded during follow-ups. Recently, gene expression from each patient was measured and used to estimate signature scores for 5 gene signatures. We used Cox proportional hazard models to test the association between survival outcomes and the signature scores, while including clinical covariates in the model. When testing the validity of predictive signatures, we also tested for an interaction between the received treatment and the signature score, using received treatment as a proxy for intended treatment.

Results: Two potentially prognostic signatures, developed for predicting prognosis in cancers that are either positive or negative for human papillomavirus (HPV), were associated with survival and were therefore validated as prognostic. A potentially predictive signature related to radiosensitivity was tested but was only validated as prognostic because the signature score was associated with survival across all treatments, not only in patients receiving radiotherapy. Lastly, two potentially predictive signatures related to chemosensitivity were tested: one signature showed no association with survival and could therefore not be validated as either prognostic or predictive. The final signature was positively associated with survival in patients receiving chemotherapy and negatively associated with survival in patients that did not receive chemotherapy, and could therefore be validated as a predictive signature for chemotherapy treatment.

Conclusions: Using a large cohort of HNC patients were we able to independently validate 4 of 5 tested gene signatures, three as prognostic signatures and one as predictive.

L2

Family-based methods for identifying genes implicated in infertility and fetal viability

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Introduction: Infertility may be associated with a genetic incompatibility within the couple that interferes with their ability to conceive. Alternatively, the combination of specific parental alleles inherited by the offspring may be incompatible with early fetal viability. If the latter is the case, a plausible hypothesis is that assisted reproductive technology (ART) might enhance embryonic survival in the earlier stages of pregnancy. Consequently, the distribution of alleles in children conceived by ART might differ from that in naturally conceived (non-ART) children.

Aims: Our study aims to help decipher the genetic mechanisms underlying infertility. Our objectives include describing and comparing various statistical methods and models, focusing both on allele combinations in the parents as well as in their offspring.

Methods: We analyzed genotype data from more than 18,000 family triads and dyads from the Norwegian Mother, Father, and Child Cohort Study (MoBa). Of these, around 1,300 children were conceived using ART. Interaction effects between parental alleles in couples using ART were modeled using various parameterizations. We examined allele distributions in ART-conceived children by estimating fetal, maternal, and parent-of-origin (PoO) effects associated with ART by applying family-based log-linear models implemented in the R package Haplin.

Results: Our findings suggest potential associations between parental allele combinations and use of ART. Specifically, we identified a few near-significant parental allelic interaction effects in relevant genes, such as *DNAH17*. Results from the analyses performed using Haplin indicated shifts in allele distributions for ART-conceived children, pinpointing several fetal, maternal, or PoO effects. We found associations with genes that are highly relevant for the phenotype under study. These include *MMP27* which is linked to recurrent pregnancy loss and thus fetal viability, *HTR1D* which is linked to disruptions in placental serotonin pathway, leading to human fetal growth restriction, and *DYNLRB2*, a potential biomarker for non-obstructive azoospermia.

Conclusions: We identified a handful of genes that were relevant for the phenotype under study. The genetic associations point to several plausible biological mechanisms that may influence early fetal viability. As is customary with single-cohort analyses, further replications would be necessary in other similar pregnancy cohorts to confirm our findings.

L3

Piloting development and integration of "hands on" epidemiological research projects into the curriculum within health professional and public health study programs – students and academic staff co-creation

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Introduction: To create new innovative epidemiological research projects designed to be integrated in the learning process for bachelor/master students are not made explicit in curricula planning or based on academic or pedagogical considerations. Undertaking research projects in student-teacher partnership is a relatively new and not widespread activity in higher education contexts. Co-creation in teaching, learning and research can impact students' belonging, mattering, and learning cultivating the student-teacher relationship.

Aims: To explore the implementation of integrating epidemiological research projects in teaching activities in co-creation with students. Secondly, to develop learning resources to be implemented in the curriculum and used in classroom settings and the learning management system.

Methods: We arranged workshops with students to identify research topics of interest. Based on topics we collaborated with students and teachers in biomedical laboratory science, clinical nutrition, public health, and medicine to develop research protocols and integrate it into the students' activities to fit the classroom activities. We developed and conducted four pilot studies. Finally, students wrote thesis at bachelor and master level and prepared scientific publications together with researchers.

Results: Research fields identified were concentrated on well-being as students. This resulted in a study of the mental health trajectories during the covid-19 pandemic and use of apps and involved students from master in public health. Another study explored the effect of coffee on the cholesterol levels and involved students from three study programs. The third study is ongoing and aim to explore different methods to measure stress among students, via hair cortisol levels, self-report of perceived stress, and qualitative interviews. Lastly, an ongoing pilot study on how first year's students learn to learn in higher education is conducted with an intervention aiming to support students develop and use effective learning strategies.

Conclusions: Undertaking research projects in student-teacher partnership is a demanding process that requires massive planning and logistics to conduct within the curriculum design. On the other hand, building on the co-creation, it builds and sustain relationship-rich education that have the potential to strengthen students' wellbeing and learning in higher education, together with development of pedagogical considerations for educators that includes student involvement.

L4

Fit Futures – lifestyle and health in the transition from adolescence to adulthood

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Introduction: Non-communicable and chronic diseases pose a major challenge for the healthcare system. Previous studies have shown that conditions early in life can predict the risk of developing chronic diseases later in life. Updated knowledge about the development of risk factors and health status in the transition from youth to adulthood is scarce.

Aims: The aim of this longitudinal study is to examine effects of changes in lifestyle, health related behavior and markers of health in a Norwegian cohort of youths and contribute to the knowledge base for the development of effective preventive measures and recommendations about lifestyle and health behavior.

Methods: The Fit Futures Study (FF) is a population-based cohort study following girls and boys from adolescence into adulthood. The participants were examined at median age 16 years (FF1, 2010/2011), 18 years (FF2, 2012/2013) and 27 years (FF3, 2021/2022). A total of 1038 adolescents (51% boys) participated in the first wave (response: 93%). In FF2, 868 participated (77%), and in FF3, 705 participated (61%). In all three surveys a broad range of data from questionnaires, clinical examinations, blood- and other biological samples, DXA-scans, oral health examinations and pain sensitivity tests were collected. In FF3, relevant questions on reproductive health, family planning and semen sampling were added.

Results: Results from FF1 and FF2 revealed new associations between lifestyle factors and health that will be followed up with data from FF3. Preliminary results from FF3 show that 6% of women and 7% of men rate their own health as bad/very bad and 41% of women and 36% of men report suffering from chronic pain. Significantly more women (61%) than men (39%) report to have a chronic disease. The prevalence of obesity has increased significantly in the cohort; 5% and 7% of girls, 4% and 8% of boys had obesity in FF1 and FF2, respectively. In FF3 20% of women and 17% of men have obesity.

Conclusions: FF3 brings new and updated information of the health status in a Norwegian cohort of young adults. The Fit Futures study is a relevant data source, now available, for a broad spectrum of research projects.

L5

About cilia, alcohol, and microbes

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Introduction: The throat and the respiratory tract have a protective lining of epithelial cilia. Food, drink, and genetics influence the cilia and the oral microbiome.

Aim: To discuss the age gradient observed in COVID-19, and the function of the cilia. Present results on the role of alcohol drinking versus the number of tooth extractions and the risk of cardiovascular disease (CVD).

Methods: This review presents studies exploring the functionality of cilia in relation to age, genetic disorders, and alcohol. The Oslo II study on elderly men provided data on oral health such as tooth extraction, chronic periodontitis, and alcohol.

Results: Cilia are tiny motile filaments of the respiratory epithelium. The epithelial cells are tapered towards the lumen and each cell has as many as 200-300 cilia on the luminal surface. The function of cilia together with the mucous produced by the goblet cells is to move debris, bacteria, viruses etc. up and out of the throat. The functionality and number decrease with age and with certain genetic conditions. This is shown in an observational study of participants aged 6 months to 43 years. Alcohol reduces the cilia movements. Alcohol is also bactericidal and potentially reduces the number of bacteria in the throat. In the Oslo II study regular alcohol drinking (drinking 4-7 times per week) was found to be independent of the risk of the number of tooth extractions for CVD mortality. This complies with the previously published J-curve for the distribution of cardiovascular disease mortality by the level of alcohol drinking.

Conclusions: Alcohol reduces the effect of cilia temporarily and has an antibacterial effect on the oral microbiome. Observational studies of the normal function of the body such as the age-gradient of the cilia provide relevant and meaningful references when studying disease.

M: Poster presentations

M1

Associations between self-rated health and mortality in the Norwegian Women and Cancer study

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Introduction: Self-rated health (SRH) is associated with mortality in numerous population-based health studies.

Aims: To investigate the association between baseline SRH and all-cause mortality in the full cohort of the Norwegian Women and Cancer (NOWAC) study, as well as the association between baseline SRH and 1) cancer risk in the full cohort, and 2) all-cause mortality in subgroups of women who did and did not receive a cancer diagnosis during follow-up.

Methods: We used prospective data from 110 104 women in the NOWAC study who were aged 41-70 years at baseline. The association between baseline SRH and all-cause mortality in the full cohort was investigated using flexible parametric survival analysis with restricted cubic splines to calculate hazard ratios (HRs) and 95% confidence intervals (CIs). The association between baseline SRH and 1) cancer risk in the full cohort, and 2) all-cause mortality in subgroups of women who did and did not receive a cancer diagnosis during follow-up was assessed using multistate survival analysis modelling baseline SRH to allow for a time-dependent effect.

Results: Median age at the end of follow-up was 68 years, and median age at cancer diagnosis was 62 years. Baseline SRH was associated with all-cause mortality in the full cohort. Baseline SRH was also associated with cancer risk in the full cohort. Poor baseline SRH was associated with all-cause mortality in the subgroup of women who received a cancer diagnosis, and baseline SRH showed a strong association with mortality in the subgroup of women who did not receive a cancer diagnosis.

Conclusions: Baseline SRH predicted cancer risk and all-cause mortality in our middle- to older aged women. The association between baseline SRH and all-cause mortality during follow-up was stronger for women who did receive a cancer diagnosis for those who did not. Our results suggests that SRH is a useful instrument in epidemiological studies of cancer, and it may be useful to healthcare providers as an assessment of a patient's overall health.

M2

Associations of adverse childhood experiences with caries and toothbrushing in adolescents. The Young-HUNT4 Survey

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Background: Adverse childhood experiences (ACEs) are associated with poor oral health. This study explored the associations of specific and cumulative ACEs with caries and toothbrushing frequency in a Norwegian adolescent population.

Methods: Participants were adolescents (n = 6351) age 13–17 years from The Young-HUNT4 Survey. Clinical data were retrieved from dental health records. Oral health outcomes were toothbrushing frequency, dentine caries experience (Decayed, Missing and Filled Teeth – DMFT), and enamel caries. ACE exposure variables were physical abuse, sexual abuse, witness to violence, parental separation, parental alcohol problems, and bully victimization. Negative binominal regression models (incident rate ratios, IRRs; 95% confidence intervals, CIs) were used to determine the associations of the various ACEs with caries; logistic regression analyses (odds ratios, ORs; 95% CIs) were used to estimate associations with toothbrushing frequency. Potential effect modification by age was assessed with the likelihood ratio test.

Results: Adolescents exposed to physical abuse by others, sexual abuse by peers, parental separation, bullying, or who had witnessed violence, were more likely to report non-daily toothbrushing compared with those with no exposure to the given ACEs. Each cumulative increase in ACE exposure was associated with a 30% higher likelihood of non-daily toothbrushing (OR 1.30, 95% CI 1.19–1.42). Similarly, increasing number of adversities were associated with both higher dentine caries experience (IRR 1.06, 95% CI 1.02–1.09) and higher enamel caries (IRR 1.07, 95% CI 1.03–1.11). This effect was modified by age (13-15 vs. 16-17 years) for dentine caries experience. Furthermore, we found evidence of effect modification by age with bully victimization for both toothbrushing frequency ($P_{interaction} = 0.014$) and dentine caries experience ($P_{interaction} < 0.001$). Specifically, bully victimization was associated with a higher likelihood of non-daily toothbrushing (OR 2.59, 95% CI 1.80–3.72) and higher dentine caries experience (IRR 1.30, 95% CI 1.14–1.50) among 16–17-year-olds.

Conclusions: Several specific ACEs were associated with non-daily toothbrushing and a higher caries experience among Norwegian adolescents in the Young-HUNT4 Survey.

M3

Drug-related readmissions of elderly to hospitals

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Background: Elderly have a higher risk of drug-related readmission due to complex medication regimens. Therefore, effective medicine management is crucial to minimize harm. The IMMENSE study tested this where pharmacists were a part of the interdisciplinary team in geriatric wards. Different methods exist to decide whether readmissions are drug-related. In a previous study the AT-HARM10-tool assessed 22.3% (n=50) of the 224 readmissions as possibly drug-related.

Objectives: The aim of this study was to validate and grade the readmissions, previously assessed as possibly drug-related by the AT-HARM10-tool.

Methods: We randomly selected 20 patient cases from the AT-HARM10 selection; 16 were assessed as possible, and four as unlikely drug-related readmissions. Relevant data from the first admission and readmission were collected from study and patient records, forming standard patient case reports. An expert group consisting of 15 experienced doctors and pharmacists used a WHO-UMC-inspired ranking system. We applied a Delphi agreement-method with two rounds. Consensus was calculated by Kendall's concordance coefficient.

Results: After completing two rounds, three patient cases were assessed as unlikely, six as possible, 9=probable, and two cases were assessed as certainly drug-related readmissions. The expert group's degree of agreement was strong. Of the four patient cases assessed as unlikely drug-related by AT-HARM10-tool, two were assessed as possible and probable, by the expert group. And one of the possible cases were assessed as unlikely.

Conclusions: In this study, we have validated and graded 30% (n=15) of the 50 possible readmissions to be possible, probable, or certainly drug-related readmissions to hospital.

M4

Consequences of the corona pandemic – studies of sequel after infection, side effects of vaccination and immune response using four Norwegian cohorts

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Introduction: The Norwegian institute of Public Health (NIPH) established the project in 2020, recruiting participants from two existing cohorts: The Norwegian Mother, Father and Child Cohort Study (MoBa) and the Norwegian Influenza Cohort (NorFlu) in March 2020. The Senior cohort was established in December 2020 whereas the Young Adult Cohort in spring 2021. The participants are between 12-82 years old.

Aims: The purpose of the project is to understand the consequences of the corona pandemic in Norway by:

1. Follow people in the cohorts who have been infected by coronavirus, in order to describe and understand any consequences for somatic and mental health, but also to recount intermediate social factors that have health implications, such as loss of work and/or loss of schooling.
2. Follow people in the cohorts to describe the immune response before and after infection as well as before and after vaccination.
3. Follow people in the cohorts to understand the side effects of vaccination.

Methods: Blood-samples and self-reported questionnaire data were collected from all four cohorts. Since March 2020, 55 electronic questionnaires have been sent via SMS to MoBa and NorFlu participants. Since May 2021, 12 electronic questionnaires have been sent via SMS and e-mail to the Senior cohort. Finally, since September 2021, 15 questionnaires have been sent to the Young Adult cohort via SMS. Blood samples from more than 10 000 MoBa and NorFlu participants were collected in 2020 and 2021 for antibody analyses. In addition, PBMC's (peripheral blood mononuclear cells) were collected from NorFlu, Young Adult and, Senior cohort participants for analyses of cellular immunity. All data is collected in NIPH's databases, and a wide range of researchers are active in the analyses. Studies of immune response are carried out at laboratories at NIPH, and at Oslo University Hospital. Linkage to Norwegian Surveillance Systems for Communicable Diseases (MSIS) and Norwegian Immunization Registry (SYSVAK) is used to relate blood test results and questionnaire data to information bearing on infection and vaccination. Adherence, vaccine failure, and side effects will be recorded from questionnaires, and, partly from links to disease registries such as the Norwegian Patient Registry (NPR) and the Norwegian Control and Payment of Health Reimbursements Database (KUHR).

Results: Between 70 000-100 000 participants answer the questionnaires each time. During the pandemic, cohort data provided running information on seroprevalence, symptoms, severity of disease and testing for SARS-CoV-2, adherence to governmental recommendations, work situation, life satisfaction, mental health, vaccination and adverse events following vaccination. In long term follow-up, special attention has so far been paid to vaccine effectiveness, long covid, chronic headaches and bleeding disturbances following vaccination. Seroprevalence- and immune data have been analyzed in studies of humoral and cellular immune responses to SARS-CoV-2 vaccines and Omicron breakthrough infections. To this point, more than 20 peer reviewed COVID-19 articles based on the NIPH-cohorts have been published.

Conclusion: The cohort data gives a unique opportunity to study the consequences of the corona pandemic, for years to come. The large advantage lies in the ability to collect detailed information that is not covered in national registers. As an example, we use standardized questions regarding post exertional malaise (PEM) in several questionnaires over time. Combining cohort data, registry data and blood samples from the same individuals offer unique research possibilities. We currently plan to carry out a whole-genome methylation analysis of 600 of the 10,000 samples that were collected before infection in 2020, to investigate whether the methylation pattern can predict the development of long COVID. For the coming year, we also plan, in collaboration with Oslo University Hospital (OUS), to do analysis of markers in plasma samples as to understand the causes of development of long COVID.

M5

Registry tool for stroke prevention in atrial fibrillation in Norway – RegTool AFNOR

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Introduction: Atrial fibrillation is an important risk factor for stroke. Anticoagulant treatment reduces the risk substantially but may also lead to haemorrhagic complications. The recommended approach is to balance the risk of stroke against the risk of bleeding when deciding between anticoagulant treatment or not. It remains challenging for medical doctors to keep track of how stroke risk changes over time in atrial fibrillation patients.

Aims: To identify targets and tools to improve timeliness and effectiveness of stroke prevention in atrial fibrillation patients.

Methods: The project is a collaboration between researchers in epidemiology, statistics and health economics and user-collaborators including the patient organization National Association of Heart and Lung Diseases (LHL) Stroke and Aphasia, and general practitioners in the Practice Consultant Collaboration, Vestre Viken Hospital Trust. In addition, the collaboration includes user representatives from the Centre for Quality Improvement in Medical Practices (SKIL) and the Directorate of e-Health. Based on health information from national registries, we will develop a personalized risk scoring tool to assess individual risk of stroke in patients with atrial fibrillation dynamically over time, as risk changes with increasing age and comorbidity.

Results: Anticipated results include assessment of whether certain characteristics of patient pathways may lead to hospital admission for stroke in atrial fibrillation patients. Further, we will investigate whether there are differences in the use of health services for different groups of patients with atrial fibrillation, in order to identify groups that may need more targeted preventive measures. Finally, we will investigate whether a registry-based tool for stroke risk has the potential to guide and improve clinical decisions for stroke prevention in patients with atrial fibrillation. Anticipated impact of the project includes contribution to the generation of innovative registry-based tools that can be used as decision support by general practitioners within the framework of existing electronic patient records. This includes exploration of whether patients themselves can benefit from access to such information.

Conclusions: The project will gain new knowledge on whether a personalized register-based risk scoring tool can guide and improve clinical decision-making for prevention of stroke in clinical practice.

M6

Placental outcomes and birthweight to placental weight ratio after mRNA COVID-19 vaccination during pregnancy: a target trial emulation approach

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Introduction: COVID-19 vaccination appears to be not only safe but also beneficial to both the pregnant mother and their offspring. However, safety data were limited during the first trimester and are lacking for placenta outcomes.

Objective: To evaluate the association of complete mRNA COVID-19 vaccination, during pregnancy, compared with no vaccination, on placental outcomes (Placental weight (low/high), birthweight to placental weight ratio (Bw/Pw), and small-for-gestational-age (SGA)).

Methods: We conducted target trial emulation of a population-based registry-linkage in Norway between January 1st and December 31st, 2021. About 50 537 pregnant women in Norway aged 18-50 who gave birth in 2021 were eligible. Inverse probability time weighting is used to achieve the assumption of conditional exchangeability at baseline. The Marginal causal effects are estimated as weighted averages of conditional effects using Cox proportional-hazards model.

Results: During preconception and early pregnancy (i.e., four weeks before and after the Last Menstrual Period (LMP)) increased risks were observed for low placental weight (HR=1.83, 95% CI: 1.14-2.95; HR=1.89, 95% CI: 1.24-2.87), high Bw/Pw (HR=1.28, 95% CI: 0.67-2.46; HR=2.41, 95% CI: 1.57-3.71), and SGA (HR=2.31, 95% CI: 1.31-4.08; HR=1.49, 95% CI: 0.80-2.77), respectively. During the second trimester, a gradually decreasing trend of risks in four-week intervals, approaching the null towards the end of the second trimester were observed for low placenta weight (HR from 2.29-1.12), high placental weight (HR from 1.69 to 0.98), low Bw/Pw (HR from 1.78 to 1.10), and for SGA (HR from 3.38 to 1.43). In terms of absolute risk, risk decreased more substantially for low placenta weight (17% to 1.6%) and SGA (17% to 3.1%) compared to high placental weight and low/ high Bw/Pw (8% to nearly zero). No association were observed from the last four weeks of the 2nd trimester through delivery for all outcomes, except SGA on week 33-36 (HR=0.53, 95% CI: 0.37-0.76).

Conclusion: There was no increased risk for placental weight in most of the second and third trimesters, but vaccinations before and within four weeks post LMP may be associated with lower placenta weight.

M7

COVID-19 Vaccine Uptake by Pregnant Women in Norway: A Descriptive Analysis

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Introduction: The COVID-19 vaccines were authorized based efficacy and safety data from clinical trials which did not include pregnant women, leading to hesitancy amongst both authorities and the general pregnant population initially. The uptake by pregnant women in 2021-2022 is still uncertain, and the factors that influence their decision to vaccinate are not well understood.

Aims: To describe the uptake of COVID-19 vaccine amongst pregnant women in Norway and to identify the maternal characteristics associated with COVID-19 vaccine uptake, specifically in the period after a recommendation for vaccination of pregnant women was issued by the Norwegian authorities.

Methods: A descriptive analysis study design was used including all pregnant women with a delivery date for the period between 1 Jan – 31 Dec 2022, with stratification by the period before or after the date 18th August 2021, when the Norwegian health authority revised the general recommendation for pregnant women to get vaccinated. Univariate and multivariate logistic regression was used to investigate associations.

Results: Among pregnant women who gave birth between Aug 18 and Dec 31st, 2021, the majority (n=11,678, 67.7%) did not take any vaccine dose. The uptake of COVID-19 vaccine was three times higher in 2022 than in the prior year. Belonging to the moderate/high underlying risk factor group for vaccine prioritization in Norway, was not related to vaccine uptake amongst this population. Being employed (Odds Ratio (OR)= 1.43, 95% Confidence Interval (CI) 1.23-1.67), with higher education (OR= 2.02, 95% CI 1.77-2.31), and being born in Scandinavia (OR= 2.63, 95% CI 2.31-3.00) were positively associated with COVID-19 vaccine uptake, relative to their counterparts.

Conclusion: Vaccine uptake amongst pregnant women in Norway was low after the Norwegian authorities issued positive recommendations for vaccination in August 2021; the vaccination uptake increased substantially in the year 2022. Demographic factors such as being born in Scandinavia, having higher education, being employed and being in the second or third trimester were associated with greater vaccine uptake amongst pregnant women in Norway. It is important for policy makers and health authorities to know their population and tailor their vaccination campaign accordingly.

M8

Mortality from amyotrophic lateral sclerosis (ALS) in a cohort of 40 000 Norwegian military veterans from international operations

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Introduction: Amyotrophic lateral sclerosis (ALS) is a progressive, degenerative neurological disease. It is the most common of the diseases in the group of motor neuron diseases (code G12.2, International Classification of Diseases, 10th revision), but still very rare. The disease has rapid progression, as only half of the patients live longer than 3 years. Several studies have found a connection between general military service and ALS, and findings indicate that veterans who have served in conflict zones have a higher incidence of ALS than other military personnel.

Aims: To investigate mortality from ALS and total mortality in a cohort of 40 000 male military veterans who served in international operations in conflict areas from 1978 to 2021. The cohort was established by the Norwegian Armed Forces Health Registry.

Materials and Methods: We followed cohort members from their first deployment to international operations through 2021. Standardized mortality ratios (SMRs) with 95% confidence intervals (CIs) by comparing the observed number of deaths in our cohort with the expected number in the general Norwegian male population.

Results: A total of 2725 deaths were observed, from which 21 were due to ALS. The SMR for total mortality was 0.88 and lower than expected (95% CI 0.85–0.92). On the other hand, the risk of dying from ALS was 24% higher than expected, but this estimate was not statistically significant (SMR=1.24, 95% CI 0.76–1.89).

Conclusions: Military veterans from international operations showed lower than expected total mortality, in line with a "healthy soldier effect". A small increase in ALS-mortality was seen, but we need more statistical power and/or a different approach such as using a cohort of non-deployed military personnel as reference population, to see if their service in conflict zones was associated with increased risk of ALS.

M9

Preterm preeclampsia and long-term maternal mortality due to cancer: Norwegian population-based cohort

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Introduction: A growing body of evidence suggests an association between obstetric events and long-term morbidity and mortality of mothers due to cancer.

Material and methods: Data was obtained from the Medical Birth Registry of Norway between 1967 and 2020 linked with the Cause of Death Registry and the Educational Database at Statistics Norway. The exposure was parity-specific complications—Preeclampsia and Preterm during pregnancy. The outcome was long-term death due to cancer between 40 and 69 years. Hazard ratios (HR) with a 95% confidence interval (CI) for CVD mortality were calculated by Cox-proportional regression adjusted for age, year of first birth, maternal education, and mothers' country of birth.

Results: Compared to mothers with one lifetime pregnancy, have an affected pregnancy was associated with a higher risk of maternal mortality due to cancer between 40 and 69 years (aHR 1.30, 95%CI 1.00-1.68) within the same stratum (reference category). However, in mothers with two and more affected pregnancies, the risk of mortality due to cancer within the same stratum was aHR 0.90 (95%CI 0.77-1.06).

Conclusion: Parity-specific complications were associated with a higher risk of maternal mortality due to cancer for mothers with one lifetime pregnancy, aged between 40 and 69 years, compared to mothers without complications within the same stratum. The results of this study highlight that parity should be considered while assessing preterm preeclampsia during pregnancy as a risk factor for long-term maternal mortality due to cancer.

M10

Family history of cardiovascular disease and parental risk factor profile – an association modified by experiencing a perinatal loss

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Introduction: There is little knowledge about the relation between paternal health characteristics and adverse pregnancy outcomes. There is also little knowledge about how adverse pregnancy outcomes may influence fathers' future health characteristics. Further, family history of coronary heart disease (CHD) is associated with fathers' health characteristics.

Aims: This study aimed at i) exploring the association between family history of premature coronary heart disease (FHpCHD) and paternal CHD risk factor profile and ii) investigate whether such association is modified by experiencing a perinatal loss (pregnancy losses from 16 gestational weeks and deaths within first month).

Methods: Information on hypertension, diabetes mellitus (DM), smoking, body mass index (BMI) and cholesterol as well as FHpCHD, was obtained from population health surveys (HS) conducted in Norway, 1974-2003. Information on fetal and neonatal loss was obtained from the Medical Birth Registry of Norway. Age-adjusted linear, logistic and multinomial regression models were used. Analyses were stratified as HS before and after childbirth.

Results: 524,282 pregnancies were analyzed. In 64,337 (12.3%) of pregnancies, fathers reported FHpCHD. HS participation was before childbirth in 10.8% of cases and after in 89.2%.

HS before childbirth: Fathers with FHpCHD had higher cholesterol levels (0.26 mg/dL[95% CI: 0.19; 0.34]), BMI (0.16 kg/m^2; [0.06; 0.27]) and higher risk of hypertension (OR=1.23; [1.15; 1.32]), DM (OR=1.30; [1.06; 1.60]) and being a smoker (RRR=1.44; [1.33; 1.56]) compared to fathers without FHpIHD.

HS after childbirth: For fathers without a perinatal loss, we observed higher levels of risk factors (except for DM) among fathers with than without FHpCHD. Among fathers who had experienced a perinatal loss, risk of hypertension, DM or being a smoker did no longer differ between those with and without FHpCHD, whereas FHpCHD was still associated with cholesterol levels and BMI, outcomes that may be more related to genetic factors.

Conclusion: Fathers with FHpCHD had higher levels of CHD risk factors compared to those without FHpCHD but among fathers who had experienced a perinatal loss, FHpCHD was no longer associated with hypertension,DM and smoking habits.

M11

Family support and 28-day mortality after hospital admission of 658,814 cardiovascular disease patients: a population-based-cohort study

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Background: Social support is associated with health outcomes among its recipients, but little is known about whether the different levels of familial support would be related to short-term mortality following the initial cardiovascular disease (CVD) admission.

Methods: Norwegian CVD patients (n=658,814) hospitalized between 1994 and 2009 ($\geq$ 30 years old) were included in a prospective cohort study. Using national databases and censuses, we operationalized family support as geographical distance to a first-degree relative ($\geq$ 18 years old) residing closest, the number of first-degree relatives (FDRs), and the marital status of patients at the year of their admission. Using Cox proportional hazards models, we assessed the relationship between family support and all-cause mortality within 28 days following the admission, adjusting for sociodemographic and clinical risk factors.

Results: 43,532 (6.6%) patients died within 28 days after admission. In a fully adjusted model, living in the same house/immediate neighborhood as a FDR was not associated with lower mortality. However, those with fewer FDRs had approximately 30% higher risk of mortality (1–3 FDRs & 0km HR: 1.31, 95%CI: 1.26–1.36; 1–3 FDRs & $\leq$30km: 1.34, 1.29–1.39; 1–3 FDRs & >30km: 1.34, 1.29–1.42) in comparison to the most favorable (reference) group—those having 4+ FDRs and living in the same basic unit with an FDR. Those without any FDRs had 50% higher mortality (1.51, 1.46–1.58) compared to the reference. Those divorced/separated/widowed (1.16, 1.14–1.19) and unmarried (1.30, 1.26 –1.35) were at increased risk of mortality compared to those married. In sub-analyses stratified by patient age and CVD types, having fewer (1–3) or no FDRs and being unmarried consistently were associated with higher mortality. Closer proximity appeared to be protective only for younger patients admitted $\leq$ 65 years old.

Conclusion: Family support was associated with reduced all-cause mortality within 28 days following initial CVD admission, adjusting for sociodemographic, clinical, and CVD risk factor covariates. These findings provide evidence for the crucial role of family support in the early survival outcomes of CVD patients.

M12

Snus use in the military – trends and habits. Is there a potential for prevention?

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Introduction: In Norway, the decline in smoking was followed by increased use of snus. Snus use is even more widespread in military population. Snus is associated with several health hazards and its' addiction is of extra concern in military settings, for example when soldiers operate in cold climate with a high risk of frost injuries. The Armed Forces is responsible for the soldier's health and must ensure that they do not establish unhealthy habits during military service. Still, preventive initiatives have been few and hampered by lack of data.

Aims: To describe prevalence trends of snus use in military personnel.

Methods: Information about snus use in military personnel was retrieved from the Armed Forces' health surveys 2003-2023, and from recruits doing basic military training in 2022. Trends were visualized in age groups together with trends in the civilian population, using data from Statistics Norway. Descriptive analyses compared snus use between sex and age-groups, and between home, military camp and field situations.

Results: Snus use in the military increased steadily from 2003 to 2023. The proportion of military staff who used snus was clearly higher than among civilians. The highest yearly prevalence was seen among military men aged 19-24 in 2011, reaching 45%. But then, the trends in the youngest age-groups decreased and/or stabilized towards the end of the period. In 2023, respectively 33% and 22% of the military men and women aged 25-34 used snus, this was similar to civilian levels. Mean con sumption was 14.6 boxes/month (12.3 boxes/month in military women), snus consumption correlated negatively with increasing age. Among 2226 recruits in basic military training, 20% said that they used snus daily at home, 23% used snus in the military camp, and 24% used snus in a military field situation. Among those who used snus daily in the military camp, 23% had started after enrollment.

Conclusions: Snus use is more common in the military than in the civilian population and is most prevalent among young men. In 2023, snus use in young military personnel was quite similar to civilian groups. Implications and the potential for prevention will be discussed.