

Doctoral thesis

Doctoral theses at NTNU, 2023:132

Bente Irene Løkken

Engagement in cultural activity and public health

The HUNT Study, Norway

NTNU
Norwegian University of Science and Technology
Thesis for the Degree of
Philosophiae Doctor
Faculty of Medicine and Health Sciences
Department of Public Health and Nursing



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ISBN 978-82-326-5785-8 (printed ver.)
ISBN 978-82-326-5923-4 (electronic ver.)
ISSN 1503-8181 (printed ver.)
ISSN 2703-8084 (online ver.)

Doctoral theses at NTNU, 2023:132

Printed by NTNU Grafisk senter

Norwegian summary (Norsk sammendrag)

Kultur og kulturdeltagelse har vært en del av menneskets daglige liv gjennom tidene. De siste årene har interessen for kulturdeltagelse og dens betydning for folkehelsen økt, og mer enn 3000 studier har forsket på hvordan kunst og kultur kan påvirke helse, livskvalitet og dødelighet. Til tross for økt bevissthet, så er det begrenset kunnskap om kulturdeltagelse faktisk påvirker helsen i befolkningen. Grunnen er at det meste av forskningen har fokusert på individuelle effekter. Både «passiv» og «aktiv» deltagelse, dvs. både det å være publikum (mottakende) versus det å være utøver (henholdsvis reseptive og kreative deltagelse), kan ha forskjellige påvirkning og derav være ulikt assosiert med helse og dødelighet. Det er få studier som undersøker begge aktivitetsformene samtidig. Tidligere studier har ulik tilnærming som gir ulike funn, og de har begrensinger i aktiviteter inkludert, alder og metodiske varierende tilnærminger. Noen få studier indikerer at deltagelse i kulturaktiviteter kan påvirke levetiden og redusere risiko for årsaksspesifikk dødelighet. Det er også hevdet at de som ofte deltar i kulturaktiviteter har lavere forbruk av helsetjenester. Det mangler imidlertid studier som kan vise til en sammenheng mellom kulturdeltagelse og bruk av helsetjenester.

Hovedmålet med denne avhandlingen var å studere forholdet mellom kulturdeltagelse, både reseptiv og kreativ, og dødelighet, årsaksspesifikk død og allmennlege-konsultasjoner. Videre var målet å utforske mulige kjønnsforskjeller i både reseptiv og kreativ kulturdeltagelse. Data i denne avhandlingen er fra Helseundersøkelsen i Trøndelag (HUNT), en av verdens største befolkningsstudier. Alle innbyggere i Nord-Trøndelag, 20 år eller eldre ble invitert, og det var frivillig å delta. Data fra HUNT3 undersøkelsen (2006-08) ble brukt, hvorav selvrapportert informasjon på et bredt utvalg av ulike reseptive og kreative aktiviteter er inkludert, og relevante helsedata ble innsamlet. Disse dataene ble koblet til registerdata fra Dødsårsaksregisteret med longitudinal oppfølging fra 2006-08 tom 2015 (artikkel I og II), samt KUHR-databasen – Kontroll og utbetaling av helserefusjoner, med aktivitetsdata fra alle allmenlegekontorer på landsbasis (artikkel III), fra 2009 tom 2015.

Den første studien i avhandlingen undersøkte om spesifikke aktiviteter, antall og frekvens av kulturdeltagelse kan være assosiert med levetid (artikkel I). Deltagelse i flere ulike kulturelle aktiviteter var assosiert med lavere risiko for død, i større grad enn det resultatene viste for deltagerfrekvens på ukentlig basis. Analysen av reseptive aktiviteter viste en redusert risiko for tidlig død med økende antall aktiviteter. Dette gjaldt spesielt menn. For kreativ deltagelse, var

det assosiasjon mellom både antall aktiviteter og frekvens og redusert risiko for tidlig død for både kvinner og menn.

Den andre studien, studerte sammenheng mellom spesifikke aktiviteter, antall og frekvens av kulturdeltagelse og hjerte- og kar-dødelighet (CVD-dødelighet), og kreftrelatert dødelighet (artikkel II). Kulturdeltagelse i kreative aktiviteter på ukentlig basis var assosiert med redusert risiko for CVD-dødelighet. Kjønnsspesifikke analyser viser at menn hadde en lavere risiko for tidlig CVD-dødelighet når de deltok mindre enn en gang i uken. For det samlede utvalget, viste dataene at deltagelse mellom to til ni ganger per uke i både reseptive og kreative aktiviteter kan redusere risiko for kreftrelatert dødelighet. Ukentlig kreativ deltagelse var assosiert med redusert risiko for tidlig kreftrelatert død. Det var en dose respons assosiasjon mellom økende antall ulike aktiviteter (både reseptive og kreative), og redusert risiko for CVD- og kreftrelatert død i hele utvalget. Den reduserte risiko for kreftrelatert død var betydelig høyere hos menn som deltok i flere ulike reseptive og kreative aktiviteter.

I den siste studien ble sammenhengen mellom kulturdeltagelse og fastlegekonsultasjoner undersøkt (artikkel III). Resultatene viste at deltagelse i kreative aktiviteter og kombinerte reseptive og kreative aktiviteter var assosiert med lavere bruk av fastlegekonsultasjoner blant menn, sammenlignet med menn som ikke deltok. Det ble ikke funnet slike sammenhenger for kvinner. Deltagelse i ulike aktiviteter ser ut til å medføre lavere bruk av fastlegekonsultasjoner i forhold til de som ikke deltar. Deltagelse i en eller flere kreative aktiviteter, eller både reseptiv og kreativ deltagelse blant menn, kan redusere sannsynligheten for bruk av fastlegekonsultasjon.

Forskningsresultatene tyder på at de som deltar i kulturelle aktiviteter har lavere dødelighet totalt, og lavere dødelighet av hjerte-karsykdom og kreftsykdom. Menn som deltar i kulturelle aktiviteter, har også færre fastlegekonsultasjoner. Gitt begrensingene i studiene, er det imidlertid ikke holdepunkter for å hevde at det er årsakssammenhenger.

På grunnlag av disse funn bør fremtidig folkehelsepolitikk stimulere for økt kulturdeltagelse i det forebyggende og helsefremmende arbeidet. Det er viktig å merke seg at våre studier er observasjonelle, og ikke intervensjonsstudier. Resultatene sier ikke noe sikkert om hva tiltak for å øke kulturdeltagelse i samfunnet vil kunne ha på helse. Uansett, deltagelse i kulturelle aktiviteter bør bli en reell mulighet for hele befolkningen, uavhengig av sosioøkonomiske levekår.

Candidate: Bente Irene Løkken, MPH.

Department: Faculty of Nursing and Health Sciences, Nord University / Department of Public Health and Nursing, Faculty of Medicine and Health Sciences, Norwegian University of Science and Technology (NTNU)

Main supervisor: Vegar Rangul, Associated Professor, HUNT Research Centre, Department of Public Health and Nursing, Faculty of Medicine and Health Sciences, Norwegian University of Science and Technology (NTNU) / Faculty of Nursing and Health Sciences, Nord University.

Co-supervisors: Erik R Sund, PhD, Research Scientist, HUNT Research Centre, NTNU.
Steinar Krokstad, MD, Professor, HUNT Research Centre, NTNU

Funding: Nord University, Faculty of Nursing and Health Sciences. The Norwegian Resource Centre for Arts and Health funded all aspects of the data.

*Ovennevnte avhandling er funnet verdig til å forsvares offentlig
for graden ph.d. i medisin.*

Disputas finner sted i auditoriet HUNT forskningscenter torsdag 27 april, kl. 12.15.

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Summary

Cultural life and engagement in cultural activity have been part of human daily life throughout the ages. In recent years, interest has increased in the public health significance of engagement in cultural activity and more than 3000 studies have identified possible impacts of participation in culture and arts. However, despite growing public awareness, there is limited evidence of whether such engagement affects public health because most research into factors affecting engagement has focused on individual-level characteristics. 'Passive' and 'active' engagement modes, attending as an observer or audience (receptive) vs active participation (creative) may have different health effects. Earlier research is characterized by diverging approaches and often lacks consideration of a broad spectrum of activities, broad age groups, and gender differences. Some studies suggest that engagement in cultural activity enhances longevity and may protect against cause-specific mortality, although knowledge about this is limited and insufficient. It has been suggested that high consumers of health services are often low consumers of cultural engagement. However, this association appears to be undocumented.

The overall objective of this thesis was to study receptive and creative engagement with cultural activity and its relationship with all-cause and cause-specific mortality and with general practitioner consultations. Further, the aim was to explore possible gender differences in both receptive and creative engagement. Data were obtained from the Trøndelag Health Study (The HUNT Study) in Norway. All citizens aged 20 years and older were invited, and participation was voluntary. Data from the HUNT3 survey (2006-08) were extracted, which contained self-reported information on engagement with a variety of receptive and creative activities, and relevant covariates. These data were linked to the Cause of Death registry (Paper I and II), and to an administrative register using activity data from all general practitioners' (GP) offices nationwide (Paper III) and up to the end of 2015.

The first aim was to examine the activities, number of different activities (variety) and the frequency of engagement in cultural activity that protected against all-cause mortality (Paper I). A total of 1 905 participants died during the mean 8.15-year follow-up. The variety of activities seems to enhance longevity cumulatively with an increasing number of different activities, to a greater extent than weekly frequency. When the number of receptive activities was associated with all-cause mortality, reduced mortality risk occurred. Gender-specific analyses suggest the association was attributable to men. Gender-specific analyses showed a

clear gradient of the protective effect of participation in creative activity both in terms of variety and frequency, for both women and men.

The second aim was to explore the association between activities, variety, and frequency of engagement in cultural activity and cardiovascular disease (CVD) and cancer-related mortality (Paper II). During an average of 8.15 years of follow-up, there were 563 cardiovascular-disease and 752 cancer-related deaths in the sample. Cultural engagement in creative activities less than once a week, and less than twice per week was associated with a reduced risk of CVD mortality. However, gender-specific findings show that men had a risk reduction when participating less than once a week. For the overall sample, participating between two to nine times per week in combined receptive and creative activities may reduce cancer-related mortality. Participation in creative activity from once up to less than twice per week, may lower the risk of cancer-related mortality. The total variety of activities lowers the CVD and cancer-related mortality risk for all participants, whereas reduction in cancer-related mortality was evident in men.

The final aim was to investigate the associations between activities, variety and the frequency of cultural activity engagement and the number of GP consultations an individual had (Paper III). In total 31 847 participants, aged 30-79, were included in a seven-year follow-up with a mean of 3.57 GP consultations. Findings revealed that participating in creative activities and a combination of receptive and creative activities was associated with lower demand for GP consultation among men who participated, compared to non-engaged men. However, no such findings were found among the engaged women. The variety of activities seem to lower GP consultations to a greater extent than weekly frequency, and the total variety (combined receptive and creative activities) may lower the likelihood of GP consultations among the engaged men.

In conclusion, the findings indicate that people who are engaged in cultural activities have lower mortality overall, and lower mortality from cardiovascular disease and cancer-related diseases specifically. Men who are engaged in cultural activities also have fewer GP consultations. However, given the limitations of the studies, there is no evidence to claim that there is a causal relationship between any of these associations.

Based on these findings, future public health policy and initiatives that facilitate citizens' participation may be health promoting. But it is important to note that our studies are

observational, and not intervention studies. The results do not say anything for certain about what effects measures to increase cultural participation in society will have on health. It is also important that there is a real opportunity for the entire population to become involved in cultural activities, regardless of socioeconomic living conditions.

Acknowledgement

Everything comes to an end, and reflections are made. All in all, this has been a unique journey in so many ways; a mixture of rewarding and inspirational days, and also demanding and long days. I have had a lot of great experiences and periods of fluency, but also challenges, such as the merger of Nord University, and the aftermath of the pandemic which slowed down the progress in a time-limited project. I have learned a lot more than I expected. Along the way, there has been a lot of great advice and support that deserves to be mentioned.

First, I would like to thank all the participants in the HUNT Study for their contribution to the valuable information collected. This enables us to gain health information and public health knowledge, which will benefit us all, both now and for generations to come.

A huge thank you to my main supervisor Associate Professor *Vegar Rangul* for sharing his knowledge and experience during this project, and for steadily guiding me, with a good overview and reflections on the subjects and for a methodological approach. You both challenged and supported me in various ways. Thank you for your effort and for all your commitment.

To my co-supervisors:

-Researcher *Erik R. Sund*, your secure knowledge of methods and explanations, have added great value. You assisted me as questions and problems appeared, and your knowledge, experience, and contributions to the project were important and valued. I am very grateful!

-Thank you Professor *Steinar Krokstad* for helping me build this solid supervisor team. Your smart advice seem to come so easily. You listened and provided insightful feedback, and you took the time even if you were running between other tasks. Thank you for guiding me through both the Master's thesis and the PhD thesis.

In addition, others have contributed to the process:

A special thanks to Professor *Dafna Merom* at Western Sydney University for sharing your knowledge of epidemiology and for your interest in this project. Thank you for your dedication, cooperation and contributions to the publications. Thank you also for your generosity, for inviting and welcoming me to a research stay in Sydney, and for the valuable conversations. I often think of the collaboration and the stay with great gratitude; and owe special thanks to *Vegar* and *Dafna* for their cooperation there, to *Vegar* and *Steinar* for initiating the collaboration, and to *Dafna* who welcomed me, so I got to visit the other side of the planet and learned and experienced so much, that I will never forget.

Special thanks to Professor emeritus *Jostein Holmen* for providing valuable basic knowledge in the initial phase, for participating in the work to prepare the public health field nationally, and for taking interest in this project.

To Professor *Ottar Bjerkeset*, you have been a valuable mentor at the campus during all these years. You are welcoming and helpful; the short research talks made a difference.

My presence and commitment have been at the Faculty of Nursing and Health Sciences, Nord University. The collaboration with HUNT Research Centre and my affiliation as a scholar at the Department of Public Health and Nursing, Faculty of Medicine and Health Sciences, NTNU have been important. Thank you to all my colleagues, who I had the privilege to work with over these years.

I would like to acknowledge the Norwegian Resource Centre for Arts and Health and the employees there for their interest and support in this project and process; for discussions, for including me, and inviting (and helping me) to take lunch breaks. I would specifically like to acknowledge former CEO *Odd Håpnes* for his interest in this project, thank you! Thank you to the current CEO *Marit Stranden*, for your valuable help and collaboration, for professional conversations (and other interesting things), and useful sparring in the later phases of the project. I am very grateful!

My appreciation to family and friends, especially to those who have been my caregivers. You all mean a lot to me. A special heartfelt thank you to my father and late mother for the foundations on which my life is built.

My deepest gratitude and infinite love to *Kaspar* and *Helle*, for being with me during this endeavour. You are my most important, valuable, and precious people, and I look forward to the journey ahead together. You are both amazing, and I am really proud of you.

Finally, a couple of statements from Johan Wolfgang von Goethe, a German author (1749-1832) which *coincided with my personal and professional drive to contribute to development*: «*Knowing is not enough; we must apply. Willing is not enough; we must do.*”;

“*One ought, every day at least, to hear a little song, read a good poem, see a fine picture, and, if it were possible, to speak a few reasonable words.*” -Goethe

Levanger 18.01.2023, Bente Irene Løkken

Funding source

Nord University, Faculty of Nursing and Health Sciences, Norway, funded the PhD Scholarship that this study is part of. The Norwegian Resource Centre for Arts and Health funded all aspects of the data. The funders had no role in the study design, data collection or analysis, any decision to publish, or any part of the preparation of the manuscript.

Data sources

The Trøndelag Health Study (The HUNT Study) is a collaboration between HUNT Research Centre, (Faculty of Medicine and Health Sciences, NTNU, Norwegian University of Science and Technology), Trøndelag County Council, Central Norway Health Authority, and the Norwegian Institute of Public Health. Data on cause of death were obtained from the Norwegian Cause of Death Registry, and data on health care usage were obtained from Control and Payment of Health Reimbursement – KUHR.

Norwegian Resource Centre for Arts and Health

The Norwegian Resource Centre for Arts and Health is a meeting point for practice, education and research within the arts and health in Norway. It was established in Levanger (2014). The Resource Centre documents and develops song, dance and other cultural expression within a professional health and care framework that can help vulnerable individuals and groups as well as create varied and interesting workplaces within health and arts. The Resource Centre also contributes to the development of methods and quality within health and care through interaction between education, research and practice.

Scientific environment

This thesis was mainly conducted from my office at Nord University, in the Faculty of Nursing and Health Sciences at the Levanger campus. The scientific environmental setting was in my home office during the pandemic period. During the final part of the working period, and the finishing stage, I used a combination of both places. As a PhD student with the PhD programme in medicine at the Faculty of Medicine (DMF), NTNU, I participated in the mandatory courses for PhD students. I was part of the scientific community at the HUNT Research centre, Levanger, and I attended their research meetings. I also collaborated with the Norwegian Resource Centre for Arts and Health in Levanger, at Nord University. The scholarship was a PhD programme over 4 years, with 75% of the work on the thesis and 25% on duties, with Nord University as my employer. I was a part of the Department of Social Education and Mental Health Division, and my duties included teaching, follow-up of learning outcomes and compulsory work requirements for students, and being external examiner at the Department of Continuing Education on the subject of public health and health behaviour. Towards the end of my compulsory work period, I collaborated with one of the five centres affiliated with the National Centre for Care Research, located in Levanger. I worked with their project to prepare a guide to health care based on the government reform programme “*Leve hele livet*” (A full life – all your life. A Quality Reform for Older People). The project was supervised by the Norwegian Directorate of Health. In teams of several researchers, we wrote recommendations for health care for the elderly, which is one of five focus areas included in the reform.

Abbreviations

BMI	Body Mass Index
CI	Confidence Interval
CVD	Cardiovascular diseases
GP	General practitioner
HUNT	The Trøndelag Health Study (The HUNT Study)
HR	Hazard ratio
KUHR	Control and Payment of Health Reimbursement Register
MET	Metabolic equivalent of task
NCDs	Non communicable diseases`
NTNU	Norwegian University of Science and Technology
Q1	Questionnaire 1, HUNT3
Q2	Questionnaire 2, HUNT3
SD	Standard deviation
SES	Socioeconomic status
UNESCO	United Nations Educational, Scientific and Cultural Organization
WHO	World Health Organization

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List of papers

This thesis is based on the following three papers mentioned in the order in which they were submitted for approval/ published. These will now be referred to by their roman numeral.

Paper I:

Løkken BI, Merom D, Sund ER, Krokstad, S., Rangul, V. *et al.* Cultural participation and all-cause mortality, with possible gender differences: an 8-year follow-up in the HUNT Study, Norway. *J Epidemiol Community Health* 2020;74:624-630.

<https://doi.org/10.1136/jech-2019-213313>

Paper II

Løkken BI, Merom D, Sund ER, Krokstad S, Rangul V (2021) Association of engagement in cultural activities with cause-specific mortality determined through an eight-year follow up: The HUNT Study, Norway. *PLoS ONE* 16(3): e0248332.

<https://doi.org/10.1371/journal.pone.0248332>

Short title: Association of cultural activity engagement with cause-specific mortality. The HUNT Study, Norway.

Paper III

Engagement in cultural activities and general practitioner consultations. Observational findings from The HUNT Study, Norway.

Peer review.

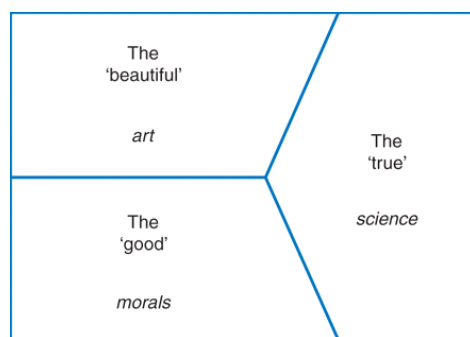
1. BACKGROUND

1.1. CULTURE IS A PART OF BEING HUMAN

Cultural life and engagement in cultural activity is part of human daily life with long traditions and history (1-3). In its broadest understanding, culture is defined as “*set of distinctive spiritual, material, intellectual and emotional features of society or a social group, that encompasses, not only art and literature, but lifestyles, ways of living together, value systems, traditions and beliefs*” (UNESCO, 1982) (4, 5). This broad subject of culture not only encompasses cultural activities, habits and beliefs, but also political, economic, legal, ethical, and moral practice and values (6). Engagement in cultural activities is innate to human lifestyle, reflecting traditions, beliefs and quality of life (7), and it is a human expression of culture, community and identity (8). It varies within the diversity of culture and depending on the variety of cultural settings where it can take place. Throughout the ages, human creativity in particular has been brought forward and come to expression in various form (1, 2). The cultural identities and values have changed over time as a part of development, and the activities are shaped by social, psychological and historical conditions (9).

The idea that we humans need something ‘beautiful’ is ancient and was already established during the time of Plato. Based on platonic thinking, a model was developed that outlines three categories; the ‘good’, the ‘true’ and the ‘beautiful’, or respectively; science, ethics and aesthetics. Whereas the right side of this model is the objective, the left is the subjective dimension of life. These are integrated into our everyday life, and we do not differentiate between these experiences. Hence exterior and interior dimensions can occur at both individual and collective level (10).

Fig. 1 Plato and the good, the true and the beautiful.



J Public Health (Oxf), Volume 33, Issue 3, September 2011, Pages 335–342, <https://doi.org/10.1093/pubmed/fdr061>



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Figure 1: Adopted from Hanlon et.al; “*Plato and the good, the true and the beautiful*”.

Presumed to be among the oldest types of human creative expression is bodypainting (2). Still, all over the world, there are numerous examples of different human traditions of performing cultural acts of creativity (11). Long ago during antiquity, the early Greeks created some of the greatest feats of creativity (12) which to this day has value for humans all over the world. Cultural imprints as traces put in nature, or stories of habits and values that are safeguarded by the society, exist from previous generations and all the way back to ancient times. For example, rock carvings exist from different eras and in all continents, and the oldest are believed to date back to the end of the early Stone Age. These imprints have survived through generations, and they consist of various forms of images ground into or painted on rock surfaces (13). The 'Bølareinen' in the county of Trøndelag, Norway, is a well-known rock carving:



Picture 1: 'Bølarein', photographer: Ronny Andreè Haugan. Licence: CC-BY. Changed: 2017-07-09.

'Goethe said that art is long, life is short.'

Culturally meaningful activities for individuals and for communities, are based on norms, values and traditions (11). There are a variety of reasons why these types of activity is valued in most societies (14). There are innumerable types of activity and diversity of cultural expression through the activities (15). Music, song and movement, such as dancing, are examples of activities that have been practised far back in time. The form and character are based on culture, development and social changes over time, and could also include cultural rituals expressed differently worldwide (2) as for example with drumming (15). Music is an activity from far back in time, which for many is still in everyday use (16, 17). Throughout time, and in most societies, people have sung together in joy and in sorrow, in everyday life, at work and in celebration. Singing together is an essential part of our common cultural heritage and characterizes, in different ways, human togetherness throughout the lifespan (18). These are

examples of historically important human activities, shaped over time by humans and their culture and cultural setting.

Hanlon et al. promoted and highlighted the paradox, the fact that we nowadays have to “*attach rights to natural, spontaneous human behaviors*” (10). The development came at a point in time where society enshrined rights through legalization of natural and previously spontaneous human behaviour in law. For the first time back in 1948, the fundamental right for everyone to partake in cultural life was integrated in international law, established and settled by the General Assembly of the United Nations (19) the Parliamentary assembly UNESCO. The United Nation’s specialized agency UNESCO has a global culture mandate (20). The Universal Declaration of Human Rights and the cultural rights in Article 27 govern cultural policies, and presupposes among other things, that everyone should have equal and free access to a variety of cultural resources (4). Importantly for culture and democracy (4), the Universal Declaration of Human Rights, Article 27, pt. 1(19), states that;

“Everyone has the right freely to participate in the cultural life of the community, to enjoy the arts and to share in scientific advancement and its benefits” (4).

Furthermore, “*The right to take part in cultural life guarantees the right of everyone to access, participate in and enjoy culture, cultural heritage and cultural expressions*” (4).

1.2. ENGAGEMENT IN CULTURAL ACTIVITY

Engagement in cultural activity is a part of the “*domain of culture*” (20), and entails varied types of activity, and is an integral part of both leisure and recreation (14, 21). Through time, it has been incorporated into several disciplines such as anthropology, education, sociology and psychology (14). Engagement in cultural activity involves a broad range of activities that can be undertaken at individual level or community level (22). Based within the cultural context, the norms, values and traditions (5, 23), a great variety of activities can be embedded within a definition of cultural activity engagement in a population (24). Cultural activities have been defined by UNESCO’s institute of statistics as: “*activities which embody or convey expressions, irrespective of the commercial value they may have. Cultural activities may be an end in themselves, or they may contribute to the production of cultural goods and services*” (25). Activity is “*the condition in which things are happening or being done*”, as “*a thing that a person or group does or has done*” (26). Pierce described it as “*Activity is defined as a more general, culturally shared idea about a category of action*” (27). UNESCO’s cultural statistics

handbook (8), presents a way cultural participation can be defined as; “*participation in any activity that, for individuals, represents a way of increasing their own cultural and informational capacity and capital, which helps define their identity, and/or allows for personal expression*” (8).

1.2.3. Terms of engagement

In general, for culture-oriented activities, there are challenges in the research field because of language differences (28). The terms overlap and are used interchangeably. This inconsistent use of the terms (24) makes it difficult to compare across different studies, as to some extent, various types of activities are included. This is also noted within the clinical studies (29, 30), as in the review by Bungay et.al. (30). Thus, various terms exist, such as cultural activity engagement, leisure activities, cultural engagement (31, 32) etc. Cultural participation (or engagement) and civic engagement are multi-dimensional concepts, which involve a broad range of activities; cultural, political and social (22). Community engagement is characterized by activities that support community interest (33). Leisure research seem more common within the social research field, although leisure has also been used within the health research field (34, 35). Engagement in cultural activity can to various degrees, overlap with activities within these other terms. This thesis has a focus on publications within the medical profession, but at the same time it crosses towards the social profession.

Culture engagement and engagement in cultural activities, or participation are terms that seem to be more commonly used in population-based epidemiological studies (36, 37). Cultural activity engagement has been regarded as a term with a broader connotation than ‘arts’ (38). ‘Art’ as a umbrella term (39) is more commonly used within the English-speaking countries (24, 40), and is usually referred to when there is intervention for patients in health care settings (29, 30, 41) or community interventions (29). Art and cultural activities, and both casual and project-based leisure, each conceptualize a range of related activities (24, 25). Within the field of public health and epidemiological population studies, both terms ‘cultural activity’ and ‘art’ are used. There seems to be no clear distinction between them. In this thesis, the term engagement in cultural activity is used and this includes arts and other cultural activities. When referring to other publications, the term they have used is retained and used in this thesis.

1.2.4. Conceptualizing cultural activities

There are several challenges associated with the concept of “*cultural activities*”. Defining cultural activity engagement is not easy (31) as it consists of a multi-dimensional concept, and each of these concepts includes a broad range of activities (22). The varying definitions (24, 42) and terminology of arts and culture, result in a lack of clarity and consensus in the concepts (24, 43). It is hard to conceptualize cultural activity as a whole, and to do so is beyond the purpose of this thesis. A wide range of activities is covered by cultural “*rights*” (44). Taking part in cultural activities can mean many things, and people can be involved in different ways. The European Commission statistics leadership group on cultural statistics identified three fundamental types of participation; ‘attending/ receiving’, ‘performance/ production by amateurs’ and ‘interaction’ (8). Previously Davies et al presented five art categories in health research (24), and this was later used in the WHO report published in 2019, to define art. These categories define what art constitutes, but each specific art type within these categories is diverse (37). The five categories include: “*performing arts (e.g. activities in the genre of music, dance, theatre, singing and film); visual arts, design and craft (e.g. crafts, design, painting, photography, sculpture and textiles); literature (e.g. writing, reading and attending literary festivals)* (24); *culture (e.g. going to museums, galleries, art exhibitions, concerts, the theatre, community events, cultural festivals and fairs); and online, digital and electronic arts (e.g. animations, film-making and computer graphics)*” (37). Furthermore, Davies et al., categorized the activity into two different modes by distinguishing between ‘passive’ and ‘active’ activities, making and creating arts or attending art engagement (45). Defining the engagement as “*active*” i.e. creative mode or “*passive*” i.e. receptive mode, has been done in previous studies (24, 42). The terms ‘receptive’ and ‘active’ have also been used (3). The designation of these two modes, active-creative (46) and passive-receptive reflect different modes of being engaged (42). Earlier studies have used similar dichotomization (42, 47) such as playing sport or spectating (48). “*Higher*” engagement seems to be more common within ‘active’ i.e. creative activities than ‘passive’ i.e. receptive activities (24, 42) in Western countries. I have chosen to use the terms “*receptive*” and “*creative*” according to Davies et.al. (24), which also was used by Cuypers et.al. (42) and the WHO scoping review (3). The terms have been use to distinguish between these two modes as follows:

Receptive activity mode

Receptive activity mode includes attendance in an event or place, i.e. seeing a movie or a concert, the informal cultural action of reading a book (7) or watching a sports event, concert,

theatre, etc. (7, 42). Attendance is the act of attending and “*being present at*” a specific place or event on an occasion, or going there regularly (49). Attend is to “*to pay attention to by listening or watch the event or place*”, for example attend a church (50) or attending a meeting. Attenders at a particular place or event are the people who go there (49). “*Attending or receiving*“ occurs when there is a communicational process between external sources of information and a receiving subject (51). It involves audience participation, that is the persons present “*the group of spectators at a public event; listeners or viewers collectively, as in attendance at a theatre or concert*”, or “*the persons reached by book, radio or television broadcast, etc.; public*”. An audience is also defined as “*a regular public that manifests interest, support, enthusiasm*”. As “*the act of hearing, or attending to, words or sounds*” (50). Other words related to audience are listeners, hearers, viewers, devotees, spectators and gallery (50). Activities such as watching a movie, are a type of activity that may occur through different channels such as mass media (47).

Creative activity mode

Creativity or the creative mode is a skill at doing a specified thing and is typically acquired through practice. The performer is a person who executes or does something, who carries out and completes a prescribed course of action (50). To act, is to process or do something, and to execute, is to carry out, to perform or to do, to accomplish something, such as an assigned task. Creek described creative activity in 2002, “*activity involves imagination and has a novel, worthwhile product. The product might be concrete, such as painting or a piece of writing, or it may be an original idea or train of thought*” (52). Thereunder, creative activity may result in the production of paintings, drawings, or sculptures (50). The creative activity mode also involves the various branches of creative activity such as music, literature, and dance (50), and thereby encompasses participatory and performing participation: “*n.pl. dance, drama, music, and other forms of entertainment that are usually performed live in front of an audience are referred to as the performing arts*” (49). Further, ‘performance/production by amateurs’ involves building up or creating material or non-material cultural products either for an audience or for a private pleasure or aim, that can be either in an organized or a non-organized context. Examples of products are musical or theatre performances, handicraft, but also amateur activities that are disseminated (51). As people interact they are participating in artistic activities (53) whereas ‘interaction’ is defined as “*a continuous feedback flow of communication between an external source and a receiving subject*” (51). The creative mode activities comprise of playing musical instruments, outdoor activities (7, 42), creating cultural activities or creating

arts, or organizational engagement such as volunteering (47), or informal cultural action such as participating in community cultural activities and amateur artistic productions (7).

1.3. POPULATION HEALTH

The public health of Norwegians is generally very good (54, 55), and Norwegians are ranked among the top ten populations for disability-adjusted life years (DALYs) (56). Not all years of life are spent in good health. Non-fatal health loss accounted for 52% of the disease burden measured in DALYs. Musculoskeletal diseases, mental disorders, and substance abuse disorders were particularly important (57). The disease groups with high mortality and DALYs are cancers, cardiovascular disease (including coronary artery, cerebrovascular diseases, and hypertension (58)) and chronic respiratory lung disease (57). The overall burden of diseases, measured in DALYs varies over the life course. While mental disorders weigh heavily in the younger age groups, musculoskeletal disorders gradually gain more importance beyond the working part of the population, while cancers and CVDs dominate towards the end of the life course. There is an increasing number of people with physical diseases who also experience psychosocial burdens (59). Over the ten years 2006-2016, the burden of disease (in age-standardized rates) has decreased for many conditions that result in lost years of life, but not for conditions that result in a non-fatal loss of health. Non-fatal loss of health made up a large and increasing proportion of the burden of disease in the population in the period, and contributed to the overall burden of disease in 2016 in Norway (57).

Our health and health outcomes depend on many factors, and traditionally, risk factors for illness and premature death have been explored in the population (60). Two important health indicators are premature mortality and health care (59).

1.3.1. Mortality and life expectancy

Over the last decades, life expectancy has increased around the globe (61). From 1986 to 2010 the differences in life expectancy between Norwegians increased sharply and uninterruptedly with 4.3 years (62). Later, life expectancy has risen less in Norway than in other countries (63). Life expectancy at birth in Norway increased from 80.4 years in 2006 to 82.1 years in 2016 (57). A further increase in life expectancy in Norway until 2100 has been predicted (61), although recent population projections show that it is expected to decline towards 2050 (64). In the United States, life expectancy started to drop in 2020 and is still dropping in 2021 (65).

Diseases and illness related to lifestyle, including cardiovascular diseases (CVD) and colon cancers are among the diseases causing the greatest mortality risk, and estimates indicate that approximately 90% of heart diseases are preventable with lifestyle changes that are effective (66). The primary reason for increases in life expectancy is a reduction in ischaemic heart disease and lung cancer mortality, whereas the underlying explanatory factor associated with decreased mortality rate, was decrease of tobacco smoking (56), and alcohol consumption (54). In 2014, 65% of all deaths in Norway were due to the four largest non-communicable disease (NCD) groups: CVD, cancer, diabetes and chronic obstructive pulmonary disease, and these are expected to be the main causes of mortality the coming decades (64). Over the last 20 years, a reduction of premature deaths among the population in the working age group has occurred. This positive change is mainly due to a declining rate of CVD mortality in this age group. This has been delayed to older age (67) with CVD in 2010 in the age groups over 65 years accounting for a total of about 35% of all deaths each year (67). Still, because of these NCDs, a considerable proportion of the population dies early (64, 68, 69), and CVD and cancer diseases are expected to remain the main causes of death in 2050 (64). 'Norway follows up with the WHO strategy and has its own NCDs strategy, with an ambition for Norway to reach the goal of a 25% reduction in the premature death of these public diseases before 2025 (70). For many decades CVD was the leading cause of death. This has reversed in recent years since 2017 (64, 71, 72) with cancer-related mortality now more common (64, 73, 74), and expected to remain so in Norway (64).

There are gender differences related to mortality and longevity (75), and it is a globally accepted phenomenon that women generally live longer than men (75, 76). A further female advantage is expected by 2030, with over 50% of women exceeding 90 years of life expectancy (77). This change may not only be related to biology but also probably to social conditions and changes over time (76). For many of these women, the extra years of life will be spent with long-standing illness, and poorer self-rated health (78).

The situation today is a growing and aging population with increasing life expectancy (57). In the coming years, a larger proportion of people will be older. A larger proportion will be over 75 years and a greater number will be over 90 years (64). And women will constitute a larger part of that group (79). Consequently, a larger proportion of the population live many of their life years with diseases as life expectancy in Norway is high (54, 57, 64, 67). Increases in life expectancy have led to an increased number of years lived with non-communicable diseases

(67), and many individuals receive treatment for these conditions for several years before they die (67). Exploring life expectancy is often done in order to forecast and plan for future needs, use and delivery of health care, according to the predicted population's gender and age distribution (77). As a consequence of the increase in life expectancy and population growth, more need for future healthcare services is expected (70, 78).

1.3.2. Use of general practitioner services

In Norway, all citizens are entitled to public health services. According to the Norwegian government's health service plan, the goal is that everyone should have the right to equal healthcare services, regardless of diagnosis, place of residence, personal economy, gender, county of birth, ethnicity, and the individual's life situation. Effort must be assessed based on three priority criteria: benefit, resource, and seriousness of condition (80).

Health care in Norway is divided into two different governmental levels: central and municipal. The municipalities are responsible for primary health care which includes the general practitioners (GPs). As defined a GP *"runs a practice where there is formal agreement on a permanent doctor-patient relationship which entitles the patient to services from their GP"* (81). Among other things, the GP works to promote health, prevent illness and injuries, provide diagnosis, treatment, and rehabilitation (82). The GP service is list-based, no health insurance is needed, and everyone registered in the National Population Register is given the right to a GP. Usually, the GP is the first healthcare provider people contact (83, 84). GPs also contribute to the municipal emergency service that covers out-of-hours care (82). In Norway, patients need a referral from a GP office or out-of-hours services to be admitted to hospitals (82, 83). The healthcare system in Norway is not free, although it is subsidised to a large extent. It is founded on the principles of universal access, decentralization (56, 82), and free choice of provider (82). The service is a part of a broader social insurance scheme for the population, and citizens must receive equal services as needed, regardless of finances, social status, age, gender and previous health etc. Despite this, there are still differences based on educational level and financial situation, even when patients are only charged up to a certain level per year (80).

There are gender differences in the use of health services: women generally seek GP appointments more often than men, especially between the ages of 16 and 49 years, where women had almost twice as many consultations as men (85, 86). The differences were smaller between genders in the age range 67 to 79 years (85). The number of consultations including

home visits in 2006 was illustrated by Nossen (Figure 2), and the scatter bar graphs point out a clear increase in GP consultations among men by ten years age categories (87).

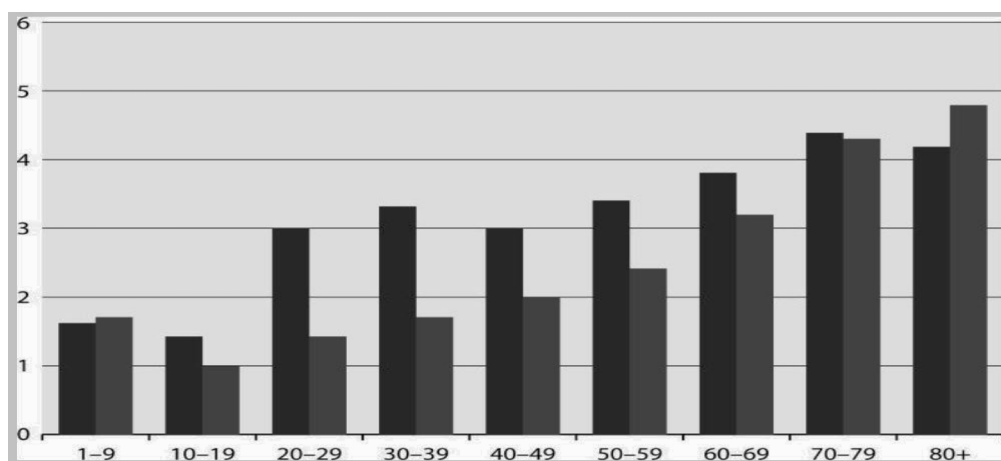


Figure 2: Number of GP consultations including home visits in 2006 per inhabitant by age and gender in Norway (woman left- and men right bar). Sources adapted from Nossen PJ. (87).

The trend in gender differences between the age groups, showed that women have more consultations than men of all ages other than 1-9 years and 80 years and older (87).

The dilemmas currently facing healthcare systems and services (57, 88) require a new way of looking at the nature of health (88). An increased workload among GPs in Norway has been reported (89), which is to be expected as a result of increasing numbers of older people and a greater share of the population with longstanding, limiting illness (78, 82). In 2007, musculoskeletal complaints, the cardiovascular system, and airways were the most frequently used code of primary cause, accounting for 46% of GP consultations (87). One in ten consultations concerns various forms of mental disorder (81). Complex issues are dealt with several times a day, and patients with multimorbidity, psychological problems, and life stress are also seen (90). The aim is for the patient to be able to master their everyday life despite illness, pain or physical, psychological or social impairments (80). There is an exponential increase in healthcare expenditure with each additional chronic disease that affects an individual (68, 82, 91). An increase in health expenditures was observed between 2008-2015 (82, 91). If such increases continue, that will bring greater challenges for the health service in the future (92). The capacity of the healthcare system is challenged by several factors (93); a high

prevalence of mental health disorders and chronic physical disorders (78), limited treatment potential in clinical settings (93) costs (54), and capacity challenges due to demographic change with increasing numbers of old people (78).

1.4. CULTURAL ACTIVITY AND PUBLIC HEALTH

Cultural activities are practised by many members of society as part of everyday life, but there is limited evidence of the public health significance of these activities. The lack of studies which include a broad variety of activities has implications for research. Earlier research is characterized by diverging approaches, and often lacks a distinction between receptive and creative activities. These two different modes are rarely investigated simultaneously and separately (24, 94) in the same sample (10). Attending events, i.e. seeing a movie, and informal cultural action, such as amateur artistic productions or reading a book (7), correspond to everyday events that may be done for enjoyment, entertainment (45, 95), as a hobby (45), recreation, or as a contribution to society (95). There are a number of reasons why people take part in these activities, and health may be one of them (96). The preventive and health promotion benefits that may be gained from these types of activities (97) is of interest in a public health context for several reasons. Being engaged may give meaning to both the individual and to the life of the specific community (21, 39) as well as the general population. There is evidence that cultural activities in general may protect and promote health (42), and that there are health benefits to be gained by participating in different types of cultural activities (98), such as in mastering everyday life (71). Engagement involves few risks (99), so, cultural activities can be considered to have few negative side effects (37, 99). This makes them suitable as a form of health promotion activity. Recent studies show that engagement in cultural activity is closely linked to health, and that this type of engagement can promote health (37, 42, 94, 100).

In different countries, evidence shows that engagement in cultural activity is associated with self-rated health (42, 101-108) and quality of life (42, 107). A body of more recent publications bring this link between engagement in cultural activity and well-being into focus (109-111). In general, epidemiological studies are sparse (108). Longitudinal cohort studies are very few in number. For example, Johannsen et.al. explored the associations between attendance at cultural events and changes in self-rated health over an 8-year span among 3 893 adults aged 24-74, in relation to habits of event attendance in the community. Those who were inactive on both the first and the second occasion, or those who decreased their activity between the two time points,

had a 65% risk of poor self-rated health compared to those who were engaged at both time points (104). Also, a significant association between cultural activities and self-rated health was observed in the United States. With each additional event the study participants attended, there was an increase of 12% in self-rated subjective health as good or excellent (103). In general, studies suggest that those who participate in cultural activities seem to experience better health and are more satisfied with their lives (42, 103). More specifically, engagement in cultural activity may encourage health-promoting behaviour (3) and promote health (37) and longevity in the general population (35, 40, 98, 112). Still, longitudinal studies examining a broad spectrum of participation are scarce.

Instruments which are aimed to support health-promoting behaviour, defined as "*the process of enabling people to increase control over, and to improve their health*" (113) have become more important in public health work. Apart from research on physical activity and exercise, less research has been done on health promoting factors based on population studies (114). Facilitating engagement in everyday activities that promote health, seems to be a powerful way to prevent chronic diseases (93). Previously, most efforts have focused on the well-established risk or benefit factors; a healthy diet, avoiding tobacco and increasing physical activity and counteracting sedentary behaviour (93). Multiple lifestyle factors have been shown to affect our health and mortality risk (115). Physical activity has long been considered a versatile 'medicine' for humans (116), and a key factor for health (117). Sedentary behaviour and physical inactivity are associated with increased risk of several chronic diseases (118-120). There is less evidence about the role of other types of leisure activity and their role in avoiding non-communicable disease and maintaining good mental health. Several publications have shown that different cultural activities are associated with good mental health in the population (37, 42, 121). Evidence from one review demonstrated that engagement in creative activity can decrease anxiety, stress, and mood disturbances (122). Engagement has been shown to have implications for both mental and social well-being (111). A lack of social relationships is strong predictor of premature mortality (123-125), is detrimental to cancer survival (123, 126), and can increase the risk of coronary heart disease and stroke by a degree similar to that found for other classic lifestyle risk factors (127). Health determinants comprise the whole context of human life that has an effect on health, both for individuals and communities (128).

Today's society, for several reasons, results in inactivity both in leisure and work time (129, 130). Promoting health and preventing disease can take place through health-related behaviours,

such as physical activity (73, 131). Making everyday health-promoting activities easier and more accessible seems to be the most effective chronic disease prevention strategy (93) for both physical and mental health conditions (93, 132). Engagement in cultural activity has the potential to prevent disease, can be combined with traditional medical treatment in clinical settings, and may be beneficial in disease management and improving patients' quality of life (37, 133). More specifically, engagement in cultural activity may encourage other health-promoting behaviour (37). Human activity through engagement in culture can be used as a measure, and as a goal, for active participation in society, or for being active in one's own life. An important part of public health work is to create meeting places and arenas where people can be actively engaged (134). Epidemiological studies can provide important knowledge about health-promoting factors (114). By weakening factors that entail health risks and strengthening factors that promote good health, we can maintain and improve the health of the population (135). Public health can be promoted by structural initiatives aimed at populations, rather than individuals (136). According to Rose and the "*preventive paradox*" theory, a larger population effect can be achieved when initiatives are aimed at the largest part of the overall population, in contrast to the high and low-risk parts of the population (137). The cultural context has been promoted by the WHO as important for our health (138), as culture influences both our health and behaviour (138, 139), in addition to having implications for our well-being (138). Lifestyle habits influence both mental and physical population health (140). The exploration of engagement in cultural activity as a possible determinant of health is relatively new.

1.4.1. Association between engagement in cultural activity and mortality

The association between engagement in cultural activity and mortality (141) has been explored in prospective longitudinal studies that focused on mortality as the main outcome (40, 142). A number of the large-scale population studies have been undertaken in Scandinavia (35, 40, 98, 143-146). Back in 1996, Bygren et al. (98) interviewed 12 982 Swedish 16-74-year olds regarding their attendance at cultural events (cinema, theatre, concerts and live music, art and other exhibitions, sermons or sporting events), reading books or magazines, making music (sometimes or rarely) and singing in a choir. They investigated survival risk with 8-year follow-up. Frequency of participation was investigated, and there was a 43% higher risk of all-cause mortality for those who attended events less than once a week compared to those who attended on average one and a half times per week (98). An additional eight year follow up of the same cohort, i.e. a total of fourteen years follow-up was investigated later by Konlaan et.al. and included a variety of cultural entertainment. This revealed significantly higher risk of mortality

in people who rarely attended cinema, concerts, museum, and art exhibition, with a relative risk range from 14% of attending art exhibitions, and 42% of attending museums, compared to those who attended more often. Insignificant estimates revealed exploring the associations between theatre, sports event, church service, reading or for music making with risk of mortality (145). Further, an additional 10 years later, i.e. after 26 years' follow-up, a 33% risk reduction of premature mortality was proved for those who reported leisure time activity. Adjustment was made for age, sex, baseline health and baseline alcohol consumption (35).

In a Finnish population, Hyyppä et al. studied the risk of death over a 20-year follow-up with a total score of 21 different activities multiplied by the frequency, from a broad range of 'leisure participation'. Including clubs and voluntary work, attendance at cultural and sporting events (visiting theatre, cinema, concerts, art exhibitions, sports events or similar), outdoor and productive activity, hobbies (drama, singing, photography, painting, collecting, handicraft or similar), studying and cultural interests (reading books, listening to recorded music). Those with an intermediate score (7 to 11) showed a 17% lower risk of mortality, whereas those with a high score (12 to 21) had a 29% lower risk, compared to those with the lowest levels of engagement (under 7) (112). Løkken et al. explored creative participation in three activities combined into one combined activity measure that include 'music, singing and theatre' in a large-scale Norwegian population. Findings showed that those who had not performed 'music, singing or theatre' activities had an increased risk of 26% for early all-cause mortality risk compared to those who participated once a week or more often. When the estimate was adjusted for other creative activity, the increased risk was reduced to 9%, although this was not statistically significant (143). Engagement in cultural activities involving even less effort, such as receptive attendance, has been linked to a longevity in England. Fancourt and Steptoe (40) studied a 14-year longitudinal association between different frequency of engagement in receptive art (museum, art galleries, exhibitions, theatre, concerts, opera) and mortality over 14 years among adults age 50 years and above. Findings shows that receptive attendance could have independent longitudinal protective associations. Those who attend events once or twice a year, had a 14% lower risk of dying compared to those not attending. Those more frequently attended, such as every few months or more, had a 31% lower risk than those who never attended. The estimates remained after adjustment for cognition, mental health and physical health (40). Agahi and Parker explored a 2-year follow-up of mortality among 1 246 people aged 65-95 years with associations for a broad variety of activities; single activity estimates, a total score and frequency of engagement (141). The findings did show that even being engaged

in only a few activities may decrease the mortality risk with each cumulative activity (141). Haak et al. studied 314 Swedish people aged between 81-91, conducting performance-oriented activity (including voluntary groups, fitness, helping others), and a 38% lower all-cause mortality risk was found after 10-year follow up (147).

A couple of studies have published results from all-cause and cause-specific mortality in the same article. Väänänen et al. (148) discovered increased survival in an adult cohort of Finnish industrial employees ($n = 7\,922$), among those who were culturally engaged outside of work. The association was investigated between a defined mean score of attending five different activities (arts and cultural activities, activities in associations, societal action, reading literature and studying) and mortality. High levels of engagement in a variety of activities decreased all-cause mortality by 29%, after controlling for relevant confounders., and lower mortality risk from external causes by 54%. High levels of engagement (i.e. approximately twice a month to daily) were associated with a 32% lower risk of cardiovascular disease (CVD) mortality (148). This is one of the few studies where engagement in cultural activity has been investigated in relation to non-communicable disease outcomes. Single individual activities have been studied in relation to CVD mortality. Merom et al. found dancing to be inversely associated with CVD mortality. Furthermore, dancing was associated with lower risk of CVD mortality to a greater extent than moderate-intensity walking (46% vs 33%, respectively). Donneyong et al. found that outdoor activity is strongly associated with a reduced risk of CVD mortality (149).

Cancer mortality was explored in an earlier Scandinavia-based prospective study by Bygren et al., that examined similar outcomes to the present research, and used an index that combined frequency of participation in receptive activities (attending a cinema, theatre, art gallery, museum, and live music) and the number of these activities attended. The study found that those who live in urban areas and rarely attend cultural events have a threefold higher risk of cancer-related mortality when compared to frequent attendees (144).

But the existing longitudinal evidence is characterised by fragmented approaches and a focus on the health benefits of specific activities, such as, dancing (150), or cover one mode such as attending cultural events (144). The cultural activities examined by studies differ considerably. There are also several studies that only include the age span of the elderly. Knowledge on the matter is insufficient and studies have rarely explored a broad spectrum of activities, in both magnitude and frequency, evaluated through entire populations and by gender. Further research

is needed to strengthen the knowledge base and widen the exploration of a variety of engagement in cultural activity within the same population sample (41).

1.4.2. Cultural activity engagement associated with general practitioner consultations

Today, cultural activities have been emphasised as both treatment and as an agent to promote health and prevent disease. The cultural approaches to treatment and public health work has been both recognised and recommended (99). Yet, to our knowledge, these associations have not been shown in a general population. A number of studies have shown a link between engagement and self-rated health (3, 42, 101-108), that “*reflects an individual’s overall perception of his or her health*” (151). Furthermore, self-rated health has previously been proven to predict future mortality risk and healthcare needs (151). Recently, a number of publications have revealed associations between engagement and well-being (97). The relationship between culture and well-being has emphasized the link between culture and health more generally (5). However, it is expected that high consumers of health care are often low consumers of cultural activity so the challenge may be in the distribution of cultural activities (152).

A good foundation for the health of an individual is primarily created outside the health services (153). The public health input takes place where people live and are (54). Health promotion and prevention of non-communicable disease largely takes place outside the healthcare sector (54). Results of earlier reviews support the effect of cultural activities in both health promotion and health care (42). Promoting health cannot be solely the responsibility of the health care sector (117). Among clinical studies and reviews involving clinical patients, it is found that different cultural activities are important for patients’ health and wellbeing (37, 133), and can assist with managing non-communicable diseases (34, 37). It is well documented that participation in creative activity has positive therapeutic effects on mental health (24, 42, 43). Earlier reviews show that creative activities have been emphasised as especially important to patients, and recommended as part of therapy (3, 94, 154). In modern culture, art is of value if it is part of regeneration or therapy (10). It has been suggested that more can be done to reduce healthcare costs and improve the population’s health (155). Nowadays it is possible to measure a wide range of lifestyle habits against several measures of population health, such as, the use of health services and mortality (156). It is therefore important to focus efforts and explore cultural participation more broadly at the population level in relation to GP consultations.

An active cultural life may be able to counteract inactivity, promote health, contribute to good mental and physical health, and influence health outcomes such as life expectancy (157). Providing opportunities for people to be physically and socially active, can reduce social isolation and promote well-being (3), and thereby has the potential to influence the demand for health care. There is less knowledge about the possible public health benefits of these different types of cultural activity and they have not been studied in a large-scale sample, so, whether such activities are associated with lower healthcare usage is not known.

1.4.3. Gender differences

Gender differences have been noted in previous studies (42, 112, 141, 146, 158, 159), but these possible differences have not been well studied and the evidence is limited (20, 160). Usually, research that investigated both genders combined have been published. Some longitudinal studies only involve one gender (161, 162), and a few studies referred to gender differences between cultural participation and the impact of this on health or mortality (42, 141). Gender inequity exists in health and mortality (58). Women generally live longer than men (78, 163) and men have a higher mortality rate for a number of diseases that affect both women and men (78). Yet women have a higher prevalence of morbidities (79, 163), and are more likely to suffer from anxiety and depression. Men are more prone to accidents (58). So, gender influences access to health care (164), although gender-specific analysis is rarely established. Yet, it is crucial to consider gender in these studies because females' and males' decisions about how to allocate their time, and their choices of behaviour may differ (165).

Gender has been shown to be a determinant of cultural engagement, from findings in empirical analyses (166). Norms, behaviours, and roles are associated characteristics of gender that are constructed socially and are different between women and men, whereas sex refers to different biological and physiological characteristics of females, males, and intersex persons (164). In general, few studies have explored the potential gender differences (141, 154). Gender can be a moderating factor (141, 154), and it is often managed as a confounding factor (141). Gender differences in behaviour choices and time allocation have previously been reported (165). Research has indicated that men participate less than women in cultural activities regarded as "*highbrow*" (166). As a dimension in health, gender is important for several reasons, as gender refers to the role patterns, social inequality, and help-seeking behaviour (167) consumption of health and care services can affect women and men's health and behaviour in different ways. There is variation between disease groups and death in terms of which of the sexes is healthiest

and lives the longest (168). There are biological differences in morbidity related to sex (169, 170) including cardiovascular and autoimmune diseases (170) mortality (171), somatic and mental health.

Previous publications of gender differences show divergent findings. Gender considerations are scarce or absent, and where they are included, they show diverging results. Fancourt and Steptoe (40) revealed gender-dependent associations and showed no evidence of moderation by gender when exploring receptive event attendance in relation to a 14-year longitudinal study of mortality outcomes (40). Agahi and Parker explored gender-specific 2-year follow-up of associations for a broad variety of activities; single activity estimates, a total score, and frequency of engagement. The findings did show gender differences in relation to mortality, and women had a decreasing mortality risk with each cumulative activity. Cultural activities were protective for women and men, with a similar risk reduction of 40%. Greater gender differences among the elderly was found, where engagement in organizational activities (organizational work) had the strongest effects on survival for women. Cultural activities (movies, theatre, concerts, museums, or art exhibitions) were protective for men (141). Li et al. studied one single activity of religious service among women. Findings show that attending a religious service more than once per week was associated with 33% lower all-cause mortality, compared to never attending. Furthermore, those who attended more than once per week had a 27% reduced risk of mortality from cardiovascular disease and a 21% lower risk of cancer-related mortality (161). By contrast, Agahi and Parker did not find any significant associations for gender related to religious services (141). Hyypä et al. also studied in the Finnish population gender-dependent risk of mortality with 20-year follow-up, when engaged (score 7 to 11) findings showed a 18 % lower risk among men, but no significant change among the engaged women. Unlike abundant engagement (max score 12-21) that showed a similar 29% lower risk for both women and men (112). Løkken et al. studied gender-specific mortality associated with ‘music, singing, and theatre’. Men who were not engaged had a 40% increased risk of dying compared to men who actively participated (\geq once a week). By contrast, the association between participation and mortality among women did not enhance longevity. After adjustment for other creative activities they reported being engaged in, the association of the independent activity disappeared (143). Studies have been conducted with a narrower age range. Nilsen et al. investigated gender-dependent all-cause mortality associations in 669 Swedish people aged 76 and older, with living arrangements in relation to an overall index including the following cultural activities: going to movies, theatre, concerts, museums and exhibitions,

outdoor activities, religious services, and organizations. The results showed no significant association among either women or men (172). Lennartsson et al. revealed survival benefits among Swedish men who participated in activities that were both solitary and sedentary (reading books/newspapers, or crossword puzzles), and active (gardening and hobbies). No activities were significantly associated with mortality among women after health variables were controlled (146).

There is a lack of studies exploring gender differences in both clinical (154) and in population-based studies (160). For this reason, establishing gender-dependent interaction terms are crucial. Policies to promote public health, should incorporate a gender perspective, as they may be more effective as a result (58).

1.5. KNOWLEDGE GAPS AND FURTHER RESEARCH

Currently, epidemiological studies examining a broad spectre of activities with longitudinal follow-up, are rare. Creative participation modes are commonly studied in relation to population health. Rarely are both modes, receptive and creative engagement, investigated simultaneously within the same sample, examined both separately and combined, in relation to different outcomes. Looking at engagement in cultural activity from a population health perspective is important because of the possible positive effects on health and longevity and the current scarcity of knowledge. Studies which include a broad range of separate measures, and distinguish between quantifiers of quantity and frequency, will expand the knowledge base. There is a need for research taking gender differences into account in the association between engagement in cultural activity and both mortality and more general health outcomes. The Norwegian government has highlighted the need for gender-specific research (58). In general, more knowledge about engagement is needed.

Both policymakers and researchers have given increased attention to engagement in cultural activity (95). In recent decades, both cultural rights and cultural contribution to sustainable development have been integrated into cultural policy and strategy documents (44). Countries around the world, including Norway, encourage broad participation in cultural activities based on the assumption that such activities can promote the population's health and well-being. In some countries, governments see a potential for using cultural activities to stimulate participation in society, based on the assumption that this will improve health (7, 42, 95, 99). Currently, the evidence is not conclusive whether this assumption is valid. There is a need for

large-scale population studies to examine the association between engagement in cultural activity and public health outcomes. The sustainability of Norway's welfare model is challenged by increasing health expenditure and declining employment rates: demographic change with increasing social health inequalities (57), and changes in the disease burden as a result of an increase in the proportion of older people (54). There is a need for new public health initiatives. It is important to take into account that more people with a low risk of negative health behaviour can result in more sick people than a smaller number of people with a high risk (136). The possible benefits of engagement in cultural activity still lack evidence. Whether such activities are associated with lower healthcare usage is not known either. Few existing studies have explored life expectancy, and cause-specific mortality is grossly understudied. The effect of culture and health needs to be quantified (173) in observational data.

The HUNT Study comprises rich information collected on a range of receptive and creative participation, and makes it possible to study the population's cultural engagement patterns and possible health benefits (31). This thesis will make a significant contribution to the literature regarding engagement in cultural activity and its links to population health and longevity. Three studies were conducted, and the doctoral thesis contains and joins these studies covering the topics outlined above.

2. AIM

The overall objective for this project was to explore engagement in cultural activity from a public health perspective in order to investigate any association of receptive and/or creative engagement with longevity; all-cause and cause-specific mortality, and use of primary health care GP services, within a general adult Norwegian population. Possible gender-dependent associations were also considered in both receptive and creative engagement.

Specific aims:

Paper I

To examine the association between engagement in cultural activities, number of different activities and the frequency, with all-cause mortality.

Paper II

This study aimed to explore whether there was an association between cultural activities, number of different activities and the frequency of engagement in cultural activity and cardiovascular disease or cancer-related mortality outcomes.

Paper III

To investigate the associations between cultural activities, number of different activities and the frequency of engagement in cultural activity and frequency of GP consultations.

3. MATERIAL AND METHODS

3.1. MATERIAL

3.1.1. The Trøndelag Health Study

The Trøndelag Health Study (HUNT) is an extensive longitudinal population-based health study suitable for epidemiological research (174). All the adult inhabitants in the former Nord-Trøndelag County age 20 years and above were invited to participate. The HUNT Study comprised of four waves and collected data over four decades. These four surveys were performed at eleven-year intervals from the beginning of 1984, and named consecutively HUNT1 (1984-86), HUNT2 (1995-97), HUNT3 (2006-08) and HUNT4 (2017-19) (www.hunt.ntnu.no).

The HUNT Study collected health data using comprehensive questionnaires covering self-reported data and also clinical examination performed by trained health personnel, collecting physical measures and biological samples. The examination was performed in accessible sites in each municipality by qualified and trained health professionals. Levels of engagement in cultural activity in the population, with emphasis on receptive and creative participation, was collected for the first time in the HUNT3 survey (174). Both HUNT3 and HUNT4 include population data covering observational data of engagement in cultural activity.

3.1.2. Study population

The sample used in this thesis is the third wave of the HUNT Study, HUNT3, collected between October 2006 and June 2008. All adult citizens of the former county North-Trøndelag, residents aged 20 years and older, received an invitation to participate in the health survey. A total of 93860 inhabitants were invited, and in total 50 807 participated, resulting in a response rate of 54.1%. Attendance percentage for the invited woman and men was 49.5% and 58.7% respectively (174).

3.2. STUDY DESIGN

All three papers are of longitudinal prospective cohort design of which observational findings from the HUNT3 survey were included and linked to national register data to follow-up for approximately eight years on the following outcome measures; all-cause and cause-specific related mortality (Paper I-II), and seven years follow-up of primary healthcare GP consultations (Paper III).

The HUNT3 survey includes baseline sociodemographic and socioeconomic data, and self-reported medical data of physical and mental health and usage of healthcare services, as well as health-related lifestyle measures such as physical activity, smoking history and alcohol consumptions. Further information about the HUNT study is available at: www.hunt.ntnu.no (174). Health data was collected with two comprehensive questionnaires covering self-reported data. The participants that were invited each received the first questionnaire Q1 (attachment 5), by mail together with the invitation to partake in the study, and a consent and an information letter. The signed consent and Q1 were collected upon attendance at the examination site. At the site, the participants were interviewed about their occupation and diseases among other questions related to health. They underwent a clinical examination in accordance with a standard protocol, where physical measures of height and weight were taken (174). A second questionnaire (Q2), stratified by age and sex, was distributed with a pre-paid envelope, to be completed at home and returned by mail (174). Q2 contained a common part that included questions regarding engagement in cultural activity (attachment 6), with emphasis on both receptive or creative participation (175).

This thesis constitute of three papers and a table was drawn up to present an overview of information regarding formulation of the project based on epidemiology, including information about the study data sources, the samples and variables, presented separately for each paper.

Table 1, shows the overviews of design, type of data, variables and inclusion criteria included, and in addition the statistical methods use in this thesis.

	Paper I	Paper II	Paper III
Design	Longitudinal	Longitudinal	Longitudinal
Outcome	All-cause mortality	Cause-specific mortality; CVD and cancer	GP consultations
Data sources	HUNT3 - Daar	HUNT3 - Daar	HUNT3 - KUHR
Type of data	<i>Health survey;</i> self-reported and objective measures from HUNT3. <i>Register data;</i> all-cause mortality	<i>Health survey;</i> self-reported and objective measures from HUNT3. <i>Register data;</i> cause-specific mortality	<i>Health survey;</i> self-reported and objective measures from HUNT3. <i>Register data;</i> primary health care
Sample size	35,902	35,902	31,847
Inclusion criteria	Age \geq 20	Age \geq 20	Age 30-79

Table 1: an overview of design, type of data and variables included in this thesis: Daar; Cause of Death Registry, and KUHR; Control and Payment of Health Reimbursement Registry (KUHR).

3.2.1. Study samples

The HUNT3 participants who returned Q2 – the part that included the cultural activity measures - form the basic data included in this study and constitute the sample, which resulted in 40214 participants. The data, the process of data collection, and the preparation of the baseline sample selection in Paper I, Paper II and Paper III are presented in a flow chart:

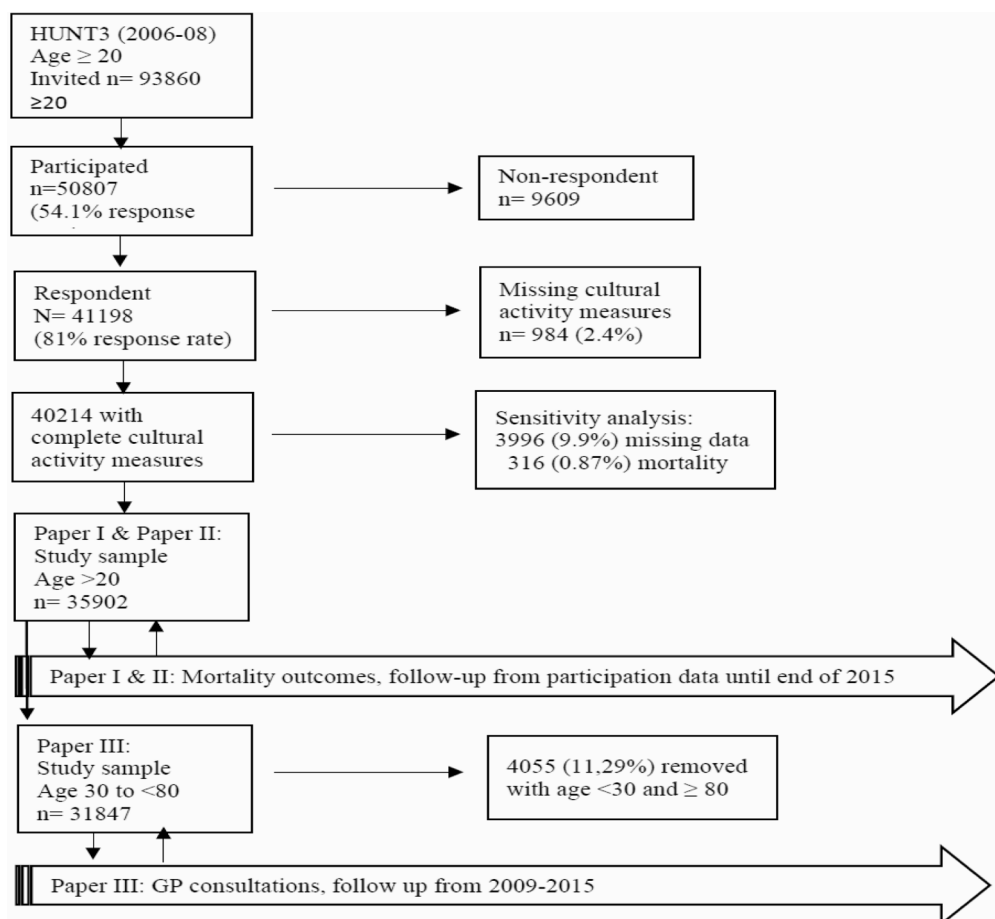


Figure 3. Flow chart showing the process of data collection and the sample selection in Paper I, Paper II and Paper III.

3.2.2. Registry linkage

For our current research, the outcome measures included were mortality and usage of primary health care, taken from two separate national health registries covering total population data; the Norwegian Cause of Death Registry based at the Norwegian Institute of Public Health and a Health Economics Administration Register for Control and Payment of Health

Reimbursement Registry (KUHR) based in the Norwegian Directorate of Health. Linking population data from several national registries is possible in Norway with the use of a passkey for the personal identification number (176). This enabling linking data and withdrawal of medical information from several sources to be included in health research projects (174, 176, 177).

Linkage of outcome variable

The sample study data from the HUNT3 survey included a unique project specific code, a PID which functions as a passkey. The HUNT databank sends the bridge with personal number and the PID to the registry of the sample set extracted from the HUNT3 survey. Each registry merged the register data that were applied for, linked with the passkey and handed over the data to this PhD project. Two data files were received separately, and were merged with received data from the HUNT3 survey.

In Paper I and Paper II: participants were followed-up from the individual date of participation in the cross-sectional HUNT3 survey between 2006-2008, and longitudinally into the Cause of Death registry for outcome measures of mortality until December 31, 2015.

In Paper III: the HUNT3 data were linked with data from KUHR and followed up over a time period of seven years from January 1, 2009 until December 31, 2015.

Cause of Death registry

Mortality data were obtained from the Cause of Death registry at the Norwegian Institute of Public Health. The institute prepares and processes these national mortality data for research. The registry includes total population mortality data for those registered with a national birth registry number, with a residential address in Norway, and collects mortality data regardless of whether death occurred in Norway or abroad (178). The statistics include information about date and causes of death, obtained from the death certificate reported by medical doctors. The data is handled in accordance with the International Classification of Diseases (ICD-10, World Health Organization (WHO) (179). Both the degree of coverage and completeness are high and the registry includes medical information for over 98% of all deaths (178). The cause of death variable is of interest in a public health perspective and is suitable for research exploring risk factors for mortality in a population. The diagnosis of death is reported as the "*underlying cause*

of death” (179). This variable refers to “*the disease or injury which initiated the train of morbid events leading directly to death*” (178).

Usage of Primary healthcare registry

The data on usage of primary care services was taken from the KUHR registry. The system is owned by the Norwegian Directorate of Health and managed by the Norwegian Health Economics Administration (Helfo)¹ that handles the reimbursement claims from therapists and healthcare institutions to the state. There are universal health services in Norway and, to avoid patients having to pay in full and getting refunded later, the service provider sends a reimbursement claim directly to the state. When an inhabitant encounters primary healthcare services, health data is generated (180) and the providers activity is registered and stored in the KUHR registry. For each contact a patient has with a GP office or out-of-hours service, a bill is sent to Helfo. Helfo then manages the reimbursement for expenses to the health provider from the National Insurance Scheme. The data collected and stored includes information about; the GP, the patient, the date, taxes, individual share paid by the patient, reimbursement from the state to the therapist or clinician and the diagnosis (181).

A consultation normally implies a physical or electronic meeting between the patient and the GP undertaking the consultation or treatment. The assessed value of taxation of different types of consultation is regulated by Norwegian law (182), under tariffs for medical doctors: <https://lovdata.no/nav/forskrift/2019-06-27-923>. There can only be one type of consultation tax for each contact the patient had with the GP related to one reimbursement account. The taxes determine how much the patients must pay as their contribution, and how much reimbursement the GP receives from the state. Reimbursement claims that are not in accordance with applicable laws and regulations are rejected (181). The GP data is, therefore, a useful source for public health research, as it measures consultation consumption in the population, and it has been used as the source of the outcome measures in Paper III.

¹ Helfo is a national public agency that provides services to residents and health care providers; helfo.no

3.3. STUDY VARIABLES

The data used in this thesis were collected from three different sources and were used as exposure, outcomes measures (dependent variable) and covariates. The table below presents an overview of the variables included and used in all three papers:

Table 2 provide an overview of variables included and used in Paper I-III.

Variables	Paper I	Paper II	Paper III
Cultural activity engagement	E	E	E
Mortality; all-cause	D		C
Mortality; cause-specific		D	
GP consultations			D
Age	C	C	C
Gender	C	C	C
SES; occupation	C	C	C
Marital status	C	C	C
Longstanding, limiting illness	C	C	C
PA	C	C	C
BMI	C	C	C
Alcohol consumption	C	C	C
Smoking	C	C	C

Table 2 showing the variables included in Paper I-III; E: exposure, C: Covariate and D: Dependent variable (outcome).

3.3.1. Cultural activity measures

Assessment of cultural activity engagement in the HUNT3 survey was collected using two separate questions covered in questionnaire number 2 (Q2), which treats both individual receptive and creative activity measures, separately (attachment 6). These two questions reflect the different modes of engagement, as an attendee/spectator versus a creative participator in a cultural activity. Each question includes a variety of response alternatives and each of them includes several frequency responses. Both questions were included and used as exposure variables in this thesis. This is further referred to as receptive and creative activity questions or measures. The questions are available at HUNT Databank, the HUNT3 survey and Questionnaire 2, www.ntnu.no/hunt.

Receptive activity measurement

Firstly, the participants were asked about their receptive activity attendance, with the question:

‘How often in the last 6 months have you been to?’

Four individual activity alternatives were included:

- 1) A museum/art exhibition?
- 2) A concert, theatre or film?
- 3) The church/chapel?
- 4) Sports event?

The response options for each of these individual activity alternatives were four frequency options: ‘more than three times a month’, ‘1-3 times a month’, ‘1-6 times in the last six months’, and ‘never’.

Creative activity measurement

Secondly, the participants were asked about their creative activity participation, with the question:

‘How often in the last 6 months have you participated in?’

Five individual activity alternatives were included:

- 1) An association or club meeting/activity?
- 2) Music, singing, or theatre?
- 3) Parish work?
- 4) Outdoor activities?
- 5) Dance?
- 6) Work out or sports?

The response options for each of these individual activity alternatives were five frequency options: ‘more than once a week’, ‘once a week’, ‘1-3 times a month’, ‘1-5 times in the last six months’, and ‘never’.

Responses for creative activity frequency included five response options as it starts with weekly participation and not monthly unlike the receptive frequency categories. For the research in this thesis, participation in ‘work out or sports’ was excluded because exercise is a subtype of physical activity, which was used as a covariate and assessed as a potential confounder.

3.3.2. Missing of exposure data

Participants who handed in Q2, who did not respond to any of the receptive or any of the creative activity questions, were considered to have provided missing data for the cultural participation module. Several individuals did not respond to any of the response alternatives

and left blank on all (n= 984). These were considered as true missing of the cultural participation module and therefore excluded from the baseline sample based on lack of response. Participants who had at least one response on any of the receptive or creative activities but left blank all other activities were not considered as truly missing, assuming they only provided answers if they participated in the specific activity. This resulted in 1 228 participants being recorded as never participated in any receptive activity and 1 347 participants being recorded as never participating in any creative activity. As a result, baseline data for 40 214 participants were advanced for operationalization of the cultural activity engagement quantifiers.

3.3.3. Operationalization of cultural activity quantifiers

Three different quantifiers were operationalized: individual activity measures for each activity response option, and two unequal quantitative measures; one measure of variety of activities and the other a measure of weekly frequency of activity engagement. Both these were calculated separately for each mode and for combined both modes together.

Individual activities

At first, measures of each individual cultural activity response was dichotomized into a 'never' versus 'ever' participated estimate, by collapsing all levels of participation frequency to one category 'ever'.

Before a decision of dichotomizing the responses, the original frequency response categories of each individual activity were tested for all-cause mortality assumptions. There was no significant influence of these split frequency categories on the association. Therefore, the frequency response options within each individual activity were dichotomized into 'never' and 'ever' estimates.

The receptive response options included in the 'ever' category were: 'more than three times a month', '1-3 times a month', and '1-6 times in the last six months'. The creative response options included in the 'ever' category were: 'more than once a week', 'once a week', '1-3 times a month', and '1-5 times in the last six months'. The last category was 'never.' This resulted in a total of nine variables reflecting the individual engagement in activity, of which four were receptive activity measures and five were creative activity measures.

Variety of engagement

Three different scores were operationalized, reflecting the diversity of engagement by summarizing the number of receptive and creative activities the individuals were engaged in separately. A combined total diversity score was constructed by summarizing the total number of activities that the participants had reported being engaged in across all receptive and creative activity responses.

Receptive variety of attendance

For each participant, we summarized a score across all four types of receptive activity. Few participants reported attending more than three types of activity; so, we created a total of 3 categories; '1 activity', '2 activities' and '3-4 activities'.

Creative variety of participation

Next, we summarised for each participant, the number of individual creative activities he/she reported engaging in. These ranged from 5 - those engaged in all the creative activity response options – to zero - those never engaged in any creative activities during the last six months. Due to a low number of participants reporting 4 and 5 creative activities, we created three categories by merging those who participated in 3-5 activities creating the categories: '1 activity', '2 activities' and '3-5 activities'.

Total variety of engagement

For each participant, we summarised all the individual activities he/she reported attending, reflecting the total diversity of their engagement. The highest score was 9 for those who participated in all four types of receptive and five types of creative activities, and the lowest was 0, for those never participated in any of the activities during the previous six months. Due to low numbers of participants reporting a high number of activities, seven categories were created by merging those who performed 7-9 activities into a single category.

Weekly frequency of engagement

Three weekly frequency quantifiers were created. These were operationalized by giving each response alternative a score reflecting the weekly frequency in each activity. These scores were then summarized within receptive and creative modes separately, and as a total weekly frequency quantifier for both modes.

Weekly frequency of receptive attendance

An index representing weekly frequency of participation in the receptive activities was assigned by giving each response option a weekly score: 'more than three times a month' received a score of 1 (i.e. approximately once a week), '1-3 times a month' was scored 0.5, '1-6 times in the last six months' was scored 0.25, and 'never' was scored zero. After totalling the scores across all receptive activities, additional group quantifications using quartiles were created to reflect weekly frequency engagement: the lowest quartile represented 'never to seldom' (score: 0-0.25), the second quartile represented 'every other week or less than once per week' (0.5-0.99), the third quartile represented 'once to less than twice per week' (1-1.99), and the highest quartile represented '2-4 times per week' (2-4).

Weekly frequency of creative participation

Similarly, an index reflecting creative weekly participation was created by giving each response option a score: 'more than once a week' and 'once a week' received a score of 1; '1-3 times a month' was scored 0.5, '1-5 times in the last six months' was scored 0.25, and 'never' was scored zero. The total of the scores across all creative activities was divided into quartiles: the lowest quartile represented 'never to seldom' (0-0.25), the second quartile represented 'every other week or less than once per week' (0.5-0.99), the third quartile represented 'once to less than twice per week' (1-1.99), and the highest quartile represented '2-5 times per week' (2-5).

Total weekly frequency of engagement

Lastly, a combined weekly participation index was created by totalling weekly participation in each individual activity for both the receptive and creative participation, and dividing it into quartiles: the lowest quartile represented 'never to seldom' (0-0.25), the second quartile represented 'every other week to less than once per week' (0.5-0.99), the third quartile represented 'once to less than twice per week' (1-1.99), and the highest quartile represented '2-9 times per week' (2-9). The maximum was nine times per week with combined receptive and creative frequency scores.

3.3.4. Mortality

The date and cause of death were taken from the individual HUNT3 participation data between 2006-08 and until the 31 December, 2015. The follow-up period was defined as the date of death or the end of follow-up date December 31, 2015, whichever occurred first. For the current

research, three separated outcome variables were conducted; all-cause mortality (Paper I) and cause-specific mortality (Paper II) were operationalized.

All-cause mortality

In Paper I, all-cause mortality was the main outcome. Each registered ICD-10 code reported within the period of follow-up, regardless of the underlying cause of death, was included and defined as the event mortality occurred. Otherwise, they were coded as survived.

Cause-specific mortality

In Paper II, two separate outcome variables were created by including cause-specific mortality covering specific ICD-10 codes for cardiovascular disease and cancer-related mortality outcomes separately, and the event was defined:

Cardiovascular disease mortality: Operationalization of CVD mortality outcomes with the selection of death reported with ICD-10 codes: 'I00-99' coded as the event.

Cancer-related mortality: Operation of cancer-related mortality outcomes with the selection of death reported with ICD-10 codes: 'C00-97' coded as the event.

3.3.5. GP consultations

Participants in the sample were followed-up for register data where GP consultations were recorded from January 1, 2009 until December 31, 2015. Classification and operationalization of GP consultations was carried out with selection and exclusion criteria. Eligibility criteria were first selected by the type of practice from the specialism field of the medical practitioner (medical doctor) (coded in the registry as 'LE'). Then the subject area medical practitioner (medical doctor) was selected as: GP independent of fixed salary, municipal emergency room, shift doctor fixed salary. Lastly, from the variable named as single contacts (labelled 'enkel'), GP consultations covering GP daytime and evening consultations (out-of-hours services), were extracted with inclusion of these specific tax codes classified as a consultation; 2ad, 2ak, 2ed, 2fk, 615* and 2ae.

3.3.6. Covariates

The following covariates assessed and retrieved from the HUNT3 cohort included in this thesis (Paper I-III) as potential confounders in the statistical analyses were: age, gender, marital status, and socioeconomic status determined by occupation, health status measured as longstanding,

limiting illness, and health-related behaviours: BMI, physical activity, alcohol consumption and smoking. All of the covariate data were self-reported and assessed in Q1 with the exception of age, gender, occupation and BMI.

Socio-demographic characteristics

The following socio-demographic characteristics were considered as potential confounders: age, gender, marital status, and socioeconomic status (SES) and these were determined based on the variable occupation available from the HUNT3 survey. Age and gender were obtained from the HUNT birth registry. The occupation data was collected by the health personnel at the examination site who asked participants about their occupational status.

Age and gender

Age and gender were delivered by the HUNT Databank as a continuous variable. Gender was withdrawn from the personal identification number and included at baseline as study variables.

Marital status

Marital status was assessed in Q1, which featured nine response options, further dichotomized into two categories. The first category that was operationalized was the category ‘being in a relationship’ that included responses married and registered partner. The second category ‘other’, including response alternatives unmarried, widow(er), divorced, separated, separated partner, divorced partner, and surviving partner.

Occupation data

Participants were asked about their occupation (174). Ten occupation types, based on the ISCO88 classification (183), were collapsed into three categories: low (‘elementary occupations’), medium (‘clerks’, ‘service workers and ship and market sales workers’, ‘skilled agriculture and fishery workers’, ‘craft and related trades workers’ and ‘plant and machine operators and assemblers’), and high level (‘legislators, senior officials, and managers’, ‘professionals’, ‘technicians and associate professionals’, and ‘armed forces and unspecified’).

The participants missing information constitute 1 442 (4.0%) individuals. Those were categorised as having elementary occupations because the data showed they were young; possibly students and not working, or old; likely retired. These were therefore excluded, as they would probably bias our results.

Health status

As both mortality and healthcare usage are highly connected with both physical and mental health status, a measure of health that embraces both these health aspects was included.

Long standing illness

A question concerning having a longstanding illness was included in Q1: *‘do you suffer from longstanding (at least one year) illness or injury of a physical or psychological nature that impairs your functioning in daily life?’*

Health-related lifestyle behaviours

In total four measures reflecting the individual’s behaviour were included and used as potential health-related confounders in this study: BMI, PA, smoking and alcohol consumption.

Body mass index

Body mass index (BMI) for each participant was calculated based on height and weight and provided by the HUNT Databank. The weight in kg and height in cm was measured and collected at the examination site by trained health experts to reduce measurement error. A standard protocol was applied, with the use of standardized weight scales and meter bands. Furthermore, the measurements registered were controlled by the HUNT Databank to treat possible typing errors, and they provided ready-made BMI measures. BMI was computed as weight divided by the square of the height.

These precalculated BMI measures were further categorised into four BMI categories: ‘underweight’ <18.5, ‘normal weight’ 18.6-24.9, ‘overweight’ 25.0-29.9 and ‘obese’ ≥ 30 (184). Due to the small number of participants in the underweight category, we merged underweight with normal weight, and ended up with three groups: ‘normal weight’ (< 18-24.9), ‘overweight’ (25.0-29.9), or ‘obese’ (≥ 30).

Physical activity

For measurements of physical activity, we calculated metabolic equivalents (METs), which reflected activity levels in minutes per week, based on frequency, duration, and intensity measures that were collected in Q1. These MET measures were divided into two levels: above and below the international recommendation of at least 150 min/week of moderate-to-vigorous intensity (185). This cut-off point corresponds to above or below 500 MET minutes per week.

Alcohol consumption

The participants reported alcohol consumption in Q1 with the number of units of beer, wine, and spirits consumed in the seven days preceding the survey. These responses were calculated summarizing all units into ‘never’: response 0 units/week, low consumption: response 1-6 units/week, and high consumption: responses ≥ 7 units/week.

Smoking

We included and operationalized smoking status from the question: ‘Do you smoke?’ The response alternatives were ‘No, I have never smoked’, ‘No, I quit smoking’, ‘Yes, cigarettes occasionally (parties, vacation, not daily)’, ‘Yes, cigars/cigarillos/pipe occasionally’, ‘Yes cigarettes daily’ and ‘Yes, cigars/cigarillos/pipe daily’. Occasional and daily smoking were collapsed together into one category ‘daily’ smoker. Smoking status was categorized as ‘never’, ‘former’, or ‘daily’.

3.4. STATISTICAL ANALYSIS

3.4.1. Descriptive methods

Basic descriptive statistics were performed in all three papers. The distribution of continuous and categorical variable allocation was performed to describe the population data sets. Central tendencies were calculated for continuous variables as average mean, with appropriate standard deviation (SD) describing the variability. Dichotomous variables were presented as numbers and percentages within each category. The variability describes the dispersion of the variable, describing characteristics of the participants in the dataset.

In Paper I and II: Cross-tabulation was performed to separate the categorical explanatory factors by each individual activity, split by gender.

In Paper III: Cross-tabulation of descriptive gender-specific variations allocated by covariates. The number of GP consultations per year is presented as numbers and percentages in addition to mean and SD, by gender.

3.4.2. Sensitivity analyses

Sensitivity analysis was conducted to circumvent problems regarding reverse causation. We assumed that those who died within the first two years may, have worse health at the baseline compared to those who die later during the follow-up period. This earlier health status may

cause confounding, so occurrences of deaths within two years of the participation date in HUNT were discarded to alleviate potential reverse causation between poor health and engagement. This excluded 0.87% (316) of participants who died from all-cause mortality within the first two years from baseline. In addition, longstanding, limiting illness was adjusted to remove the possibility of reverse causation.

3.4.3. Handling of item missingness

Complete case method was used because of missing information on some of the covariates. This method was chosen as it is useful when there is a lack of information. Any observation with missing data was discarded, and only complete observations have been analysed. The major potential advantage of this approach is its simplicity, as a standard complete data set, so its analyses can be used in a straightforward manner. The disadvantages are the potential loss of information by discarding participants with incomplete information which can lead to reduced precision and information bias because the data set is not complete with all random samples.

To test the complete case method, the variables were specified by constructing a missing category. Compared to the results from the missing category variables, the complete case method did not affect our results. Therefore, the missing may be random, and will probably not constitute systematic errors caused by the missingness on the covariates.

3.4.4. Statistics Paper I and Paper II

Cox proportional-hazards regression was used to estimate the risk of specific mortality based on baseline cultural participation. Cox regression, with time from date of baseline cultural activity measures, to investigate the association between engagement and mortality, aimed to assess the hazard ratio (HR) for cultural activity engagement within the different time spans of mortality. HR “*indicates the instantaneous risk or hazard (hazard per unit time, usually 1 day) of an event (e.g. death)*” in one group of exposed relative to a reference group (186). HRs can be interpreted as relative risk that “*implies a comparison of probabilities*” (186). These HRs represented the ratios between various groups regarding the probability of dying from all-causes, cardiovascular disease, and cancer-related mortality, respectively among those exposed compared to those non-exposed.

The models were specified with days as the timescale to compute the hazard ratios (HRs) and were assessed for all-cause mortality in Paper I, and cause-specific mortality; cardiovascular disease and cancer-related outcomes, in Paper II. The precision of the estimates was evaluated with a 99% confidence interval (CIs). Gender was revealed to be significant as a covariate in almost every established model of cultural activity quantifier and in the mortality outcomes in Papers I and II. Based on the results, we established interaction and performed gender-specific analysis to control for the effect of gender.

In Paper I, the relationships between cultural participation and all-cause mortality were analysed using the univariate and multivariable time-to-event models. Five statistical models were constructed for adjusting the associations' effect estimated with 99% confidence intervals (CIs) and presented results for each model. Model I: age and gender; Model II: socioeconomic status (occupation) and marital status; Model III: longstanding, limiting illness; Model IV: smoking, alcohol consumption, physical activity, and BMI.

In Paper II, multivariable time-to-event models were executed, and estimates were presented for fully adjusted models with 99% CI.

3.4.5. Statistics Paper III

Data were analysed using multilevel negative binomial regression models and associations between cultural engagement and GP consultations are reported as rate ratios. The method of negative binomial regression is a generalization of the Poisson regression, with exception of the deviance of the criterion to satisfy the Poisson distribution, the mean = variance assumption (187). When investigating event counts, it is rarely the case that the observed data comply with the rather strict criterion of the Poisson method. The negative binomial regression does not assume equal dispersion assumption, as two parameters are included (μ and α), which allow the variance to vary independently of its mean (188). The values of the count outcomes cannot be negative (non-negative integers) (187). The multi-level method account for the non-independence of healthcare contacts within individuals. Given a hierarchical data structure with annual primary health care contacts nested within individuals yearly during the time of follow up from 2009 to 2015.

The results are expressed as adjusted rate ratios, with 99 % CIs, and p -values <0.01 were considered statistically significant. To provide separate results for males and females, the

models were re-parametrized by including an interaction term between the cultural activity indicator and gender while omitting the main effect of cultural activity. There were significant results for almost all quantifiers of cultural activity. Interaction or effect modification is the effect of one variable that is changed, or modified, depending on the level of the other variable. In these nested models, a likelihood ratio test was performed in order to test the difference between the two models, comparing women and men (189), in relation to the exposure cultural activity quantifier and outcome measure GP consultations. The data were analysed with Stata v16 (ref StataCorp) when conducted for statistical analysis.

3.4.6. Precision of reported estimates

Every statistical test comes with an inherent type I error rate which is equal to the threshold set for statistical significance, typically .05. However, this is the error rate for one test. When performing multiple hypothesis tests, which was the case in all the analyses, the overall type I error rate becomes much larger than 5%. To reduce the likelihood of chance findings (i.e., to falsely reject the null hypothesis when it is in fact true) we set the alpha level to .01 in the analyses. However, it should be noted that there is no common consensus about when, or how, analyses should be adjusted for multiple statistical testing (190).

3.5. ETHICS

The HUNT3 survey was approved by the Norwegian National Committee for Ethics in Medical Research (REC) and the Norwegian Data Inspectorate, and it was conducted in accordance with the Helsinki Declaration. Participation in health studies is voluntary and requires informed consent. The study used an information letter and a dynamic and broad consent that was obtained (attachment 4), that permits linkage to national registries (191). Prior to participation, all participants had to hand in a signed consent. Participants are allowed to withdraw from the survey at any later point, whenever they want. Data already delivered to the research project cannot be withdrawn.

The benefits of this study were regarded by the committee for ethics in medical research to outweigh any possible disadvantages for the participants. This study follows the general ethical guidelines for research set out by the Norwegian National Research Ethics Committees and the Declaration of Helsinki. The HUNT Study presents research findings on the website for participants.

Ethical approval

This project was approved by the Regional Committee for Ethics in Medical Research and Health Research (REC), reference 2016/282/REK midt.

4. RESULTS

4.1. DESCRIPTIVE FINDINGS

In Papers I and II, data from 40 214 participants (43.8% men, 56.2% women) were included in the descriptive analyses. 5.6% of women and 4.9% of men reported not being engaged in any activity during the last six months. The largest proportion of women was observed within the age spans 20-29, 30-39, 40-49 and above 80 years, unlike men were within age span 50-59, 60-69, and 70-79. Strong gender differences were noted for occupational class, marital status, alcohol use, and BMI. For occupational categories 4.7% of men were in low occupations, compared to 15.5% of women. Never using alcohol and having a normal BMI were more prevalent among women than men. Excessive alcohol consumption was much higher for men (10.0%) than for women (2.9%). Regarding BMI, 53.1% of men and 38.1% of women were classified as ‘normal weight’, while 38.4% of women and 24.6% of men were classified as ‘overweight’.

Table 3: Distribution of number (%) of participants split by papers and gender. The HUNT Study (2006-08).

		Paper I & II (n=35 902)		Paper III (n=31 847)	
		Men	Women	Men	Women
Total		17 606 (43.8)	22 608 (56.2)	15 574 (44.4)	19 491 (55.6)
Mean age ± Std.		55,2 ±15,0	53,5 ±16,1	55,8 ±12,2	54,5 ±12,7
Non-engaged	Never*	4.9	5.6	4.5	5.1
Weekly frequency	Never to seldom**	10.0	10.6	9.2	9.8
Occupation level	Low	4.7	15.5	3.5	13.4
	Medium	60.0	51.7	59.7	52.2
	High	35.4	32.8	36.8	34.4
Marital status	Marriage***	64.8	57.6	68.5	63.7
	Other	35.2	42.4	31.5	36.3
LLI****	Yes	41.4	41.9	41.2	42.1
	No	58.6	58.1	58.8	57.9
Alcohol, units/week	Never	15.1	27.9	14.1	26.4
	0.5-6.5	74.9	69.2	76.2	70.8
	≥7	10.0	2.9	9.7	2.8
Cigarette smoking	Never	40.1	45.2	39.7	43.0
	Former	38.1	30.4	38.7	32.1
	Daily	21.8	24.4	21.5	24.9
Physical activity (Mets*****)	<2.5	60.2	56.4	60.5	55.7
	≥2.5	39.8	43.6	39.5	44.3
BMI	Normal	24.6	38.4	22.2	36.6
	Overweight	53.1	38.1	54.5	38.9
	Obesity	22.4	23.5	23.1	24.5

Age, category	20-29	6.1	8.4	-	-
	30-39	10.6	13.6	11.9	15.8
	40-49	19.1	19.6	21.4	22.7
	50-59	24.6	22.0	27.5	25.4
	60-69	22.6	19.7	25.2	22.7
	70-79	12.7	11.8	14.0	13.5
	≥ 80	4.4	4.9	-	-

*Non activities reported the last six month of the 9 response alternatives; **Never engaged or seldom; `once up to maximum six times` in the last 6 months; ***Marriage/ relationship; ****LLI: Limiting longstanding, limiting illness > one year; *****Met: metabolic equivalent.

Sample in Paper III

In Paper III, in total 31 847 participants aged 30 to 79 years, (54.6% women and 45.4% men), were included in the analyses. The mean age was 53.6 years (12.4 SD) and 53.4 years (12.1 SD). 5.1% of women and 4.5% of men reported not being engaged in any activity during the last six months. The largest proportion of women was observed within age span 50-59, and men between the age span 50-59 and 60-69. Nevertheless, the lowest proportion was in category 70-79 among women and 30-39 among men. Gender differences were observed for occupational class, marital status, physical activity, smoking, alcohol use, and BMI. A higher representation of women from low occupational classes and a higher share of men being in a marriage or relationship was noted. Gender differences in health-related behaviours were apparent for alcohol, smoking and BMI; more men than women were overweight and reported drinking alcohol, whereas daily smoking was more common among women. More men than women were married, and slightly fewer men were affected by longstanding, limiting illness compared to women. A larger portion of men, compared to women, were not meeting the national recommendation of physical activity.

4.2. PAPER I: ALL-CAUSE MORTALITY

In summary, 1 905 of the participants died during 8.15 years of follow-up, among the sample population (292 416 person-years). In total, 17 606 (43.8%) men and 22 608 (56.2%) women were included in the analysis, with a mean age of 55 years and 53 years, respectively. The results revealed that the number of receptive activities was associated with all-cause mortality, and a reduced risk occurred with attendance at 2, or `3-4` activities (21% and 31%, respectively). The risk was reduced through creative activities, with participation in 1, 2, and `3-5` activities (28%, 40%, and 43%, respectively). Gender-specific analyses showed a clear gradient where participation in creative cultural activity lowered the likelihood of mortality with engagement in 1, 2, or `3-5` activities by 28%, 44%, and 44% for men, respectively, and for women 28%, 35%, and 44%. However, the association between receptive activities and all-

cause mortality was less consistent. For women, the risk reduction of 22% appeared only by attending one activity with no relation to further accumulation, whereas, for men, there was a gradient, with a 23% reduction of risk from 2 activities, and 35% from '3-4' activities.

Weekly frequency by receptive attendance and creative participation, showed a reduced risk related to frequent participation in creative activities. For receptive activities, the estimates were less strong and similar for 'less than once', 'once to less than twice' per week (21% and 19%, respectively). Gender-specific findings show that risk reduction was not present for women but was present for men which may reduce their mortality risk by attending receptive activities 'less than once', or 'once to less than twice' per week by 23% and 22%. Furthermore, risk reduction by frequency of creative activities showed a gradient from 30%, to 33%, and up to 36%, with a quite similar effect estimate for both genders separately, ranging from 29%, to 34%, up to 38% among women and from 31%, to 33%, and up to 33% among men. Total weekly frequency (combined receptive and creative) revealed gradients, with relatively similar risk reductions as creative participation, ranging from 18% to 31%, and up to 39% for all. The findings revealed a risk reduction from 27%, to 29%, and up to 37% among women, whereas men may only lower the risk when engaged once to less than twice, and twice or more often, with 32% and 39%, respectively.

The main findings of individual activity engagement were higher mortality risk for non-participants in any receptive or creative activities, except for sport event attendees. Gender association was also evaluated, and among men, we found similar results as above except for parish work, while women increased their longevity through creative activity participation in association or club meeting/activity, parish work, and outdoor activities. Notably, women who engaged in parish work halved their mortality risk compared to their counterparts that reported not being engaged.

4.3. PAPER II: CAUSE-SPECIFIC MORTALITY

During the mean duration of the follow-up of 8.15 years (292 416 person-years), a total of 235 (1.04%) women and 328 (1.86%) men died from cardiovascular disease (CVD), and 313 (1.38%) women and 439 (2.49%) men died from cancer-related issues.

Taking part in a variety of receptive or creative activities was not found to be an important determinant of CVD or cancer-related mortality for all, or either men or women, with the exception of creative participation and CVD mortality. Participating in one, two, or '3-5' activities, may reduce the CVD mortality risk by 25%, 40%, and 35%. The risk reduction may be attributable to the women, with a gradient revealed with a lower risk from 38%, up to 43%. Notably, participating in increasing numbers of receptive activities did not seem to moderate a reduction in the risk of CVD or cancer-related mortality.

The total variety (number of receptive and creative activities combined) may lower the risk of cancer-related mortality. The risk reduction ranged from 38%, up to 55% when engaged in a cumulative number of activities from one up to the highest category '7-9' activities. Furthermore, the gender-specific analysis showed that these associations affected the mortality risk among those engaged men, with lower risk from 40%, up to 69%.

Weekly frequency of engagement suggests that total participation (both modes combined) and creative participation may lower the risk of CVD mortality. Overall, reduced risk of CVD mortality was associated with engaging in creative activities (combined mode) on a weekly basis less than once, and less than twice per week with a risk reduction of 36% and 26%. However, gender-specific findings show that men had a risk reduction of 40% when participating less than once a week.

Weekly frequency of engagement did not prove to be strongly associated with cancer-related mortality. For the overall sample, participating once to less than twice per week (in both modes combined) reduced cancer-related mortality by 29%. This is probably attributable to creative participation, whereas less than twice a week showed a 26% of significant risk reduction.

The risk of CVD mortality was lower among participants in associations/club meetings (22%) and outdoor activities (23%), respectively, as well as attendees of art exhibitions (28%). Gender-specific findings show that women participating in associations/club meetings may lower their risk by 36%. However, no risk reduction was revealed among men by engagement in individual activities.

The results of the individual activity measures among receptive activities revealed that attending museum/art exhibitions was associated with a lower risk of CVD mortality; the fully

adjusted model showed a significantly lower risk of 28% for the whole population in this regard. Gender-specific analyses revealed that neither women nor men experienced a significantly lower mortality risk when participating in any of the receptive activities.

Those who participated in music, singing, and theatre had a 27% reduced risk of cancer mortality. Gender-specific findings show that men who engaged had a 33% reduced risk by participating in these activities.

4.4. PAPER III: GP CONSULTATIONS

In Paper III, a mean of 3.57 GP visits per individual was recorded during the seven years follow-up period, with a mean consultation number of 3.8 among women and 3.3 among males, respectively. Women used approximately 55% of the consultation for the whole period and had a higher share of annual consultations during the period.

The variety of activities shows that engagement in a cumulative number of activities resulted in a lower rate ratio of GP consultations. Gender-specific analyses suggest that these effects were attributable to men, with a 12%, 16%, and 16% lower rate when participating in one, or two, or '3-5' activities, respectively. The total variety of activity engagement when combining both activity modes, shows a similar pattern, with a 13%, up to 22% low rate when engaged in from one, up to highest category '7-9' activities, compared to non-engaged. However, no such findings were identified among the engaged women.

The weekly frequency estimates, show that the rate of GP consultations among men taking part in creative activities less than once, less than twice, and twice or more often (≤ 5 times) per week, is 10%, 11%, and 13% lower, respectively, compared to non-participants. The total weekly frequency of combined receptive and creative activity engagement less than once, once to less than twice, and twice or more often (≤ 9 times) showed an 8%, 13%, and 17% lower rate ratio among those engaged men, compared to non-engaged.

According to individual activity engagement, the rate of GP consultation was lower for museum/art exhibition, sport event attendees, and participants in association or club activity and outdoor activity, compared to non-attendees. The gender-specific association revealed that attending museum/art exhibitions led to fewer GP visits showing similar effects estimates in

both genders with a 5% lower likelihood among men and 6% among women, compared to their counterparts that reported not being engaged. Likewise, participation in association or club meeting showed a 9%, and 4%, lower likelihood of GP consultations among men and women, respectively. Men also had a lower likelihood of GP consultations when attending `concert, theatre, or film` and sports events with a 5%, and 10% reductions. Whereas outdoor activity participation had a 13% lower likelihood of GP consultations among men.

5. DISCUSSION

In this thesis, the focus has been to study various quantified exposure measures of receptive and creative activity engagement in a normal Norwegian population in relation to longevity, cause-specific mortality and usage of GP consultations, in addition to conducting gender-dependent associations between cultural activity engagement and the outcome measures.

In the following sections I will discuss strengths and limitations, including the methodological choices made in this thesis. I will also define and identify both random and systematic sources of errors that may affect the interpretation of the results.

5.1. METHODOLOGICAL CONSIDERATIONS

This chapter presents some considerations of the research methods used in this thesis and elaborates upon the methodologies and their strengths and limitations. These represent the boundaries and the thought forms that influence how the findings should be considered.

5.1.1. Study design

Because of the aim of this study, a cohort study with a prospective design was used in all three papers. The baseline sample of participants was taken from the HUNT3 survey, in a prospective cohort design. Participants were assessed at baseline with longitudinal follow-up over a time period with records of the occurrences of outcome measures of interest (192) among the exposed compared to the non-exposed (193). A cohort study is one of three non-experimental observational studies (193-195), and shares common characteristics (193). The information about individuals is collected before an event occurs, and this study type is suitable for comparing the incidence of outcomes as well as for assessing associations when there are more than two exposure categories or different levels of exposure (192, 196).

A strength in this thesis is the prospective longitudinal follow-up of mortality outcomes over a time period from 2006-08 until 2015, and primary health care including general practitioner consultations over a 7-year period from 2009-2015. This type of general population cohort study can be used in combination with other data (195), such as registry data that enable exploration of mortality follow-up for all cases, as well as for case-specific mortality (197). In prospective cohort studies, loss of follow-up can give rise to information bias (196). Loss of follow-up is important for exposure and outcome measures in this type of study (193). The

advantage of the design and the longitudinal follow-up of the mortality endpoint included a total sample with no exception or possibility to withdraw later from the ongoing research, as it includes those who did not withdraw before the sample was extracted from the HUNT3 data. However, observational studies cannot establish that the association identified represents a cause-and-effect relationship (causal association), and do not have the benefit of randomization to allocate by change of risk factors for an outcome of interest. A notable limitation is the lack of repeated measurement information to account for possible changes of exposure to cultural activity and relevant health-related covariates during the follow-up period.

Validity of the research is necessary for the results to be assessed as both reliable and generalizable. When assessing validity, a distinction is made between random and systematic errors (198), and these will be discussed further.

5.1.2. External validity and generalizability

External validity “*refers to the extent to which results from a study can be applied (generalized) to other situations, groups or events*” (199), in terms of the transferability to other populations outside the study population (200). If the study participants differ substantially from the main population, it threatens external validity (199). Generalizing the results of the study to the general population is less problematic when the general population, rather than a narrower sample, is the starting point (196). The sample size according to population size and characteristics is important to ensure representativeness (5). The major strengths in the observational data used in this thesis, are the large population, which creates a representative sample (174), and with the option to link to national, valid register data.

The life expectancy in former Nord-Trøndelag County follows the national life expectancy and reduced inequalities in disease burden between counties (56, 201). A growth in national GP services with an increase in GP consultations was observed from 2010-15 (202, 203) similar to the findings in the HUNT3 population. In general, there are limited possibilities to account for the multi-dimensional concept of cultural activity engagement in the population. Our health-related behaviour is shaped by many factors, such as belief, the local understanding of diseases, the available health system, and our historical understanding of disease (204). Culture is a complex concept, as it is rooted in separate areas of society (44), with its own value and set of characteristics (11). In addition, cultural participation is culture-dependent, a part of different cultures. Some activities can be clustered in local places, and other activities can be common

worldwide (5). As a consequence, cultural considerations need to be added to the questionnaires (8), as the measures of cultural activities may vary with the diversity of cultures, and inter-study comparisons are challenged by the seldom presence of equal measurability. Hence, when comparing our findings in the context of other studies, it is important to note the methodological differences between studies. Since cultural context is important for cultural behaviour, we will be able to consider this research to be most generalizable for populations which are more similar to the Norwegian one. These findings are applicable to the Norwegian population as a whole and Northern European countries, especially Scandinavian countries.

5.1.3. Random errors (precision)

Random errors refer to “*fluctuations around a true value*” (205) and are “*the variability in the data that cannot be readily explained*” (206). Random errors affect the estimates and results in either over or underestimated values. Biological variation, sampling error and measurement error are sources that influence random errors; as biological processes fluctuate in each individual over time, the random influence of what or who is selected influences the error, and fluctuations in measurement may cause the error(s) (205). A representative sample of the target population will represent the true results. If it is not representative, the findings will not reflect the reality of the investigated population (207). These errors can be factors that are either unmeasured, so far unknown, or hidden factors. By increasing the sample size, the occurrence of random errors is reduced (206). Estimates that are less affected by random error are considered precise (200). These types of errors lead to lower precision in the estimates and hence greater variation in the estimates. Noteworthy is that these random errors can also bias the estimates (198). Precision is connected with random errors and is obtained when there is a lack of random error (208).



Figure 4: Illustration of the relationship between accuracy and precision and error, both random- and systematic error. Source adapted from Scribbr.com (209).

The accuracy of the point estimate in Papers I, II, and III was calculated with 99% CI, which set a 1% chance maximum to reject the null hypothesis incorrectly. Quantifying uncertainty by hypotheses testing can be of two different types; type-1 and type-2 errors. Type 1 is when the null hypothesis is incorrectly rejected, and the consequence is that a difference is observed when in reality there is no difference between the exposure (predictor) and the outcome. Type-2 error is when the null hypothesis is wrongly accepted, the consequence is that no difference is observed when there, in fact, is a difference (205, 207). A conservative statistical approach was chosen by presenting the estimates with 99% CIs, based on multiple testing performed on the same sample. The 99% CIs were used to limit the risk of type-1 error rate, thus, reducing the probability of false positive conclusions. Notably, the influence from random errors decreases with increasing sample size (206). When the gender-dependent analysis was performed, it resulted in a lower sample size, which resulted in a wider CI. So, random errors are more likely in these estimates. But still, the sample size can be defined as large, and the sample data allow for high precision and hence assume that random errors still have less implications on the estimates.

The major strengths of our study include the population-based prospective design and the large sample size with a good response rate (54%). A low participation rate increases the risk that those who do participate are not representative of the group under investigation. The sample from the study population must have a certain variation in the exposure variables. If variation does not exist, then no connection between exposure and outcome can be found. The larger the sample size, the greater the variation, and an association between exposure and outcome will be detected because of the sample size (196). In case of random errors, the precision is not good enough, and this leads to increased variation, but does not necessarily threaten the validity (210).

5.1.4. Internal validity

The validity can be reduced by systematic errors, which are “*consistent or proportional difference between the observed and true values*” that causes bias (211). Systematic errors may reduce the internal validity, i.e., the degree of confidence that the causal relationship is not influenced by other factors or variables. There are some threats to internal validity, like; selection bias, information bias, and confounding factors (199, 200, 211). Separately, or together, they can lead to distortion and to incorrect results, from bias in the estimates (198, 212).

Selection bias

Selection bias is a subject of controversy in epidemiology and the definition is not as clear as that of confounding or information bias. Part of the controversy relates to the fact that it has sometimes been considered a threat to internal validity and at other times been seen as a threat to external validity (213). Selection bias is systematic error (214) that occurs and exists when *“the subjects studied are not representative of the target population”* from which conclusions based on the results must be drawn (215). Selection bias can arise either from the procedures for the selection of study participants or from factors that influence individuals' study participation. The selection of a study population is essential for the generalisability of the study results and may be influenced by many factors (214), and these are necessary to address.

In observational studies, the participants are not selected randomly, so selection bias often occurs (216). The final study sample is dependent on a number of factors, which either separately or together, may influence the sample (215). If non-responders or excluded individuals have different characteristics, patterns and degrees of exposure, outcomes, or other relevant health-related explanatory factors from the individuals who are included in the sample, then selection bias may have occurred (217). Although the sample in this thesis encompasses a very large part of the population which would tend to minimize selection bias, the prospective longitudinal design has some disadvantages with non-responders at baseline.

Systematic differences between HUNT3 participants compared to non-participants can cause selection bias. Those who participated may be in better health than non-participants (217). Previously, Langhammer et al. conducted a non-participant study of the HUNT3 population. In summary, findings revealed that the non-participants were more likely to experience shorter longevity compared to the participants and to display higher mortality rates in the years after the survey was conducted. In addition, a higher prevalence of several chronic diseases was observed among those who declined to participate compared to the participants. This was the case for cardiovascular disease and mental distress. Langhammer et al also uncovered indications of lower socio-economic status among the non-participants and an unhealthier lifestyle in terms of physical inactivity and tobacco smoking (191).

To avoid and reduce biases in Paper III, the sample was restricted to a narrower age range by taking out age groups 20-29 and 80 years and above, mainly because of the low participation

rate. The oldest are more likely to be connected to doctors by the institutionalized exit of the GP scheme (89). Among women, the number of consultations is overestimated because of pregnancy-related consultations. Contraception, pregnancy, and childbirth are common reasons for a GP consultation for women of childbearing age. These make up 21% of all consultations for women aged 25 to 44 (81). We attempted to remove bias by taken out ages below 30 years. This resulted in a smaller analytical sample with 31 847 individuals, so random error may have increased as was already likely in the smaller gender-dependent samples. Notably, gender participation was more equally distributed in Paper III (55.6% women vs 44.4% men), though higher among women than men in Papers I and II (56.2% compared to 43.8% respectively).

Information bias

Information bias (measurement bias) occurs when study information obtained is “*inaccurately measured or classified*” (216). Systematic distortion or errors may arise from data collecting procedures, when data is measured, or during further handling of the measurements or classification of the collected study information. Systematic variation might cause information bias, and measurement error may affect the obtained data of exposures, outcomes, or other relevant covariates, or in all of them (200, 215, 216). If information bias exists, misclassification has occurred and consists of either non-differential or differential misclassification (211, 214). The quality of the information in an observational study is crucial to whether the results can show any real effect of exposure to the response (outcomes) (210). The comprehensive HUNT3 survey obtained rich data information, and the ability to link valid national register data constitutes a major strength in information sources.

Cultural activity measure

Defining engagement in cultural activity is not easy (31), though Q2 in the HUNT3 survey includes detailed questions on a broad variety of activities. Data were collected using a standardized questionnaire (attachment 6), with a module that includes two questions covering both receptive and creative engagement modes. Each single activity measure had several frequency response options (31), so the data on cultural activity is detailed and quantified. Missing data is an important source of bias in observational population data. Whether this missingness was due to random loss on the main exposure measures, or due to systematic loss (31), was not possible to investigate in this case. Participants who provided only one response across the receptive and creative activity questions were not considered to have provided missing data, on the assumption that they only provided answers for the specific activity they

had engaged in. If this is not the case, then these were misplaced, and misclassification has biased our estimates with an increasing number of non-engaged in the control groups of the quantifiers.

Several frequency response options were measured, enabling the quantification of various unequal quantifiers of engagement. The risk of classification errors was reduced by dichotomizing each individual activity frequency measure by collapsing all frequency response options into one category 'engaged', as incorrect responses may be more likely to occur between the frequency options. In advance, the hazard ratio of all-cause mortality was estimated for each level of the frequency categories for each individual activity separately, to estimate how increased participant frequency affects longevity. There did not appear to be considerable changes in the association. Thus, dichotomization of the frequency information was performed to reduce possible frequency information bias. The variety index was constructed out of these individual dichotomous activity measures, as an effort to ensure a low risk of misclassification. The weekly frequency quantifiers may be more vulnerable to misclassification because the construction was based on the participants' original response to the frequency options.

A qualitative validation study conducted by Holmen et al. (31), indicated that adults managed to distinguish between receptive and creative activity modes and separate these response options. Random individual variations in the interpretation of the questions can always occur and be a source of error. Since the analysis is performed at the group level, this is rarely a problem. The interviews conducted revealed no evidence of systematic misinterpretations. As a result, both the receptive and creative questions with the appurtenant response options were proven to be adequate for conducting analyses at the group level. In conclusion, the data were sufficiently precise for public health research, providing a rough estimate of the cultural activity engagement in the population (31).

Recall bias is another form of information bias created by differences in accuracy of recall between study participants (199), and how well they remember when reporting information. However, most of the self-reported variables in the HUNT study assessed recent behaviours, except cultural participation. But, a 6-month recall of memorizing exposure information of activity and frequency is assumed to be appropriate to prevent recall bias, and it is anticipated to be a valid recall time interval (31). Importantly, an extensive interval timeframe may increase recall bias and lead to unreliable responses (8). Regarding seasonal variations, which if not

considered can lead to information bias, a 6-monthly interval is considered short, so, a longer interval like 12 months is better (31). The HUNT3 data was gathered over a 2-year period, with a 6-month retrospective recall of assessing the self-reported cultural activity data. The statistical estimates may probably not be influenced. Because the data collection took place over two years, and at the group level, seasonal variations were ensured (31). If recall bias has occurred, most likely it will be non-differential in relation to the exposure measures, and hence misclassification unrelated to other study variables (217), and if so, probably both under-reporting and over-reporting have occurred when the participants provided information.

Outcome measures

A major privilege is the ability to link complete national register-based outcome measures of each participant, based on the validity of these data (176, 178, 218). Among the strengths of using mandatory register data is that people cannot oppose being registered if an event occurs, and that recall bias is eliminated (176) and avoided when the outcomes are determined after the exposures (192). The occurrence of the events was registered from records by medical doctors, hence, misclassification of the outcome measures is assumed to be low. When using outcome measures recorded in such national mandatory registers, dropouts and losses to follow-up are minimized, expected to be few and are assumed not to influence the estimates considerably. The follow-up time may be considered sufficiently long for this research design.

Mortality data provided from the high-quality Cause of Death register is accurate and valid. Both all-cause (Paper I) and cause-specific (Paper II) mortality are considered to be very accurate (218) in the register and it provides high degrees of coverage and completeness regarding these data (178). In Paper II, a major strength was the ability to explore the risk of cardiovascular and cancer-related mortality, based on the registration of data codes of the underlying causes of death. These records are in general regarded as high-quality data (178, 219).

In Paper III, aggregated GP consultations from 2009-15 were retrieved, and the annual number of consultations was calculated. This data is based on the registration of consultation codes by the GP and the procedures for claiming reimbursement, a procedure between the treating GP and Helfo. Each contact, when service is received from the GP, generates a unique claim of reimbursement for the service provided by the treating GP and registered in the KUHR registry. The registry provides prospective accuracy register information, with less than 1% non-

participants (89). Reporting is economically incentivized so high coverage and completeness in the KUHR register can be assumed (176). Furthermore, it was advantageous to be able to use GP consultations, covering both GP office and out-of-hours services (consultations in the evenings) (176). It captures when there is pressure on the services during daytime, as this increases the out-of-hours service usage. The list-based system, which implies that all inhabitants were assigned the right to choose their regular GP as their primary health care provider, aimed to strengthen the relationship and to improve stability in the relation between GP and the patient, and to promote equity (82, 84). A health system with a foundation based on strong primary health care is more likely to provide responsive, effective, equitable, and efficient health services (220). The density of GP per 1 000 inhabitants is 4.7, which is among the highest in Europe (56) and can therefore allow us to assume good access to GP consultations.

Confounding

Confounding is one type of systematic error (221), considered as “*confusion of the effect*” (214). When present, it causes a systematic “*distortion of the association between an exposure and health outcome by an extraneous, third variable*” (221). Unnecessary adjustment, by covariates that are not truly a confounder, can introduce bias into the estimate of effect and can lower the precision (214). The decisions about confounders should be made on the best knowledge and available information (221), as they affect the estimates. Ways to control for confounder(s) include; restriction, matching, and randomization (222). To handle bias that may arise from confounding factors, statistical methods such as adjustment of confounders, and stratification of the sample can be used (217, 223).

The HUNT3 data include information on important covariates, enabling the inclusion of relevant adjustment factors (174). This is advantageous and enables one to rule out bias for the estimated associations investigated, as several covariates are available and easily accessible. First, to approach and guide the selection of adjustment factors, the knowledge base of previously published studies exploring mortality outcomes was used although, they were somewhat divergent regarding the choice of adjustment factors and possible interaction. Selected and considered as potential sources of systematic errors in all three papers, if not adjusted were; age, gender, socio-economic status, health status, and lifestyle behaviour factors; physical activity, alcohol consumption, smoking, and BMI. These factors are related to mortality risk and morbidity and these factors can be assumed to affect usage of health care and GP consultations. Both health and mortality vary with age (129), and gender (75, 76). Marital

status was included as an adjustment factor, as previous findings have shown that married people participate in fewer highbrow cultural activities than single people (224). The probability of both spouses being engaged in cultural activities increases with income level, and it decreases with the presence of young children (159). Importantly, the adjustment of longstanding, limiting illness was measured by only one question. According to self-rated health (a measure of people's perceptions of their subjective health (225, 226), this is proved to be sufficient (227). However, considering anxiety and depression separately may have been an advantage, as these conditions may have a different influence on engagement in cultural activity and the outcome measures. Anxiety and depression are prevalent conditions and were found to be barriers to cultural engagement by Fancourt et al. (228). Other possible barriers to being engaged may be mental and physical disabilities, economic and social barriers, and price. The elderly may have problems reaching events or activities and may be dependent on others (20). Nevertheless, these barriers may turn out to differ by activities and modes of engagement (8), and further research is needed to explore these aspects. Furthermore, neither comorbidity nor multimorbidity was examined. Possible joint effects of multiple risk factors (e.g. a cluster of risk factors within a single individual) were not considered. Living habits are socially conditioned, and people with a shorter education and lower income often have a poor diet, are less physically active, and have higher use of tobacco (59). The association may partly be on behalf of distinct and more healthy lifestyle (229). Importantly, a limitation may be a relatively poor adjustment of socio-economic status conditions, as adjustments were made only for occupational status. Occupational categories were the only socio-economic variable included in available data. In the youngest age category, there was a partial lack of reported occupational status, so these individuals were categorized in a low occupational group. Of these, several can be assumed to be on an educational course and could be from a relatively high-ranking household, so a level of misclassification can be assumed in this age group. Also, among elderly women, misclassification in the low occupation category may have occurred where the spousal income and education level may influence the household's socio-economic status.

Residual confounding

The remaining bias after controlling for potential confounding factors is residual confounding (214). Although adjustments were made for a range of factors, residual confounding is possible, as the estimates were not tested for other factors such as social capital or socio-economic status (SES) that may influence engagement and the outcomes. Inequalities in SES can be measured by education, occupational status or income, or a combination of these factors (230). Household

income could also be considered (231). Both income and education variables are expensive and time-consuming data to access. Previous reports (232) and articles on health and arts (42), showed a clear association between SES and the likelihood of attendance at arts events (42, 232), and this has previously been emphasized as an important topic to be aware of (42). Bygren et al. declared cultural stimulations may underlie some of the social class differences of mortality (98). Importantly, SES is associated with health in all levels of the hierarchy (230, 233), and there is an unequal distribution of the opportunity to be and remain healthy (234). This gradient of SES is strongly associated with longevity, hence the further down in the hierarchy, the greater the risk of premature mortality (230, 233). There is a gap in life expectancy at age 30 years according to education level for women and men in Norway, with the greatest difference seen among men (235). Several factors of health behaviours, support (both emotional and instrumental), and the degree of control, vary (233). This among other issues, challenges the investigation, as SES is difficult to measure accurately, and issues such as cost of activities may influence participation.

It is difficult to disentangle whether the association between cultural engagement and the outcomes is because of self-selection, reverse causality, or because these activities have the potential to reduce mortality and GP consultations. The multi-dimensional nature and the complexity of engagement in cultural activity unfolds (236) at multiple levels (204), as there probably is a complex interplay between cultural, social and economic capital (229). It is very difficult to account for this through a limited number of variables (20). Engagement in cultural activities may serve as a proxy for other factors (237), such as social capital (229), economic and social resources (e.g. values, behaviour, norms, and knowledge). Social capital and socio-economic status are established factors affecting health and have been shown to influence longevity (124, 229). Future research should explore socio-economic conditions more thoroughly. Finally, the border between participation in cultural activities and wider social participation is difficult to determine (237) and operationalize. Lack of social support may increase cardiovascular mortality risk (238), and socially isolated individuals are more likely to seek medical assistance to satisfy their need for socialization and stimulation (239). The cultural activity module lacks information on whether participation was alone or in a group during the activity. Hence, cultural participation itself could not be separated as the social component.

5.1.5. Construct validity

Construct validity is of importance when we construct new variables, as it may be “*incomplete correspondence between the conceptual construct and the actual measurement*” (240). You risk that the constructed variable does not measure or represent what it was intended to, and there are challenges connected with explicit constructing variables that are separate from each other, and errors can be introduced when variables are constructed.

The main challenge - of considerable importance - is the lack of consistency in how cultural activity should be measured and categorized, as there is no gold standard. How we ought to define exposure and include a broad range of activities and several quantifiers, has not previously been investigated while separating and combining the engagement modes. Furthermore, the purpose of this study was to measure the variety of activities people were engaged in, as well as the frequency, as engagement can be an integral part of everyday life, or an occasional event (8). Distinguishing these factors was the background intention for the choice of quantifiers operationalized. Engagement mode, attendance and participation in cultural activities have rarely been explored simultaneously, both separately and in combination. However, these different modes and participation patterns may affect the health and mortality outcomes differently (8) even though they are linked to each other.

The limitations of these quantifiers must be highlighted, as diversity and weekly frequency are not mutually exclusive. The difficulty is separating the total number of activities from the frequency of participation, as it is likely that, the more activities a person performs, the higher their frequency score. Also, the receptive and creative indices are not mutually exclusive. The border between receptive and creative engagement is not necessary not so clear (237).

Lastly, isolating activities is complex. Single individual variables were constructed without considering that the participants may, at the same time, be engaged in other cultural activities. Thus, estimates of individual activity engagement are not adjusted for engagement in other activities at the same time. On the other hand, the complexity of patterns of engagement, such as participating in creative activities like music, singing and theatre could increase the likelihood of attending a concert, theatre, and/or cinema, or vice-versa. It has not yet been possible to take these eventualities into account. Consequently, the single-effect estimates may be confounded and may have measured attributable effects from other activities. These associations could thereby be due to chance.

5.2. DISCUSSION OF KEY FINDINGS

The overall goal for this thesis was to investigate the association between both receptive and creative engagement in cultural activities with longevity; all-cause and cause-specific mortality, and usage of primary health care in a Norwegian population. This thesis constitutes findings revealed in Papers I-III and the key findings will further be discussed:

5.2.1. Engagement associated with all-cause mortality

In summary, the findings from Paper I showed a clear gradient in the accumulated number of creative activities and all-cause mortality, and in the frequency of engagement for the whole sample and separately for both genders. The results demonstrate that creative activities enhance longevity in both genders equally, compared to receptive activities that proved only to protect the men who attended. Furthermore, the protective effect of an accumulated number of different creative activities was stronger than an increase in weekly frequency. Several population studies show positive findings between engagement and longevity (35, 40, 98, 112, 145), but methodological differences challenge the comparison. A growing body of studies show that creative engagement is important for health (3, 94).

The association between the number of receptive activities and all-cause mortality was less consistent. For women, the risk reduction appeared only in one activity with no relation to further accumulation, whereas, for men, a gradient in risk reduction was clear. This is similar to the findings shown by Agahi et al., that found no significant associations among women. They also investigated the overall sample and results among men, but no significant associations were found, similarly to our findings. However, they did not differentiate between receptive and creative activities (141).

The weekly frequency of receptive activities shows a protective association, though the association may be due to the attending men. However, a negative association was retrieved with increased weekly frequency in receptive activities among women. In line with our results, studies in England have found that those (age 50 years and above) who attended receptive activities every other month or more often, have a lower mortality risk by 31% (40). Participants in our results, within the lowest frequency category, had a 21% lower mortality risk, compared to people who do not participate in cultural activities. That could be due to the sample population (such as age range) and other methodological differences.

Furthermore, the associations from creative participation showed a lower mortality rate quite similar for all and separately by gender. The total weekly frequency estimate (receptive and creative activities combined) may reduce the mortality risk with increasing weekly frequency. The gender-specific findings also turned out to be relatively similar for both women and men. So far, no other studies have investigated separate and combined activity modes of frequency. However, Hyppä et al. noticed from a Finnish population that participation (number of receptive and creative activities combined and multiplied by the frequency) may lower the risk of all-cause mortality by 29% (112).

Mortality risk was higher for non-participants in any individual receptive or creative activity, except for attending sport events. Gender association was also evaluated: among men, we found similar results as above except for parish work, while women increased their longevity only through creative activity participation. In contrast to our results, Bygren, et al. found an association between playing music and singing in a choir with longevity (98). Unlike measures may partly explain the dissimilarity in the finding. Attending parish work may lower mortality risk among women (46%), likewise the findings of Li et al. are in line with ours but show a lower mortality risk (33%) among women (161). In contrast to our findings, Agahi et al. found no significant associations in women, investigating the overall sample or results among men (141).

5.2.2. Findings of engagement and cause-specific mortality

In Paper II, findings revealed that participating frequently in both receptive and creative activities was associated with lower risks of cardiovascular-disease (CVD) and cancer-related mortality. Further, our results indicated that diversity of participation may not influence this association. To the best of our knowledge, no other study has distinguished between variety and frequency of engagement in relation to cause-specific mortality outcomes.

Overall, our findings suggest that participation in cultural activities is associated with a reduced risk of CVD mortality. In particular, the results indicate that frequent weekly participation in creative activities reduces the risk of CVD mortality. Engagement in creative activities on a weekly basis was associated with 36% lower CVD mortality risk, and less than twice per week with 26% lower risk of CVD mortality, compared to non-participants. Participating in creative activities less than once a week reduced CVD mortality risk by 33% for women and 40% for men.

When receptive and creative activities were combined, a significantly lower risk for cancer-related mortality was found for the overall sample, but only if the frequency of participation was twice a week or more. Participating more often than twice (≤ 9 times) per week combined with receptive and creative activities reduced cancer-related mortality by 29%. This is probably attributable to creative activity participation. Further, our results indicated that diversity of participation does not influence this association. In contrast to previous studies (144), no association was found between attendance in only receptive activities and cancer-related mortality, unless creative activities also were performed. The Scandinavia-based prospective study examined receptive attendance (mix of amount of activities and frequency), and revealed a threefold higher risk of cancer-related mortality among those who rarely attended compared to those frequent attendees (144).

Risk of CVD mortality was lower among people who participate in associations/club meetings (22%) and outdoor activities (23%), as well as attendees of art exhibitions (28%) compared to people who do not engage. Similar, Donneyong et al. found that outdoor activity was strongly associated with lower CVD mortality (30-47% depending on participation frequency) (149). Gender-dependent findings shows that among women, participating in associations/club meetings reduced the risk of CVD mortality by 36%. Furthermore, in contrast to our findings, Li et al. revealed that women attending religious services more than once per week had a 27% reduced risk of CVD mortality and a 21% lower risk of cancer-related mortality (161).

The only creative activity that proved significant was 'music, singing, and theatre', where people who engaged had a 27% reduced risk of cancer-related mortality when compared to non-participants. Gender-specific analysis showed that the risk reduction by participating was not present for women but strong for men with 33% risk reduction. Clinical studies have shown that such activities have a therapeutic effect on cancer patients (3, 94, 133).

5.2.3. Associations between engagement and GP consultations

In Paper III, participating in creative activities and a combination of both receptive and creative activities was associated with lower demand for GP consultations among men.

It may seem that the effect estimates of the association between cultural activity engagement and the outcomes are cumulative and related to the increasing number of activities that the participants reported being engaged in, rather than the frequency or a particular type of activity.

Outdoor activity proves to be most strongly associated with GP consultations among men, followed by association/ club meeting. Participating in one or more creative activities may lower the likelihood of GP consultations among men. Similarly, from the combined number of receptive and creative activities, a clear cumulative gradient of lower GP consultations was revealed among the engaged men, compared to the non-engaged.

However, no statistical evidence was found for associations between cultural activities (frequency or type of activity) and GP consultation among women.

The association between receptive and creative cultural activity and later demand for GP consultations has not previously been investigated in large-scale population samples. Hence, there were no previous findings to compare these estimates with, and further research is required.

5.2.4. Gender-specific findings

Our findings have broadened the knowledge in relation to gender-specific findings, as these results revealed differences between genders in relation to different outcomes. The research findings in this thesis are an important contribution to a previously weak knowledge base. The gender differences in the findings in this thesis appear clear, especially in relation to GP consultations.

Often gender is presented in the descriptive gender-specific distribution of engagement, and in relation to health-related factors, but there is rarely any further in-depth analysis (241). Gender differences are prominent and there are biological phenotypes which include neuroanatomy and psychological traits. Some differences can be assumed to be influenced by environmental factors, which may, in turn, influence specific behaviours (242). Biological mechanisms demonstrate differences in gender, and potential behaviour differences are debatable; men are generally less expressive and emotional.

Even though both women and men had a lower cancer-related mortality rate associated with a diversity of creative participation, the combined diversity of both receptive and creative activities showed that men had a reduction in cancer-related mortality with an increasing number of activities. Lastly, findings revealed that receptive activities seemed less associated with all-cause mortality for women than creative activities, though men received enhanced

longevity benefits from both types. Similarly, in Paper III, prominent gender-dependent effects were found, particularly for men engaged in receptive activities and GP consumption. In relation to the consumption of GP consultations, interaction tests between genders were performed, as the results showed significant differences between the genders.

6. CONCLUSION

This is one of the first studies with observational data of various receptive and creative cultural activities with longitudinal associations between several mortality outcomes and GP consultations, as well as considering the amount and frequency of cultural participation with the same population sample. The findings indicate that those who are engaged in cultural activities had a lower risk of overall mortality and lowered their mortality risk from cardiovascular disease (CVD) and cancer-related cause-specific mortality, compared to the non-engaged. In addition, men who were engaged had fewer GP consultations compared to non-engaged men. However, there were no differences in the number of GP consultations among women.

Engagement in at least one creative cultural activity influenced longevity when compared to non-engagement. The variety of activities seemed to enhance longevity cumulatively with the number of different activities, to a greater extent than weekly frequency. Creative activities seemed to lower all-cause mortality in both genders, while receptive activity benefits were mostly found for men.

The results indicate that participating frequently in creative activities may lower the risk of CVD and cancer-related mortality. When frequency of receptive and creative activities was combined, a lower risk for cancer-related mortality was found for the whole sample (both genders included), but only if the frequency was over twice a week. Further, our findings indicate that variety of activities does not influence this association, with the exception of creative participation which may lower the risk of CVD mortality, and the total variety (receptive and creative activities combined) decreased the risk of both CVD and cancer-related mortality. Gender-specific findings revealed the associations may be attributable to the men.

Findings suggest that engagement as a creative participant, or combining both receptive and creative participation, may lower the rate of GP consultations among men. A higher participation frequency among men was associated with a lower rate of GP consultations.

Cultural activity engagement in the population, especially as a creative participant may have positive health effects. Importantly, receptive attendance may affect longevity and usage of GP consultations among men, and the findings have demonstrated that gender-dependent

associations should be explored in further research. We cannot claim that the association is based on a gender characteristic. Potentially, the significant association for men is also generalizable to women. Engagement may affect health, however, the observational nature of this study cannot support statements of causation. It may be that people whose health is good tend to participate actively in various cultural activities or more frequently, rather than that participation in cultural activities leads to improve health. Further research is needed to establish causation.

These findings suggest that cultural activities can play a role in health promotion and disease prevention. Facilitating and promoting a culturally-engaged lifestyle in the population is vital for longevity and may lower usage of GP consultations, particularly in men. For this reason, it can potentially also be cost-effective. To counteract the public health burden of CVD and cancer-related mortality, policies and initiatives to increase citizens' participation in cultural activities should be considered. It is recommended that health-promoting strategies are culturally appropriate to encourage health behaviours and facilitate cultural active lifestyle choices. Public health policies should provide equal and easy access to a variety of cultural activities, which may promote longevity and affect the population's health in a positive way. Participation in cultural activity is to be considered free of side effects and can be based on existing initiatives. Positive health benefits in the population may occur from simulating cultural activities, though further research is warranted to confirm these findings. It is important to note that our studies are observational, and not experimental. Therefore, they leave an uncertainty regarding the effects on health of interventions to increase participation in cultural activities.

7. IMPLICATIONS FOR FURTHER RESEARCH

Based on the current findings, quantifying approaches are needed in future research. The gender differences revealed should also guide future research, with clear recommendations for conducting gender-specific analysis. For this reason, it is important to continue finding empirical support for risk factors to strengthen both the evidence and studies that may support or refute these results.

There is limited knowledge about the associations related to longevity, and cause-specific mortality. Associations with the demand for healthcare services are lacking. It is important to investigate the group who are rarely engaged in cultural activities more closely in relation to health outcomes.

Longitudinal cohort studies are highly warranted. The ability to produce quantitative evidence including longitudinal exposure data with a large sample size of the population's life course is important to strengthen the evidence. Further research should assess associations over time, including multiple time point measurements of exposure and health-related adjustment factors, with the goal of obtaining unbiased estimates. The HUNT Study contains longitudinal data that enable the investigation of cultural activity measures with ten years between from both HUNT3 and HUNT4 cross-sectional surveys, simultaneously. With several time exposure measures, it is possible to assess how changes or continuity over a period may affect the association. This provides the possibility of investigating if any differences occur between those who are active at both measurement time points and those who change their behaviour during the time period. Such studies would also provide valuable information about differences throughout the life course. In addition, knowledge related to activity patterns can be extracted. Patterns of engagement may be different in men and women throughout the life course, but there is currently scarce knowledge. The HUNT Study gives a rare opportunity to operationalize patterns of engagement, and combinations of different activities, that could be explored more thoroughly.

Future empirical research should focus on whether cultural engagement is actually shared between different social groups, as most empirical studies implicitly assume. However, it should also consider whether there are variations, and if cultural hierarchies build boundaries. Are competing hierarchies and social inequality related to cultural participation: do students

whose cultural participation coincides with practices from the top of the cultural hierarchy have a greater chance of educational success?

There is also a need to implement and evaluate interventions aimed at including people who are not traditionally involved in cultural activities. Our data are observational. Intervention studies, with proper evaluation, will be able to contribute more useful and reliable knowledge for public health policy.

There is currently little research into the effect these types of activities can have on health at a population level or the cost benefits. Combining qualitative and quantitative research will bring understanding and measurement together to increase our knowledge and improve health.

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Appendix 1

Paper I.



OPEN ACCESS

Cultural participation and all-cause mortality, with possible gender differences: an 8-year follow-up in the HUNT Study, Norway

B I Løkken¹,² D Merom,³ E R Sund,^{1,2,4} S Krokstad,^{2,4,5} V Rangul^{1,2,5}

► Additional material is published online only. To view please visit the journal online (<http://dx.doi.org/10.1136/jech-2019-213313>).

¹The Faculty of Nursing and Health Sciences, Nord Universitet - Levanger Campus, Levanger, Norway

²HUNT Research Centre, Department of Public Health and Nursing, Faculty of Medicine and Health Sciences, Norwegian University of Science and Technology (NTNU), Levanger, Norway

³School of Science and Health, Western Sydney University, Sydney, New South Wales, Australia

⁴Levanger Hospital, Nord-Trøndelag Hospital Trust, Levanger, Norway

⁵Norwegian Resource Centre for Arts and Health, Nord University, Levanger, Norway

Correspondence to

Bente Irene Løkken, Nord University, Faculty of Nursing and Health Sciences, Levanger, Norway; bente.i.lokken@nord.no

Received 1 October 2019

Revised 18 January 2020

Accepted 28 March 2020



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To cite: Løkken BI, Merom D, Sund ER, et al. *Journal of Epidemiology & Community Health* Epub ahead of print: [please include Day Month Year]. doi: 10.1136/jech-2019-213313

ABSTRACT

Background Cultural activities can promote health and longevity, but longitudinal studies examining a broad spectrum of participation are scarce. This study investigated the gender-specific association between all-causes of mortality and participation in single types of cultural activities, amount and participation frequency.

Methods We used cohort data from the Nord-Trøndelag Health Study (HUNT Study), Norway (2006–2008), resulting in 35 902 participants, aged 20 and above. Cultural participation in receptive and creative activities was measured. HRs were reported for partially and fully adjusted models.

Results A total of 1905 participants died during the median 8-year follow-up. Mortality risk was higher for non-participants in any receptive or creative activities, except sport event attendees. Gender association was also evaluated: among men, we found similar results as above except for parish work, while women increased their longevity only through creative activity participation. When a number of receptive activities was associated with all-cause mortality, reduced risk occurred with attendance in 2 or 3–4 activities (21% and 31%, respectively). Risk was reduced through creative activities, with participation in 3–5 activities (43%). Gender-specific analyses showed a clear gradient of protective effect in creative activity participation: for men, 28%, 44% and 44% reduction with 1, 2 or 3–5 activities, respectively, and a 28%, 35% and 44% reduction for women.

Conclusion Frequently attending at least one cultural activity influenced longevity. Creative activities lowered mortality in both genders, while receptive activity benefits were mostly found for men. Thus, promoting and facilitating engaged cultural lifestyles are vital for longevity.

INTRODUCTION

Participation in cultural activities is innate to human lifestyle, reflecting quality of life, traditions and beliefs. Cultural activity event attendance, that is, seeing a movie or a concert, and informal cultural action, that is, participating in community cultural activities and amateur artistic productions or reading a book,¹ correspond to everyday events done for enjoyment, entertainment, recreation or as a contribution to society.² Countries around the world, including Norway, encourage participation in cultural activities based on the notion that such activities can promote the population's health and well-being.^{1–3} Further evidence is still needed to empirically support this belief.

Systematic reviews of intervention trials have shown that cultural activities have therapeutic effects.

However, most intervention studies were conducted with patients in clinical contexts involving small samples, which limits generalisation for scaling up of the evidence towards public health purposes.^{4–5} Epidemiological research, on the other hand, can explore how cultural participation positively affects population health by preventing morbidity and mortality and improving quality of life and well-being. Most of the research to date were cross-sectional, which cannot support causality.⁶ While evidence from longitudinal studies has grown in the past decade, these investigations have been characterised by fragmented approaches that focus on the health benefits of specific cultural activities, such as attending church and religious services^{7–8} as well as longitudinal studies on physical activity, exercise and sport participation.⁹ However, a person's cultural lifestyle as a whole has rarely been examined in the same sample.^{4–10} Furthermore, some longitudinal studies involved only one gender, and few studies referred to the gender difference between cultural participation and its impact on health.¹¹ Yet female and males exhibit different choices of behaviours and decision about time allocation,⁹ considering gender in these studies is crucial.

Taking part in cultural activities can be 'passive' (ie, receptive mode—sports event, concerts, theatre and so on) or 'active' (ie, creative mode—playing musical instruments, outdoor activities and so on).^{1–3} Active participation modes are commonly studied in relation to population health; both modes are rarely examined together and investigated simultaneously. The Nord-Trøndelag Health Study (HUNT Study) in Norway provides a rare opportunity to profile participants' cultural pattern due to the rich information collected on receptive and creative participation. Persisting inequalities in mortality highlight the need for exploring factors that can promote longevity in the general population; leisure behaviour needs further exploration.

The main purpose of this study was to identify the types of cultural activities and participation modes (receptive and creative) that protect against all-cause mortality. A number of activities and frequency of weekly participation were considered. Possible gender differences were also considered.

METHODS

Study population

The HUNT Study is a longitudinal population health study that consisted of four cross-sectional surveys. The present study uses data from the HUNT3 survey (2006–2008), where all adults,

aged ≥ 20 years, and residents of Nord-Trøndelag county ($n=93\ 860$) were invited to participate. The survey resulted in 50 807 total participants (response rate=54.1%).¹² Participants were asked to answer a self-reported questionnaire (Q1), which was mailed together with the invitation to partake in the study. At the clinical examination, a second questionnaire (Q2) was distributed, with a prepaid envelope, to be completed at home and returned by mail. Q2 contained information on cultural activities.¹³ The participants signed a written consent form, which included an approval for linking their information to national registers.¹⁴ The Regional Committees for Medical Research and Health Research Ethics in Norway approved this study, ref. number 2016/282/REK midt.

Cultural participation

Self-reported receptive and creative cultural activity participation were measured, with two validated questions on creative and receptive activities. Validation proved the data to be sufficiently precise and relevant information to be used in analyses at the group level.¹⁵ Creative activities were measured followed by a list of activities: 'an association or club meeting/activity', 'music, singing or theatre', 'parish work', 'outdoor activities', 'dance' and 'sports or exercise'. The response options were: more than once a week, once a week, 1–3 times a month, 1–5 times in the last 6 months and never. Receptive activities were measured: 'a museum/art exhibition', 'a concert, theatre, or film', 'the church/chapel' and 'a sports event'. The response alternatives were: more than three times a month, 1–3 times a month, 1–6 times in the last 6 months or never. Responses for each activity were operationalised in three quantifiers: single, number and weekly frequency activity participation (Supplementary File).

Mortality

The study data were linked to the Norwegian Cause of Death Registry. Mortality data are based on death certificates reported by doctors who are required to follow the International Classification of Diseases (ICD, WHO). Both the degree of coverage and completeness are high.¹⁶

Statistical analysis

The relationship between cultural participation and all-cause mortality was analysed using multivariable time to event models. Of the 41 198 participants who returned Q2, 2.4% (984) did not answer any creative or receptive questions and 9.9% (3996) were missing the covariates. They were excluded from the analyses. In addition, we excluded 0.87% (316) of the participants who died within the first 2 years from baseline to circumvent problems with reverse causation. The total analytical sample was 35 902 individuals.

Cox proportional hazard regression models were specified, and HRs and 99% CIs were assessed for all-cause mortality. Estimates were reported for single creative and receptive activities and for the activity classes' amounts and frequency separately, in addition to a total weekly frequency. Proportional hazard assumptions and specifications on a missing category for missing items were tested on the covariates. A sensitivity analysis removed the participants who died within the first 2 years.

Causal directed acyclic graphs (DAGs) were used to guide the modelling strategy. All estimates were adjusted for potential confounding effects of age and gender. The second model included marital status (single, in a relationship, divorced, separated, separated partner, divorced partner and surviving partner) and

occupation (ISCO88 classification,¹⁷ three categories: low, medium and high education). Model III included longstanding illness, and the fully adjusted model (model IV) contained smoking status (never, former and current smoker), alcohol consumption (7 units/week, <7 units/week or abstainer), physical activity (calculated metabolic equivalent (MET)) and body mass index (BMI) (<18–24.9, 25.0–29.9, ≥ 30). Person-time was accrued from baseline participation date until the date of death, loss to follow-up, or 31 December 2015, whichever came first. We used IBM SPSS version 24 (SPSS, INC., Chicago, Illinois) for statistical analysis.

RESULTS

Baseline characteristics

In total, 17 606 (43.8%) men and 22 608 (56.2%) women were included in the analyses, with a mean age of 55 years and 53 years, respectively. Differences between genders were noted for occupational categories, 4.7% of men were in low occupations, compared to 15.5% of women. Further, excessive alcohol consumption was much higher for men (10.0%) than women (2.9%). Regarding BMI, 53.1% of men and 38.1% of women were classified as 'normal weight', while 38.4% of women and 24.6% of men were classified as 'overweight'. Tables 1 and 2 show the characteristics of the participants in different cultural activities.

Cultural participation in association with all-cause mortality

During a mean follow-up of 8.15 years (292 416 person-years), 35 902 participants received followed-up for survival; 804 (4.0%) women and 1101 (6.9%) men died during this period.

The fully adjusted multivariable analysis revealed that those attending receptive activities, except sport events, had a significantly lower risk of all-cause mortality (table 3). When compared to those who neither attended nor participated in the above activities had a lower risk of premature death. By contrast, these receptive activities had insignificant effects on women. Participating in creative activities significantly lowered the risk of all-cause mortality for the whole population (HR 0.70 to 0.83). The corresponding estimated risk reductions for men who participated in these activities were also significant, except for parish work (HR 0.73 to 0.81). By contrast, women halved their risk of premature death with parish work (HR 0.54) and reduced their risk when they were members of associations or club meeting (HR 0.79) and participating in outdoor activities (HR 0.71).

Figure 1 presents the association between the number of receptive activities (A) and creative activities (B) and the risk of all-cause mortality for both the whole sample and by gender. For both receptive and creative activities, a clear gradient appeared in risk reduction for every increase in the number of activities score: 2 and 3 or more receptive (HR 0.79, 0.69) and 1, 2 and 3–5 creative (HR 0.72, 0.60, 0.57) activities, respectively. Gender-specific analyses showed a clear gradient of reduced risk from only participating in creative activities. For women, risk reduced by HR 0.72, 0.65, 0.56, with 1, 2 or 3–5 activities, respectively. For men, the corresponding declines were HR 0.72 for 1 activity and HR 0.56 for 2 or 3–5 activities.

Weekly frequency results stratified by receptive and creative activity, showing a reduced risk with frequent participation in creative activities. For receptive activities, the HR was less strong and similar for less than one time, one time and less than two times per week (0.79 and 0.81, respectively) (table 4).

Total weekly frequency (combined receptive and creative activities) revealed that a more frequent participation was associated

Table 1 Distribution (%) of participants in the receptive activities, total and split by gender, N=40 214. The HUNT Study (2006–2008)

		All		Museum/art exhibition		Concert, theatre, film		Church/chapel		Sports event	
		Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Total		17 606 (43.8)	22 608 (56.2)	4913 (27.9)	7210 (31.9)	10 008 (56.8)	14 591 (64.5)	9581 (54.4)	12 957 (57.3)	9182 (52.2)	9165 (40.5)
Mean age ± SD		55.2±15.0	53.5±16.1	54.8±14.1	52.2±14.6	51.6±14.8	49.5±15.1	56.5±14.4	54.4±15.9	51.9±14.3	46.9±14.1
Occupation level	Low	4.7	15.5	4.7	7.9	4.7	10.5	3.9	14.0	4.7	9.5
	Medium	60.0	51.7	40.3	40.2	50.8	47.5	58.6	51.4	54.4	48.2
	High	35.4	32.8	55.0	51.9	44.5	42.0	37.5	34.6	40.8	42.3
Marital status	Marriage*	64.8	57.6	69.0	61.7	64.6	58.5	29.4	61.8	65.0	59.8
	Other	35.2	42.4	31.0	38.3	35.4	41.5	70.6	48.2	35.0	40.2
LLI	Yes	41.4	41.9	35.3	36.4	34.1	35.5	41.0	41.5	34.7	31.4
	No	58.6	58.1	64.7	63.6	65.9	64.5	59.0	58.5	65.3	68.6
Alcohol, units/week	Never	15.1	27.9	11.3	18.6	10.4	20.7	16.4	29.6	10.5	20.2
	0.5–6.5	74.9	69.2	75.9	77.2	78.1	76.0	75.6	68.0	79.3	77.1
	≥7	10.0	2.9	12.8	4.2	11.5	3.3	8.1	2.5	10.2	2.7
Cigarette smoking	Never	40.1	45.2	45.1	48.7	45.9	47.0	43.2	49.9	46.6	48.2
	Former	38.1	30.4	38.0	32.7	34.6	31.1	38.5	29.6	33.8	28.7
	Daily	21.8	24.4	16.9	18.7	19.5	21.9	18.3	20.5	19.5	23.1
Physical activity	<2.5	60.2	56.4	53.9	49.8	55.9	51.2	59.0	56.4	52.9	47.6
	≥2.5	39.8	43.6	46.1	50.2	44.1	48.8	41.0	43.6	47.1	52.4
BMI	Normal	24.6	38.4	25.4	42.5	25.4	41.4	23.8	36.6	25.1	43.6
	Overweight	53.1	38.1	53.5	37.5	53.9	37.6	54.1	39.5	53.9	36.6
	Obesity	22.4	23.5	21.0	20.0	20.6	21.1	22.2	23.9	21.0	19.8

*Marriage/relationship.

BMI, body mass index; HUNT Study, Nord-Trøndelag Health Study; LLI, limiting longstanding illness.

Table 2 Distribution (%) of participants in the creative activities, total and split by gender, N=40 214. The HUNT Study (2006–2008)

		Association or club meet- ing/activity		Music, singing, theatre		Parish work		Outdoor activities		Dance	
		Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Total		7136 (40.5)	9373 (41.5)	3364 (19.1)	4404 (19.5)	802 (4.6)	1410 (6.2)	14 426 (81.9)	16 999 (75.2)	5683 (32.3)	8443 (37.3)
Mean age ± SD		53.9±13.8	54.5±15.3	54.4±15.2	49.8±16.0	56.6±14.8	57.0±15.5	54.1±14.4	51.1±14.8	54.9±13.3	50.2±14.2
Occupation level	Low	3.7	10.9	4.7	9.7	4.5	13.7	4.5	11.4	4.3	10.7
	Medium	50.0	48.2	49.9	45.0	51.0	44.5	56.9	50.0	54.7	50.5
	High	46.3	40.9	45.3	45.3	44.5	41.8	38.7	38.6	41.0	38.9
Marital status	Marriage*	69.5	63.0	67.3	57.7	78.9	68.3	65.5	60.2	67.3	59.8
	Other	30.5	37.0	32.7	42.3	21.1	31.7	34.5	39.8	32.7	40.2
LLI†	Yes	36.7	39.5	38.9	36.3	39.8	44.8	38.3	37.0	36.4	34.9
	No	63.3	60.5	61.1	63.7	60.2	55.2	61.7	63.0	63.6	65.1
Alcohol, units/ week	Never	12.7	25.8	14.2	24.2	46.3	55.4	13.0	23.1	7.4	16.7
	0.5–6.5	77.1	71.5	75.0	72.9	50.2	43.3	76.6	73.7	81.7	79.7
	≥7	10.2	2.7	10.8	3.0	3.5	1.3	10.4	3.2	10.9	3.6
Cigarette smoking	Never	46.8	50.3	42.9	50.7	54.2	66.3	42.5	45.6	43.5	44.8
	Former	34.7	9.8	36.7	28.1	30.3	22.6	36.9	30.9	36.4	30.4
	Daily	18.5	19.8	20.5	21.3	15.5	11.1	20.7	23.5	20.1	24.9
Physical activity	<2.5	57.8	54.9	57.6	52.0	61.7	62.2	56.7	50.5	55.8	48.1
	≥2.5	43.1	45.1	42.4	48.0	38.3	37.8	43.3	49.5	44.2	51.9
BMI	Normal	23.7	36.7	24.8	40.2	25.2	35.6	24.7	40.9	23.5	42.0
	Overweight	53.8	39.0	53.8	36.9	51.1	37.7	54.0	38.2	55.0	38.5
	Obesity	22.5	24.3	21.4	22.9	23.8	26.7	21.3	20.8	21.5	19.5

*Marriage/relationship.

BMI, body mass index; HUNT Study, Nord-Trøndelag Health Study; LLI, limiting longstanding illness.

Table 3 Total and gender-specific associations between single receptive and creative activities and all-cause mortality. HRs and 99% CIs, n=35 902. The Nord-Trøndelag Health Study (HUNT Study) (2006–2008)

	Deaths/per-son-years	Receptive activities				Creative activities				
		Museum/art exhibition	Concert, theatre, film	Church/chapel	Sports event	Association or club meeting/activity	Music, singing, theatre	Parish work	Outdoor activities	Dance
Participators		11 305 (31.5)	22 870 (63.7)	20 232 (56.4)	17 082 (47.6)	15 143 (42.2)	7 167 (20.0)	1 970 (5.5)	28 910 (80.5)	13 083 (36.4)
Models		HR (99% CI)				HR (99% CI)				
All	I 1905/292 416	0.71 (0.61 to 0.82)	0.73 (0.64 to 0.82)	0.78 (0.69 to 0.87)	0.80 (0.69 to 0.91)	0.71 (0.63 to 0.81)	0.77 (0.65 to 0.91)	0.67 (0.50 to 0.89)	0.63 (0.55 to 0.71)	0.76 (0.66 to 0.88)
	II	0.74 (0.64 to 0.86)	0.76 (0.67 to 0.86)	0.79 (0.67 to 0.89)	0.81 (0.71 to 0.93)	0.73 (0.64 to 0.83)	0.79 (0.67 to 0.94)	0.68 (0.51 to 0.91)	0.65 (0.57 to 0.74)	0.77 (0.67 to 0.89)
	III	0.76 (0.65 to 0.88)	0.78 (0.69 to 0.89)	0.80 (0.71 to 0.90)	0.84 (0.73 to 0.96)	0.74 (0.65 to 0.84)	0.79 (0.67 to 0.94)	0.68 (0.51 to 0.91)	0.67 (0.59 to 0.77)	0.79 (0.68 to 0.91)
	IV	0.80 (0.69 to 0.93)	0.84 (0.74 to 0.96)	0.84 (0.75 to 0.95)	0.89 (0.77 to 1.02)	0.79 (0.69 to 0.90)	0.83 (0.70 to 0.98)	0.70 (0.53 to 0.94)	0.72 (0.63 to 0.82)	0.83 (0.72 to 0.96)
Men	I 1101/129 851	0.68 (0.56 to 0.83)	0.69 (0.59 to 0.82)	0.75 (0.64 to 0.88)	0.76 (0.64 to 0.90)	0.71 (0.60 to 0.84)	0.74 (0.59 to 0.92)	0.85 (0.58 to 1.24)	0.62 (0.53 to 0.74)	0.74 (0.61 to 0.89)
	II	0.70 (0.58 to 0.86)	0.72 (0.61 to 0.85)	0.77 (0.66 to 0.90)	0.78 (0.66 to 0.92)	0.74 (0.62 to 0.88)	0.75 (0.61 to 0.94)	0.86 (0.58 to 1.26)	0.64 (0.54 to 0.76)	0.74 (0.61 to 0.89)
	III	0.71 (0.59 to 0.87)	0.74 (0.63 to 0.88)	0.78 (0.66 to 0.91)	0.80 (0.68 to 0.94)	0.74 (0.62 to 0.88)	0.75 (0.61 to 0.94)	0.87 (0.59 to 1.28)	0.67 (0.56 to 0.80)	0.76 (0.63 to 0.91)
	IV	0.76 (0.62 to 0.93)	0.81 (0.68 to 0.96)	0.82 (0.70 to 0.96)	0.85 (0.72 to 1.01)	0.79 (0.66 to 0.94)	0.78 (0.63 to 0.98)	0.90 (0.61 to 1.32)	0.73 (0.61 to 0.87)	0.81 (0.67 to 0.97)
Woman	I 804/162 565	0.75 (0.60 to 0.94)	0.78 (0.64 to 0.94)	0.81 (0.67 to 0.97)	0.87 (0.68 to 1.11)	0.71 (0.59 to 0.86)	0.83 (0.64 to 1.08)	0.52 (0.34 to 0.80)	0.63 (0.52 to 0.76)	0.80 (0.63 to 1.00)
	II	0.79 (0.63 to 1.00)	0.81 (0.66 to 0.98)	0.82 (0.68 to 0.99)	0.88 (0.70 to 1.13)	0.73 (0.60 to 0.88)	0.85 (0.65 to 1.11)	0.54 (0.35 to 0.83)	0.65 (0.53 to 0.79)	0.80 (0.64 to 1.01)
	III	0.81 (0.64 to 1.03)	0.84 (0.69 to 1.02)	0.83 (0.69 to 0.99)	0.91 (0.72 to 1.16)	0.75 (0.62 to 0.90)	0.85 (0.65 to 1.11)	0.53 (0.34 to 0.82)	0.70 (0.55 to 0.82)	0.83 (0.66 to 1.04)
	IV	0.85 (0.67 to 1.08)	0.90 (0.73 to 1.10)	0.87 (0.72 to 1.05)	0.96 (0.75 to 1.23)	0.79 (0.65 to 0.95)	0.89 (0.68 to 1.16)	0.54 (0.35 to 0.84)	0.71 (0.58 to 0.86)	0.87 (0.69 to 1.10)

Adjusted for: Model I: age and gender, Model II: occupation and marital status, Model III: LLI, and Model IV: behaviour lifestyle factors; smoking, alcohol consumption, physical activity and BMI. Ref.: never or seldom.

with reduced mortality risk for participating less than once, once and less than twice and for more than twice per week (HR 0.77, 0.60 and 0.54), respectively.

Gender-specific analysis stratification by activity types revealed that, for men, frequent participation in receptive and creative activities reduced the risk of premature mortality (HR 0.69–0.90, respectively). By contrast, among women, a gradient in risk reduction appeared with participation frequency in creative activities only across the frequency category (HR 0.71, 0.66 and 0.62). Total weekly frequency reduced the risk of all-cause mortality across all frequency categories for women with no clear gradient and more profoundly for men.

DISCUSSION

The main finding of this study was that any single cultural activity protects against all-cause mortality, except for sport events. A clear gradient appeared in the accumulated number of creative activities and all-cause mortality, and in the frequency of creative activities for the whole sample and for both genders. However, the association between receptive activities and all-cause mortality was less consistent. For women, the risk reduction appeared only in one activity with no relation to further accumulation, whereas, for men, a gradient in risk reduction was clear. The protective effect of an accumulated number of activities was stronger than an increase in weekly frequency. Brown *et al*

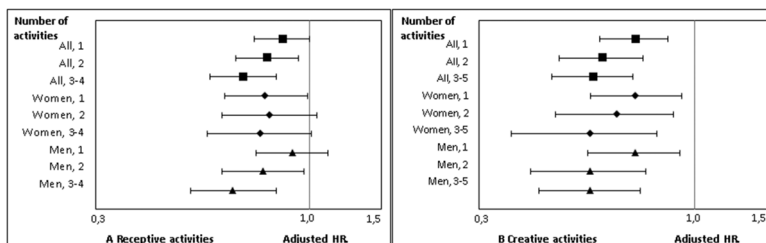


Figure 1 Sum of activities score (1, 2, 3–4) of receptive activities (A) and score (1, 2, 3–5) creative activities (B) and the fully adjusted HRs with all-cause mortality for the whole population and by gender. *Adjusted for age, gender, occupation, marital status, LLI, BMI, PA, alcohol consumption and smoking.

Table 4 Weekly frequency in participation, and gender-specific analysis, in association with ACM, HR and 99% CI, n=35 902. The Nord-Trøndelag Health Study (HUNT Study) (2006–2008)

Frequency			0.5-<1/week	1-<2/week	≥2*	
Receptive	All	I	0.70 (0.61 to 0.80)	0.69 (0.59 to 0.80)	0.84 (0.52 to 1.35)	
		II	0.72 (0.62 to 0.83)	0.72 (0.61 to 0.84)	0.85 (0.53 to 1.38)	
		III	0.74 (0.64 to 0.85)	0.74 (0.63 to 0.86)	0.89 (0.55 to 1.43)	
		IV	0.79 (0.68 to 0.91)	0.81 (0.69 to 0.94)	0.98 (0.61 to 1.59)	
	Men	I	0.67 (0.56 to 0.81)	0.66 (0.54 to 0.81)	0.75 (0.40 to 1.42)	
		II	0.69 (0.58 to 0.83)	0.69 (0.56 to 0.84)	0.76 (0.40 to 1.43)	
		III	0.72 (0.60 to 0.87)	0.71 (0.58 to 0.87)	0.79 (0.42 to 1.49)	
		IV	0.77 (0.64 to 0.93)	0.78 (0.64 to 0.96)	0.90 (0.47 to 1.70)	
	Woman	I	0.73 (0.59 to 0.91)	0.73 (0.57 to 0.93)	1.00 (0.48 to 2.06)	
		II	0.75 (0.61 to 0.93)	0.76 (0.60 to 0.98)	0.99 (0.48 to 2.05)	
		III	0.77 (0.62 to 0.95)	0.78 (0.61 to 1.00)	1.08 (0.52 to 2.24)	
		IV	0.81 (0.65 to 1.00)	0.85 (0.66 to 1.09)	1.16 (0.56 to 2.41)	
	Creative	All	I	0.65 (0.55 to 0.77)	0.58 (0.50 to 0.66)	0.53 (0.40 to 0.69)
			II	0.66 (0.56 to 0.78)	0.59 (0.52 to 0.68)	0.55 (0.42 to 0.72)
			III	0.67 (0.57 to 0.79)	0.61 (0.53 to 0.70)	0.57 (0.44 to 0.75)
			IV	0.70 (0.59 to 0.83)	0.67 (0.58 to 0.77)	0.64 (0.49 to 0.85)
Men		I	0.64 (0.51 to 0.80)	0.58 (0.48 to 0.69)	0.53 (0.38 to 0.76)	
		II	0.65 (0.52 to 0.81)	0.59 (0.49 to 0.71)	0.56 (0.39 to 0.79)	
		III	0.66 (0.53 to 0.82)	0.61 (0.51 to 0.73)	0.58 (0.41 to 0.82)	
		IV	0.69 (0.55 to 0.87)	0.67 (0.55 to 0.81)	0.67 (0.47 to 0.95)	
Woman		I	0.70 (0.52 to 0.86)	0.58 (0.52 to 0.86)	0.52 (0.34 to 0.79)	
		II	0.68 (0.52 to 0.87)	0.59 (0.47 to 0.73)	0.54 (0.34 to 0.82)	
		III	0.69 (0.53 to 0.89)	0.61 (0.49 to 0.76)	0.56 (0.36 to 0.86)	
		IV	0.71 (0.55 to 0.92)	0.66 (0.53 to 0.83)	0.62 (0.40 to 0.96)	
Total		All	I	0.77 (0.64 to 0.92)	0.60 (0.51 to 0.71)	0.50 (0.41 to 0.59)
			II	0.77 (0.64 to 0.93)	0.62 (0.52 to 0.73)	0.51 (0.43 to 0.61)
			III	0.79 (0.65 to 0.95)	0.64 (0.54 to 0.75)	0.54 (0.45 to 0.64)
			IV	0.82 (0.68 to 0.99)	0.69 (0.59 to 0.82)	0.61 (0.51 to 0.74)
	Men	I	0.82 (0.64 to 1.05)	0.58 (0.47 to 0.73)	0.48 (0.38 to 0.61)	
		II	0.84 (0.65 to 1.07)	0.60 (0.48 to 0.74)	0.50 (0.39 to 0.64)	
		III	0.86 (0.67 to 1.10)	0.62 (0.50 to 0.78)	0.53 (0.41 to 0.67)	
		IV	0.89 (0.70 to 1.14)	0.68 (0.54 to 0.85)	0.61 (0.47 to 0.77)	
	Woman	I	0.69 (0.52 to 0.92)	0.63 (0.49 to 0.81)	0.51 (0.39 to 0.66)	
		II	0.70 (0.52 to 0.92)	0.64 (0.50 to 0.82)	0.53 (0.40 to 0.69)	
		III	0.70 (0.53 to 0.93)	0.66 (0.51 to 0.84)	0.55 (0.42 to 0.72)	
		IV	0.73 (0.55 to 0.97)	0.71 (0.55 to 0.91)	0.63 (0.47 to 0.83)	

* Respective activities max 4 activities/week, creative activities max 5 activities/week and total frequency max 9 activities/week.

Adjusted for: Model I: age and gender, Model II: occupation and marital status, Model III: LLI, and Model IV: behaviour lifestyle factors; smoking, alcohol consumption, physical activity and BMI. Ref.: never or seldom.

found that engaging in several different activities was associated with higher life satisfaction, rather than participation frequency. Although they did not explicitly use receptive and creative classifications, positive results emerged with sport, heritage and active-creative activities, but not for entertainment, theatre, hobbies and museum/galleries,¹⁸ which are similar to the receptive categorisation and findings in this study. Our findings support stronger effects of exposure to many receptive and creative activities, and less so for increased weekly participation frequency in relation to premature death.

Bygren, Konlaan and Johansson investigated the frequency of participation in cultural activities and reported a 43% higher risk of all-cause mortality for those aged 16 to 74 who attended cultural events less than once a week (eg, cinema, concert, museums, art exhibitions, ceremonies and sport events)

compared with more than ca 1.5 per week.¹⁹ Their risk estimates are higher and contradict our estimates for the amount or frequency of receptive activities, and our total weekly frequency results had lower risk estimates. However, they found an association between playing music (excluding singing) and all-cause mortality,¹⁹ which contrasts our result. Further research by Konlaan, Bygren and Johansson included a variety of cultural entertainment and revealed significant estimates for cinema, concerts, museum and art exhibition and insignificant estimates for sport events.²⁰ This is in line with our findings. Väänänen, Murray, Koskinen *et al* discovered increased survival among the culturally engaged outside of work life, defining a mean score from the frequency of attending five different activities (arts and cultural activities, activities in associations, societal action, reading literature and studying). High engagement decreased all-

cause mortality by 23%, after controlling for relevant confounders.²¹ This estimate is equal to the risk reduction as we revealed for weekly frequency less than once per week. Hyppä, Mäki, Impivaara *et al* noticed that participating in a number of receptive and creative activities, multiplied with the frequency, reduced all-cause mortality by 29%.²² This is similar to our weekly frequency estimates. The definition,¹⁰ methodology and operationalisation³ of arts and culture varied substantially between studies and therefore challenged the appropriateness of any comparison. Also, distinguishing between amount and frequency is seldom operationalised.

Gender can be a moderating factor, given the gender differences in behaviour choices and time allocation as previously reported⁹; it is also, however, not well studied.²³ It is often managed as a confounding factor, and few studies have these differences.^{11 21 22 24 25} Hyppä, Mäki, Impivaara *et al* investigated the gender differences and found a protective effect among woman and men, limited to those participating at the highest sum score with a 29% risk reduction.²² Similarly, this study found prominent gender depended effects, particularly for men engaged in receptive activities. Despite insignificant associations for women, the estimates were not adjusted for self-reported health, which may explain various results. Agahi and Parker found greater gender differences among the elderly, where engagement in organisational activities (organisational work) had the strongest effects on survival among women¹¹; this study found similar effects for both genders. In contrast, cultural activities (movies, theatre, concerts, museums or art exhibitions) were protective for men, woman and for all compared with a risk reduction of 40% to 60%.¹¹ This study revealed lower effect estimates for receptive activity participation which were inconsistent across gender for both amount and weekly frequency. Furthermore, Agahi and Parker found that dancing was non-significant in gender-specific analyses,¹¹ which contrasts this study's sample as dancing reduced all-cause mortality risk for only men. This study found that women participating in parish work demonstrated the strongest effect of a single activity (44%). Li, Stampfer, Williams *et al* similarly found that attending a religious service more than once a week was associated with a 33% risk reduction.⁷ Contrastingly, Agahi and Parker did not find significant associations for either gender.¹¹ In this investigation of each cultural activity type, the relationship was consistent across genders for club meetings- and outdoor activities, with a protective effect and similar risk reduction for both genders. Receptive activities seemed less associated with all-cause mortality for women than creative activities, though men received enhanced longevity benefits from both types. It is possible that by attending receptive activities, men's mental health is positively affected, which in turn increases longevity. These receptive activities involved no physical effort.

Gender differences are prominent, and biological phenotypes include neuroanatomy and psychological traits. Some contrasts can be assumed to be influenced by environmental factors, that may, in turn, influence specific behaviours.²⁶ Biological mechanisms demonstrate differences in gender, and potential behaviour differences are debatable; men are generally less expressive and emotional. Thus, receptive activities may give men the opportunity to express themselves. We cannot claim the association to be based on a gender-based characteristic. Potentially, the significant association for men is also generalisable to women.

The mechanisms behind cultural participation, health behaviour and mortality are a complex interplay between biological, genetic and physiological and environmental exposure.

Nonetheless, sociocultural connections do impact biological processes.^{27 28} Cultural activities have been associated with better mental, physical, social and emotional health, as well as well-being^{3 23} and vary between different groups within populations in the context of social capital.⁶ Positive social relations improve survival and influence health as well as other well-established risk factors, such as inactivity and alcohol consumption.²⁹ Healthy behaviours may improve by being a part of social network.³⁰ The border between cultural activity participation and wider social participation is difficult to determine⁶ and operationalise. However, a cross-sectional design does not support the causal impact of cultural participation on all-cause mortality.

Strengths and limitations

The major strengths of this study are the large population, which creates a representative sample, and the prospective design that includes a pre-set variety of cultural activities. The questionnaires are validated,¹⁵ and the all-cause mortality data without missing information¹⁶ and the adjusting of data for multiple potential confounders also reinforce this study's importance. In addition, those who died within the first 2 years of the analyses were removed; longstanding illness was adjusted for to remove the possibility of reverse causation.

However, some limitations need to be acknowledged. We did not conduct repeated measurements over the follow-up period, to account for changes in participation resulting from variations in health or lifestyle, which can bias our estimates, as reverse causation during follow-up is still possible. The effect of residual confounding still exists as we did not adjust for social networks. Hence, the association between cultural participation itself and the social component could not be separated. Missing data on covariates could introduce information bias. However, we tested the results by repeating the analysis with a category for the missing data and the results did not differ considerably. Further, we were not able to separate the effect of singing apart from playing music and theatre, and these activities could involve therapeutic effects. Our measure of frequency score is not explicit and may not be entirely separable from a number of activities.

CONCLUSION

We confirmed the beneficial effects of cultural participating in both receptive and creative activities on longevity. Creative activities lowered the mortality risk in both genders, but the effect of receptive activities was most pronounced in men. Including cultural participation in everyday life with promoting accessible programmes for the general population has the potential to influence life expectancy. Public health policies should take these findings into account by providing access to a variety of cultural activities at a minimal cost. Future research is recommended involving longitudinal studies with multiple time point measurements to get less unbiased estimates.

What is already known on this subject

- ▶ Studies have shown associations between several cultural activities and health.
- ▶ Some population studies suggest cultural activities enhance longevity, though knowledge is insufficient.
- ▶ Receptive and creative activities may have different health effects.

What this study adds

- ▶ Our data is the first to show a longitudinal association between all-cause mortality, and single receptive and creative cultural activities, and amount and frequency of cultural participation.
- ▶ The results demonstrate that creative activities enhance longevity in both genders equally, compared to receptive activities that proved to only protect men.
- ▶ Public health policies should provide equal and easy access to a variety of cultural activities to promote longevity.

Acknowledgements The HUNT Study is a collaboration between HUNT Research Centre (Faculty of Medicine and Health Sciences, NTNU, Norwegian University of Science and Technology), Nord-Trøndelag County Council, Central Norway Health Authority and the Norwegian Institute of Public Health. Data on cause of death were obtained from the Norwegian Cause of Death Registry.

Contributors VR and SK conceived and designed the study. VR supervised the study, drafted the results and assisted in the interpretation and implications. DM and BIL contribute in designing, analysing and interpretation of results and drafted the introduction, methods, results and the discussion. ERS assisted in the statistical analysis, drafted the methods and interpretation and presentation of the result. SK assisted in interpretation and editing. BIL is responsible for the overall content. All authors read and revised drafts for important contents and approved the final manuscript.

Funding PhD student Bente Irene Løkken was funded by Nord University. The Norwegian Resource Centre for Arts and Health funded all aspects of the data.

Competing interests None declared.

Patient consent for publication Not required.

Data sharing statement Data may be obtained from a third party and are not publicly available.

Provenance and peer review Not commissioned; externally peer reviewed.

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ORCID iD

B I Løkken <http://orcid.org/0000-0002-3791-4653>

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Paper II.

RESEARCH ARTICLE

Association of engagement in cultural activities with cause-specific mortality determined through an eight-year follow up: The HUNT Study, Norway

Bente I. Løkken^{1*}, Dafna Merom², Erik R. Sund^{1,3,4}, Steinar Krokstad^{3,4,5}, Vegar Rangul^{1,3,5}

1 Nord University, Levanger, Norway, **2** School of Health Science, Western Sydney University, Sydney, New South Wales, Australia, **3** HUNT Research Centre, Department of Public Health and Nursing, Faculty of Medicine and Health Sciences, Norwegian University of Science and Technology (NTNU), Levanger, Norway, **4** Levanger Hospital, Nord-Trøndelags Hospital Trust, Levanger, Norway, **5** Norwegian Resource Centre for Arts and Health, Levanger, Norway

* bente.i.lokken@nord.no



OPEN ACCESS

Citation: Løkken BI, Merom D, Sund ER, Krokstad S, Rangul V (2021) Association of engagement in cultural activities with cause-specific mortality determined through an eight-year follow up: The HUNT Study, Norway. PLoS ONE 16(3): e0248332. <https://doi.org/10.1371/journal.pone.0248332>

Editor: Brecht Devleesschauwer, Sciensano, BELGIUM

Received: April 14, 2020

Accepted: February 25, 2021

Published: March 11, 2021

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Data Availability Statement: Data cannot be shared publicly because of strict requirements on the protection of privacy and ethical guidelines. Data are available upon request from the HUNT Research Centre. Projects must have recommendations from The Regional Committee for Medical Research in Norway (REK) and be registered with The Norwegian Social Science Data Services (NSD). The project leader affiliated with The Medical Faculty at NTNU is covered under HUNT's licence from The Data Inspectorate, but must obtain a recommendation from the Regional

Abstract

Participation in cultural activities may protect against cause-specific mortality; however, there is limited knowledge regarding this association. The present study examines the association between participation in a range of receptive and creative cultural activities and risk of cardiovascular disease- and cancer-related mortality. We also examined whether participation in such activities and influence by gender have on this association. We followed 35,902 participants of the Nord-Trøndelag Health Study (HUNT3) of Cardiovascular-Disease and Cancer Mortality from 2006–08 to 2016. Cox proportional-hazards regression was used to estimate the risk of specific mortality based on baseline cultural participation. During the eight-year follow-up, there were 563 cardiovascular-disease- and 752 cancer-related deaths among the sample (292,416 person years). Risk of cardiovascular-disease mortality was higher among non-participants in associations/club meetings (22%) and outdoor activities (23%), respectively, as well as non-attendees of art exhibitions (28%). People who engaged in music, singing, and theatre had a 27% reduced risk of cancer-related mortality when compared to non-participants. Among women, participating in associations/club meetings reduced the risk of cardiovascular-disease mortality by 36%. Men who participated in music, singing, and theatre had a 33% reduced risk of cancer mortality. Overall, a reduced risk of cardiovascular-disease mortality was associated with engaging in creative activities on weekly basis to less than twice per week. For both genders, participating in creative activities less than once a week reduced cardiovascular-disease mortality risk by 40% and 33%, respectively. For the overall sample, participating > 2 times per week in combined receptive and creative activities reduced cancer-related mortality by 29%. Participating frequently in both receptive and creative activities cultural activities was associated with lower risks of CVD and cancer-related mortality. Our data suggest that, to counteract the public health burden of cardiovascular disease- and cancer

Committee for Medical and Health Research Ethics (REK). Interested, qualified researchers may request these data by contacting HUNT Research Centre, Levanger, Norwegian University of Science and Technology at hunt@medisin.ntnu.no.

Funding: PhD student Bente Irene Løkken was funded by Nord University. The Norwegian Resource Centre for Arts and Health founded all aspects of the data. The founders had no role in study design, data collection and analysis, decisions to publish, or preparation of the manuscript.

Competing interests: The authors have declared that no competing interests exist.

mortality, policies and initiatives to increase citizens' participation in cultural activities should be considered.

Introduction

Non-communicable diseases (NCDs) contribute to approximately 40.5 million (71%) of all deaths globally [1], and to almost half of the disease burden in low- and middle- income countries [2]. Cardiovascular diseases (CVDs) and cancer are the leading causes of NCD-related deaths, accounting for 44% and 22%, respectively [1]. CVDs and cancer are complex and multi-causal, but lifestyle plays an important role in the prevention and management of these diseases. Consequently, preventive efforts have mainly encouraged smoking cessation, avoiding excessive alcohol intake, healthy eating, and leading a physically active lifestyle [1, 3].

Interest in the association between participation in cultural activities and health outcomes has increased in recent years. Cultural activities include everyday events performed for enjoyment, entertainment, recreation, or to contribute to society [4]. Such activities can provide opportunities for social and physical engagement [5] and, hence, may impact the population burden of major chronic diseases such as CVDs and cancer. A lack of social relationships is strong predictor of premature mortality [6–8], is detrimental to cancer survival [6, 9], and can increase the risk of coronary heart disease and stroke by a degree similar to that found for other classic lifestyle risk factors [10]. Cultural profiles and consumption patterns vary significantly across social contexts [11]. Participation in cultural activities can be 'passive' or 'active' (i.e. 'receptive' or 'creative', respectively); passive participation includes being an attendee or spectator, while active participation includes actively engaging in creative activities by doing or performing. Creative cultural participation seems to be more common than receptive attendance [12]. However, there has been a lack of research regarding the effect cultural activities can have on population health and longevity.

Cultural activities can have health-enhancing therapeutic effects; however, most related studies have involved small sample sizes and were conducted in clinical contexts [13–15] (including research on patients with CVDs [16] and cancer [17–19]). This has limited the generalisability of the findings to the public health context [13, 20, 21]. Existing longitudinal evidence is characterised by fragmented approaches and a focus on the health benefits of specific activities; for example, dancing seems to reduce the risk of CVD-related mortality [22], and attending cultural events to reduce the risk of cancer-related mortality [23]. Epidemiological studies in this field have rarely examined a person's cultural lifestyle as a whole in relation to investigating cause-specific mortality in the same sample [12, 14] and, to our knowledge, the association between receptive and creative cultural activities and cause-specific mortality has not been previously examined. Thus, evidence from population-based samples concerning the effects of participation in a wide-range of receptive and creative activities is important for establishing the public health significance of such activities. A Scandinavian study conducted by Väänänen et al. in 2009 explored the association between cultural engagement (arts and culture, activities in associations, societal action, reading literature, and studying) and all cause- and cause specific mortality, among full-time employees [24]. Intermediate and high engagements in such activities reduced the risk of CVD-related mortality but not cancer-related mortality. We are following up exploring this hypothesis in a total adult population cohort that is

not limited to the workforce, with participation in cultural life measured by a range of receptive and creative activities in a Norwegian setting.

Data from the Nord-Trøndelag Health Study (HUNT) can be linked to the Norwegian Cause of Death Registry and affords the profiling of individuals' cultural patterns in terms of the risk of CVD- and cancer-related mortality. Using these data, the present study aimed to: 1) identify the types of cultural activities that protect against CVD- and cancer-related mortality; 2) assess whether the number of receptive and creative activities a person engages in, including weekly frequency of participation, are associated with CVD- and cancer-related mortality; and 3) explore possible gender differences between these three quantifiers (type, number, and weekly frequency).

Materials and methods

Study population

HUNT is a longitudinal population health study that comprised four cross-sectional surveys. Participation in the surveys was voluntary. The present study uses data from the third HUNT survey (HUNT3, 2006–2008), in which all residents of the north part of Trøndelag County ($n = 93,860$) who were aged ≥ 20 years were invited to participate; in total, 50,807 (response rate = 54.1%) participated [25]. Participants were given a self-report questionnaire (Q1; mailed with the invitation to participate) and were invited to a clinical examination. Q1 included questions concerning participants' socio-demographic characteristics, health behaviours and diseases (both physical and mental), and social relationships. At the clinical examination, a second questionnaire (Q2), which concerned cultural activities [26], was distributed with a pre-paid envelope; this was to be completed at home and returned by mail. Overall, 41,198 participants (response rate = 81%) returned Q2; of these, 2.4% (984) did not answer any of the questions concerning receptive or creative activities and were excluded, meaning our baseline sample comprised 40,214 participants.

The participants signed written consent forms, which included approval to link their information to national registers [27]. This study was approved by the Regional Committees for Medical Research and Health Research Ethics in Norway (ref. no.: 2016/282/REK midt).

Cultural participation

Cultural participation was assessed using two validated questions concerning receptive and creative activities, respectively. These questions were proven to be sufficient for public health research [28].

The receptive activity question was 'How often in the last six months have you attended: 1) a museum/art exhibition; 2) a concert, theatre, or film; 3) a church/chapel; 4) a sports event?' The response options were: 'more than three times a month', '1–3 times a month', '1–6 times in the last six months', and 'never'. We dichotomised the responses into 'never' and 'ever'. Then, for each participant, we summarised all of activities he/she reported attending, which reflected the diversity of their engagement. Summing the scores across all receptive activities produced a range from 4 (attending all receptive activities) to 0 (answering 'never' to all). Few participants reported attending more than three activities; thus, we created the category '3–4 activities'. Next, a score representing weekly frequency of participation in the receptive activities was assigned by giving each response option a weekly score: 'more than three times a month' received a score of 1 (i.e. approximately once a week), '1–3 times a month' was scored 0.5, '1–6 times in the last six months' was scored 0.25, and 'never' was scored zero. After summing the scores across all receptive activities, we used quartiles to reflect weekly engagement: the lowest quartile represented 'never to seldom' (score: 0–0.25), the second quartile

represented 'every other week or less than once per week' (0.5–0.99), the third quartile represented 'once to less than twice per week' (1–1.99), and the highest quartile represented '2–4 times per week' (2–4).

Engagement in creative activities was measured using the question: 'How often in the last six months have you participated in: 1) an association or club meeting/activity, 2) music, singing, or theatre, 3) parish work, 4) outdoor activities, 5) dancing, 6) sports or exercise?' For this research, participation in 'sports or exercise' was excluded because exercise is a subtype of physical activity (PA), which was assessed as a covariate in Q1. The response options were: 'more than once a week', 'once a week', '1–3 times a month', '1–5 times in the last six months', and 'never.' As above, we dichotomised these categories into 'never' and 'ever'. Then, for assessing diversity of participation in creative activities we summarised, for each participant, the number of activities he/she reported engaging in, ranging from 5 (participation in all creative activities) to 0 (never). We created three categories overall by merging those who performed 3–5 activities into a single category. Next, an index reflecting weekly participation was created by giving each response option a score: 'more than once a week' and 'once a week' received a score of 1; '1–3 times a month' was scored 0.5, '1–5 times in the last six months' was scored 0.25, and 'never' was scored zero. The sum of the scores across all creative activities was divided into quartiles: the lowest quartile represented 'never to seldom' (0–0.25), the second quartile represented 'every other week or less than once per week' (0.5–0.99), the third quartile represented 'once to less than twice per week' (1–1.99), and the highest quartile represented '2–5 times per week' (2–5).

Finally, we examined the total number of activities each participant engaged in during the past six months, combining all types of receptive and creative activities. The highest score was 9 (participation in all four receptive and five creative activities), and the lowest was 0 (never). We created seven categories by merging those who performed 7–9 activities into a single category. Similarly, combined weekly participation was created by summing weekly participation in each activity and dividing it into quartiles: the lowest quartile represented 'never to seldom' (0–0.25), the second quartile represented 'every other week to less than once per week' (0.5–0.99), the third quartile represented 'once to less than twice per week' (1–1.99), and the highest quartile represented '2–9 times per week' (2–9).

Participants who did not respond to any of the receptive and creative activity questions were considered to have provided missing data for the cultural participation module ($n = 984$), and were excluded. Participants who provided only one response across the receptive and creative activity questions were not considered to have provided missing data, under the assumption that they only provided answers if they participated in the specific activity, given it was a self-completed questionnaire. This resulted in 1,228 and 1,347 participants being recorded as never participating in any receptive activity and any creative activity, respectively. As a result, our descriptive analysis of the sample included 40,214 participants.

Mortality

The study data were linked to the Norwegian Cause of Death Registry. These mortality data are based on death certificates reported by doctors, who are required to report the cause of death in accordance with the International Classification of Diseases (ICD-10). Both the degree of coverage and completeness are high, with medical information available for over 98% of all deaths [29]. For the present research, the cause-specific outcomes were CVD- and cancer-related deaths, for which the ICD-10 codes are 'I00-99' and 'C00-97', respectively.

Covariates

The following socio-demographic characteristics were considered confounders: age, gender, marital status, and socioeconomic status (SES) determined based on occupation). Age was categorised into 10-year categories, beginning at 20–29 years and ending at 80+ years. Ten occupation types, listed based on the ISCO88 classification [30], were collapsed into three categories: low ('elementary occupations'), medium ('clerks', 'service workers and ship and market sales workers', 'skilled agriculture and fishery workers', 'craft and related trades workers' and 'plant and machine operators and assemblers'), and high level ('legislators, senior officials, and managers', 'professionals', 'technicians and associate professionals', and 'armed forces and unspecified'). Of the participants who provided missing information regarding occupation, 1,442 (4.0%) were categorised as having elementary occupations because the data showed they were young (possibly students and not working) or old (likely retired). Marital status, which featured nine response options, was dichotomised into 'being in a relationship' (married, registered partner) or 'other' (unmarried, widow(er), divorced, separated, separated partner, divorced partner, and surviving partner). Health-related confounders comprised longstanding illness and a range of health behaviours. Q1 included one question concerning having a longstanding illness: 'do you suffer from longstanding (at least one year) illness or injury of a physical or psychological nature that impairs your functioning in daily life?' (response: 'yes' or 'no'). Smoking status was reported as 'never', 'former', or 'daily'. Alcohol consumption (number of units of beer, wine, and spirits consumed in the seven days preceding the survey) was calculated and categorised into 'never' (0 units/week), low (1–6 units/week), and high (≥ 7 units/week). For PA, we calculated metabolic equivalents (METs), which reflected activity level in min per week, based on frequency, duration, and intensity. This was divided into two levels: above and below the international recommendation of at least 150 min/week of moderate-to-vigorous intensity, respectively [31]; this corresponds to 500 MET minutes per week. A continuous body mass index (BMI) variable was constructed based on the height and weight variables measured in the clinical examination; participants were categorised into three groups: 'normal weight' (< 18 – 24.9), 'overweight' (25.0 – 29.9), or 'obese' (≥ 30).

Statistical analysis

First, we cross-tabulated our primary exposures (cultural activity) with likely confounding factors for each gender. The relationships between cultural participation and cause-specific mortality were analysed using multivariable time to event models. The Cox proportional hazard regression model was applied, and hazard ratios (HRs) and 99% confidence intervals (CIs) were reported. These HRs represented the ratios between various groups regarding the probability of dying from CVD and cancer, respectively. Proportional hazard assumptions were tested. Based on the large number of hypothesis tests performed, 99% CIs were used to reduce the probability for type-1 error rate. We developed estimates for each receptive and creative activity. We also examined the effect of diversity of participation (based on the number of different activities participants engaged in) and level of participation (measured using weekly frequency). These explanatory quantifiers were explored within each mode of cultural activity (i.e. receptive and creative), and also for all cultural activities combined. Models with missing category on the covariates were also specified, and finally, we fitted models in which we removed participants who died within the first two years (to circumvent problems regarding reverse causation). Hence the association between cultural participation and cause-specific mortality included comprised 35,902 individuals, as 9.9% (3,996) provided missing data for any covariates and 0.87% (316) died from all-cause mortality.

Causal directed acyclic graphs were used to guide the modelling strategy. First, models were run with each cultural activity only, adjusting for age and gender. Second, SES and marital status were added to the model, and the third model included longstanding illness. In the final model, lifestyle covariates were added (alcohol consumption, smoking status, PA, BMI). In addition, gender-specific analyses were performed for all of these models. Person-time was determined for each participant based on the period from the date of baseline participation to date of death, of loss to follow up, or December 31st, 2015, whichever came first. IBM SPSS version 24 (SPSS, inc., Chicago, Illinois) was used to perform the analyses.

Results

Descriptive analyses

Overall, data for 17,606 (43.8%) men and 22,608 (56.2%) women (mean age: 55 and 53 years, respectively) were included in the descriptive analyses. [Table 1](#) shows the gender-specific distribution of the participants in terms of the covariates (first column), and among those who performed each receptive cultural activity. Strong gender differences were observed for occupational class, marital status, alcohol use, and BMI. Regarding activities, notable gender differences were observed for attending places of worship (church/chapel) and concert/theatre/film. Women with low-level occupations tended to participate in these activities more than men with low-level occupations; similarly, married women tended to visit places of worship more than married men (67% vs. 28%). Never using alcohol and having normal BMI were more prevalent among women than men across all receptive activities, whereas gender differences regarding smoking status and longstanding illness were small across each receptive activity.

[Table 2](#) shows gender-specific distribution of participation in each creative activity in terms of each covariate. For each creative activity, there was a higher representation of women with low-level occupations than men with low-level occupations. Strong gender differences regarding marital status were observed for participation in 'parish work' and 'dance', with more married men than married women engaging in these activities. Gender differences regarding alcohol, smoking, and BMI were noted across all activities, with more women than men never drinking alcohol, never smoking, and being of normal weight.

Association with cause-specific mortality

The mean duration of follow-up was 8.15 years, resulting in a total of 292,416 person years. During this time, 235 (1.04%) women and 328 (1.86%) men died from CVD-related issues, and 313 (1.38%) women and 439 (2.49%) men died from cancer-related issues ([Table 3](#)).

Individual activities

The relationships between each cultural activity and the respective dependent variables of CVD- and cancer-related mortality were examined individually ([Table 3](#)). The results of the fully adjusted multivariable analysis revealed that, among receptive activities, only attending museum/art exhibitions positively influenced CVD-related mortality; the fully adjusted model showed a significantly lower risk (HR: 0.72; 99% CI: 0.53–0.97) for the whole population in this regard. Gender-specific analyses revealed that neither women nor men experienced a significant effect of participating in any of the receptive activities.

Several creative activities lowered the risk of CVD-related mortality; association or club meetings/activities reduced CVD-related mortality by 22% (adjusted HR: 0.78; 99% CI: 0.62–0.99), and outdoor activities produced a reduction of 23% (adjusted HR: 0.77; 99% CI: 0.61–0.98). Gender-specific analysis revealed that the only activity that lowered the risk of CVD-

Table 1. Gender-specific distribution (%) of the participants in terms of the covariates and participation in each receptive cultural activity (n = 40,214). The HUNT Study (2006–08).

		All		Museum/art exhibition		Concert, theatre, film		Church/chapel		Sports event	
		Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Total		17,606 (43.8)	22,608 (56.2)	4,913 (27.9)	7,210 (31.9)	10,008 (56.8)	14,591 (64.5)	9,581 (54.4)	12,957 (57.3)	9,182 (52.2)	9,165 (40.5)
Mean age ± std.		55.2 ± 15.0	53.5 ± 16.1	54.8 ± 14.1	52.2 ± 14.6	51.6 ± 14.8	49.5 ± 15.1	56.5 ± 14.4	54.4 ± 15.9	51.9 ± 14.3	46.9 ± 14.1
Occupation level	Low	4.7	15.5	4.7	7.9	4.7	10.5	3.9	14.0	4.7	9.5
	Medium	60.0	51.7	40.3	40.2	50.8	47.5	58.6	51.4	54.4	48.2
	High	35.4	32.8	55.0	51.9	44.5	42.0	37.5	34.6	40.8	42.3
Marital status	Marriage [†]	64.8	57.6	69.0	61.7	64.6	58.5	29.4	61.8	65.0	59.8
	Other	35.2	42.4	31.0	38.3	35.4	41.5	70.6	48.2	35.0	40.2
LLI	Yes	41.4	41.9	35.3	36.4	34.1	35.5	41.0	41.5	34.7	31.4
	No	58.6	58.1	64.7	63.6	65.9	64.5	59.0	58.5	65.3	68.6
Alcohol, units/ week	Never	15.1	27.9	11.3	18.6	10.4	20.7	16.4	29.6	10.5	20.2
	0.5–6.5	74.9	69.2	75.9	77.2	78.1	76.0	75.6	68.0	79.3	77.1
	≥ 7	10.0	2.9	12.8	4.2	11.5	3.3	8.1	2.5	10.2	2.7
Cigarette smoking	Never	40.1	45.2	45.1	48.7	45.9	47.0	43.2	49.9	46.6	48.2
	Former	38.1	30.4	38.0	32.7	34.6	31.1	38.5	29.6	33.8	28.7
	Daily	21.8	24.4	16.9	18.7	19.5	21.9	18.3	20.5	19.5	23.1
Physical activity, MET	< 2.5	60.2	56.4	53.9	49.8	55.9	51.2	59.0	56.4	52.9	47.6
	≥ 2.5	39.8	43.6	46.1	50.2	44.1	48.8	41.0	43.6	47.1	52.4
BMI	Normal	24.6	38.4	25.4	42.5	25.4	41.4	23.8	36.6	25.1	43.6
	Overweight	53.1	38.1	53.5	37.5	53.9	37.6	54.1	39.5	53.9	36.6
	Obesity	22.4	23.5	21.0	20.0	20.6	21.1	22.2	23.9	21.0	19.8

[†]Marriage/relationship

MET: metabolic equivalent; LLI: Limiting longstanding illness.

<https://doi.org/10.1371/journal.pone.0248332.t001>

related mortality in women was participating in association or club meetings/activities (risk reduction: 36%; adjusted HR: 0.64; 99% CI: 0.45–0.92). In contrast, no creative activities were found to reduce CVD-related mortality among men.

Only music, singing, and theatre was found to significantly influence cancer-related mortality (risk reduction: 27%; adjusted HR: 0.73; 99% CI: 0.56–0.97). However, gender-specific analysis showed that the protective effect of music, singing and theatre was not present for women but was strong for men, at 33% (adjusted HR: 0.67; 99% CI 0.47–0.96).

Diversity of participation

Diversity in participation was not found to be an important determinant of CVD- or cancer-related mortality for either men or for women (S1–S6 Figs). In the fully adjusted model CVD-related mortality among those who participated in two, three or more receptive or creative activities did not significantly differ when compared to those who participated in less than two activities. A similar pattern was found in gender-specific analysis, which suggested that engaging in several different activities did not produce any extra benefits regarding CVD-related mortality. In contrast, the total number of receptive and creative activities engaged in impacted cancer-related mortality, and gender-specific analyses revealed that this influenced men's longevity (S6 Fig). Notably, participating in increasing numbers of receptive activities did not seem to moderate a reduction in risk of CVD- or cancer-related mortality (see S3 and S4 Figs).

Table 2. Gender-specific distribution (%) of participants in terms of engagement in each creative cultural activity (n = 40,214). The HUNT Study (2006–08).

		Association or club meeting/activity		Music, singing, theatre		Parish work		Outdoor activities		Dance	
		Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Total		7,136 (40.5)	9,373 (41.5)	3,364 (19.1)	4,404 (19.5)	802 (4.6)	1,410 (6.2)	14,426 (81.9)	16,999 (75.2)	5,683 (32.3)	8,443 (37.3)
Mean age ± std.		53.9 ± 13.8	54.5 ± 15.3	54.4 ± 15.2	49.8 ± 16.0	56.6 ± 14.8	57.0 ± 15.5	54.1 ± 14.4	51.1 ± 14.8	54.9 ± 13.3	50.2 ± 14.2
Occupation level	Low	3.7	10.9	4.7	9.7	4.5	13.7	4.5	11.4	4.3	10.7
	Medium	50.0	48.2	49.9	45.0	51.0	44.5	56.9	50.0	54.7	50.5
	High	46.3	40.9	45.3	45.3	44.5	41.8	38.7	38.6	41.0	38.9
Marital status	Marriage [†]	69.5	63.0	67.3	57.7	78.9	68.3	65.5	60.2	67.3	59.8
	Other	30.5	37.0	32.7	42.3	21.1	31.7	34.5	39.8	32.7	40.2
LLI	Yes	36.7	39.5	38.9	36.3	39.8	44.8	38.3	37.0	36.4	34.9
	No	63.3	60.5	61.1	63.7	60.2	55.2	61.7	63.0	63.6	65.1
Alcohol, units/ week	Never	12.7	25.8	14.2	24.2	46.3	55.4	13.0	23.1	7.4	16.7
	0.5–6.5	77.1	71.5	75.0	72.9	50.2	43.3	76.6	73.7	81.7	79.7
	≥ 7	10.2	2.7	10.8	3.0	3.5	1.3	10.4	3.2	10.9	3.6
Cigarette smoking	Never	46.8	50.3	42.9	50.7	54.2	66.3	42.5	45.6	43.5	44.8
	Former	34.7	9.8	36.7	28.1	30.3	22.6	36.9	30.9	36.4	30.4
	Daily	18.5	19.8	20.5	21.3	15.5	11.1	20.7	23.5	20.1	24.9
Physical activity, MET	< 2.5	57.8	54.9	57.6	52.0	61.7	62.2	56.7	50.5	55.8	48.1
	≥ 2.5	43.1	45.1	42.4	48.0	38.3	37.8	43.3	49.5	44.2	51.9
BMI	Normal	23.7	36.7	24.8	40.2	25.2	35.6	24.7	40.9	23.5	42.0
	Overweight	53.8	39.0	53.8	36.9	51.1	37.7	54.0	38.2	55.0	38.5
	Obesity	22.5	24.3	21.4	22.9	23.8	26.7	21.3	20.8	21.5	19.5

[†]Marriage/relationship

MET: metabolic equivalent; LLI: Limiting longstanding illness

<https://doi.org/10.1371/journal.pone.0248332.t002>

The differences appeared between participants who participated in one activity and those who did not participate at all.

Weekly frequency of participation

Table 4 shows the results of the fully adjusted models presenting the association between weekly frequency of participation and CVD- and cancer-related mortality for all activities combined, as well as for receptive and creative activities, respectively. Weekly participation in creative activities significantly reduced the risk of CVD-related mortality; those participating every other week or less than once per week and those participating once to less than twice per week had a 36% (HR: 0.64; 99% CI: 0.46–0.89) and 26% (HR: 0.74; 99% CI: 0.57–0.96), respectively, lower risk of CVD-related death. Participating more than twice a week in any of the creative activities was not associated with a significantly lower risk of CVD-related mortality. While gender-specific analyses indicated similar trends for both genders in terms of risk reduction, statistical significance was found only among men who participated in creative activities every other week or less than once per week (40%; HR: 0.60; 99% CI: 0.39–0.93).

In contrast, for cancer-related mortality significant reductions, after full adjustment, were observed when weekly frequency of participation in combined activities was more than twice a week. In other words, when creative and receptive activities were combined, a significantly lower HR of cancer-related mortality was found (HR: 0.71; 99% CI: 0.53–0.97).

Table 3. Total and gender-specific associations (based on adjusted[†] hazard ratios and 99% confidence intervals) between participation in one or more receptive/creative cultural activities and cardiovascular-disease- and cancer-related mortality (n = 35,902). The HUNT Study (2006–08).

			Receptive activities				Creative activities					
Deaths/ person years			Museum/art exhibition	Concert, theatre, film	Church/ chapel	Sports event	Association or club meeting/activity	Music, singing, theatre	Parish work	Outdoor activities	Dance	
Participants			11,305 (31.5)	22,870 (63.7)	20,232 (56.4)	17,082 (47.6)	15,143 (42.2)	7,167 (20.0)	1,970 (5.5)	28,910 (80.5)	13,083 (36.4)	
			HR (99% CI)				HR (99% CI)					
CVD	All	563/292416	0.72 (0.53–0.97)	0.85 (0.66–1.08)	1.00 (0.80–1.26)	0.83 (0.63–1.09)	0.78 (0.62–0.99)	1.07 (0.81–1.43)	0.91 (0.57–1.46)	0.77 (0.61–0.98)	0.82 (0.62–1.10)	
			Men	328/129851	0.74 (0.51–1.07)	0.75 (0.54–1.03)	0.97 (0.73–1.31)	0.75 (0.55–1.04)	0.90 (0.65–1.24)	1.04 (0.72–1.50)	1.40 (0.78–2.51)	0.74 (0.54–1.01)
	Woman	235/162565			0.71 (0.43–1.17)	1.04 (0.71–1.52)	1.02 (0.72–1.45)	1.06 (0.64,1.74)	0.64 (0.45–0.92)	1.10 (0.69,1.76)	0.53 (0.24–1.17)	0.83 (0.57–1.19)
			Cancer	All	752/292416	0.98 (0.78–1.22)	0.90 (0.73–1.10)	0.85 (0.70–1.03)	0.95 (0.77–1.17)	0.88 (0.72–1.08)	0.73 (0.56–0.97)	0.72 (0.45–1.16)
	Men	439/129851				0.83 (0.61–1.13)	0.84 (0.64–1.10)	0.84 (0.66–1.08)	0.95 (0.73–1.23)	0.91 (0.70–1.20)	0.67 (0.47–0.96)	0.73 (0.37–1.46)
				Woman	313/162565	1.18 (0.84–1.65)	0.98 (0.71–1.35)	0.86 (0.64–1.16)	0.93 (0.65–1.33)	0.86 (0.64–1.17)	0.83 (0.54–1.27)	0.71 (0.37–1.37)

[†] Adjusted for: age and gender, occupation and marital status, limiting longstanding illness, and behavioural lifestyle factors (smoking, alcohol consumption, physical activity, and body mass index; ref.: never).

CI: confidence interval; CVD: cardiovascular disease; HR: hazard ratio

<https://doi.org/10.1371/journal.pone.0248332.t003>

Discussion

The results of this observational cohort study suggest that participation in cultural life is associated with a reduced risk of CVD-related death. In particular, our results indicate that frequent weekly participation in creative activities reduces the risk of CVD- and cancer-related mortality. When receptive and creative activities were combined, a significantly lower HR for cancer-related mortality was found for the sample (both genders included), but only if the frequency of participation was over twice a week; this is probably attributable to creative activity participation. Further, our results indicated that diversity of participation does not influence this association.

Before discussing our findings in the context of other studies, it is important to note that methodological differences between studies, such as the types of cultural activities examined, the operationalisation of the exposure measures (i.e. measuring individual activities or frequency or diversity of participation), and the outcomes measured, greatly impact inter-study comparisons. Another important issue is the difficulty separating the total number of activities from the frequency of participation, as it is likely that, the more activities a person performs, the higher his/her frequency score. These two quantifiers of the diversity and frequency of cultural-activity engagement are not mutually exclusive and have seldom been implemented in other studies. We observed that in previous published articles, the most common method was to combine the number of activities and frequency in the same index.

Table 4. Association, both overall and gender-specific, between CVD- and cancer-related mortality, respectively, and weekly frequency of participation in receptive, creative, and combined activities (based on adjusted[†] hazard ratios and 99% confidence intervals: N = 35,902). The HUNT Study (2006–08).

Frequency/wk.			0.5–< 1	1–< 2.	≥ 2*
CVD	Combined	All	0.92 (0.66–1.29)	0.71 (0.55–1.01)	0.72 (0.52–1.01)
		Men	1.03 (0.65–1.63)	0.78 (0.51–1.19)	0.76 (0.48–1.19)
		Women	0.79 (0.48–1.29)	0.68 (0.43–1.07)	0.67 (0.41–1.11)
	Receptive	All	0.82 (0.63–1.07)	0.92 (0.69–1.22)	0.85 (0.33–2.15)
		Men	0.77 (0.54–1.09)	0.84 (0.58–1.22)	0.69 (0.18–2.56)
		Women	0.88 (0.59–1.31)	1.05 (0.67–1.65)	1.43 (0.38–5.32)
	Creative	All	0.64 (0.46–0.89)	0.74 (0.57–0.96)	0.90 (0.56–1.44)
		Men	0.60 (0.39–0.93)	0.77 (0.55–1.08)	0.80 (0.43–1.51)
		Women	0.67 (0.41–1.09)	0.68 (0.45–1.03)	0.96 (0.47–1.96)
Cancer	Combined	All	0.90 (0.65–1.23)	0.78 (0.59–1.04)	0.71 (0.53–0.97)
		Men	0.94 (0.62–1.42)	0.77 (0.53–1.12)	0.70 (0.47–1.04)
		Women	0.85 (0.52–1.40)	0.80 (0.52–1.25)	0.74 (0.46–1.18)
	Receptive	All	0.81 (0.64–1.01)	0.86 (0.67–1.11)	1.15 (0.56–2.41)
		Men	0.83 (0.62–1.12)	0.87 (0.63–1.20)	1.18 (0.46–3.01)
		Women	0.79 (0.55–1.12)	0.85 (0.58–1.26)	1.07 (0.33–3.47)
	Creative	All	0.80 (0.62–1.05)	0.74 (0.59–0.93)	0.66 (0.43–1.02)
		Men	0.78 (0.55–1.11)	0.75 (0.56–1.02)	0.74 (0.43–1.27)
		Women	0.84 (0.56–1.27)	0.71 (0.49–1.02)	0.58 (0.29–1.17)

[†] Respective frequency max: four times/wk; creative frequency max: five times/wk; combined frequency max: nine times/wk.

Fully adjusted ref.: never or seldom.

<https://doi.org/10.1371/journal.pone.0248332.t004>

A previous Scandinavia-based prospective study examined similar outcomes to the present research, and used an index that combined frequency of participation in receptive activities (attending a cinema, theatre, art gallery, museum, and live music) and the number of these activities attended. The study found that those who live in urban areas and rarely attend cultural events have a threefold higher risk of cancer-related mortality when compared to frequent attendees [23]. In contrast, we did not find an association between reduced cancer-related mortality and frequent attendance of receptive activities, unless creative activities were also performed. Contrary to our finding, Fancourt et al. studied the association between all-cause mortality among adults aged 50 years and above and found that those who engaged with receptive arts activities even on an infrequent basis such as every few months or more had 31% lower mortality rate compared to those who never engaged in such activities. This finding was independent of demographic, SES, health related behaviour and social factor and after adjustment for their cognitive status, mental health and PA [32].

In our cohort, participation in outdoor activities and club meetings was strongly associated with CVD-related mortality, while parish work, singing or playing music, and dancing were not. Väänänen et al. [24] studied, among a cohort of Finnish industrial employees (n = 7,922), the association between engagement in cultural activities (arts and culture, association activities, societal actions, reading literature, and studying) and main causes of mortality. High engagement (i.e. approximately twice a month to daily) was associated with a 32% lower risk of CVD-related mortality. There are several differences between these findings and those of the present study. The creative activities examined by Väänänen et al. differed from those measured in HUNT3; we found a reduced risk of CVD-related mortality among those who participated in creative activities as infrequently as less than once a week; and Väänänen et al. did not find any associations with cancer-related mortality [24].

Also contrasting with our results, Merom et al. [22] found dancing to be inversely associated with CVD-related mortality. Specifically, they found moderate-intensity dancing to be associated with a lower risk of CVD-related mortality to a greater extent than moderate-intensity walking (46% versus 33%, respectively). Outdoor activity is positively related to PA, which is an established protective factor against mortality from CVD and from some types of cancer. Donneyong et al. [33] found that outdoor activity is strongly associated with a reduced risk of CVD-related mortality (30–47%, depending on participation frequency), and later reported a risk reduction of 28% independent of total PA [34]. These results are stronger than those obtained for our cohort, which showed that outdoor-activity participation produces a risk reduction of 23%. Outdoor activities may be a marker of an active lifestyle, and reduced sedentary behaviour. However, engagement in such activities does not necessarily involve PA, and outdoor activity is significantly different from exercise. Engagement in outdoor activity influences levels of inactivity and sedentarism, both of which are contributors to chronic diseases [35, 36]. The joint association between PA and sedentary behaviour has been intensively explored in the past decade [37]. Rangul et al. [38] found no evidence that people who spend prolonged periods seated or who have low levels of PA have an increased risk of total cancer incidence when compared to people who spend short periods seated or who are physically active. Autenrieth et al. [39] found that PA during leisure time is associated with cancer-related mortality, and vigorous activity with CVD-related mortality. In contrast, a systematic review found significant associations between sedentary behaviour and cancer [40]. Sedentary behaviour and physical inactivity are associated with a risk of several chronic diseases [41–43], and are of importance in regard to incident CVD [44] and cancer, especially colon and breast cancer [41]. Stamatakis, E et al. revealed that by replacing one hour sedentary time with walking, led to a 14% reduced risk of all-cause mortality [45]. Another explanation for the strong association between outdoor activity and reduced CVD risk is that outdoor activity involves exposure to natural environments and provides opportunities for positive restoration [46]. The level of energy expenditure associated with outdoor activities can vary; in the present study, we adjusted for energy expenditure, but an attributable effect on CVD risk remained. Another possible explanation is that outdoor activities increase sunlight exposure, which can prevent autoimmune diseases, CVD, and cancers [47]. Sunlight exposure counteracts vitamin-D deficiency, which is associated with increased risk of CVD [47], deadly cancers [47, 48], and non-melanoma skin cancer [47]. However, Donneyong et al. found CVD-related mortality risk to be independent of vitamin-D level [33, 34].

Among receptive activities, only attending museum and art exhibitions appeared to protect against CVD-related mortality, but none protected against cancer-related mortality. To our knowledge, museum visits has not been previously explored as an activity related to mortality; but instead, it has been considered in relation to general health and wellbeing [49–52] or cognitive decline and the prevention of dementia. A longitudinal study by Fancourt et al. [49] found that visiting a museum every few months is related to lower incidence of dementia in adults aged > 50 years. A possible explanation is that visiting museums reduces the negative effect of possible sedentary behaviours and isolation, and can also represent social engagement [49]. In general, a lack of social support is known to cause negative psychological states, such as anxiety and depression, which further can increase the risk of CVD [53]. A previous study performed a tactile experiment in which participants handled and discussed a selection of museum objects and discussed photographs of the same objects; this activity enhanced cancer patients' well-being, positive emotions, and happiness [54]. However, we found no association between attending museums or art exhibitions and cancer-related mortality.

Music, singing, and theatre engagement was the only creative activity that was significantly associated with a reduced risk of cancer-related mortality. This findings is supported by many

clinical studies that have shown such activity to have a therapeutic effect on cancer patients. Music has been linked to immune response [13, 55, 56], with stress reduction as a possible pathway, and may impact individuals' neurological and immunological systems [56]. However, there is a lack of epidemiological studies in this regard. Our results, therefore, the first to show that music, singing, and theatre participation reduces the risk of cancer-related mortality by 27% in the general population; this should have implications for future research.

There is a strong empirical rationale for our exploring of gender differences. First, patterns and durations of diseases can differ across genders [57]. Second, there is evidence that behavioural choices and the time allocated to making these choices differ by gender [58]. In our analysis, gender was a significant covariate for each exposure variable (i.e. never/ever, number of activities, and frequency). Specifying interaction terms between cultural participation and sex, we found statistically significant differences for 'association and club meeting activities' and parish work for CVD-related mortality, and 'museum and art exhibition' and dance for cancer-related mortality. We found that club meetings reduce the risk of CVD-related mortality among women by 36%, and that music, singing, and theatre engagement may reduce cancer-related mortality among men by 27%. Further, men who engaged in creative activities less than once a week showed a significantly (33%) lower risk of CVD-related mortality, whereas, for women the weekly frequency did not seem to be of importance. We are not aware of any other studies that have examined gender differences in relation to frequency of cultural participation and CVD-related mortality. A women-only cohort found that frequent attendance of religious services is associated with a significantly lower risk of CVD- and cancer-related mortality, when compared to never attending religious services; women who attend more than once a week have a 27% and 21% lower risk of CVD-related mortality and cancer-related mortality, respectively [59]. In our study, parish work was associated with a reduced risk of CVD-related mortality by 47% among women, while this was not statistically significant which could be due to small sample reporting parish work, ($n = 1410$) it is a strong protective effect size. Similar to our findings, Eng et al. did not find religious-service attendance to be significantly associated with reduced CVD-related mortality among men [6].

Causal pathways in health are presumably complex, and there are several risk factors for disease onset and mortality. Stress is strongly associated with CVD incidence [60], and is associated with depression and metabolic abnormalities that increase CVD risk [61]; further, chronic psychosocial stress modifies the association between inflammation and CVD [62]. A previous meta-analysis found chronic stressors to be associated with suppression of cellular and hormonal measures [63]. Additionally, stress may promote the initiation and progression of some types of cancer [64], thereby influencing cancer-related mortality [23]. The immune system and stress response seem to be of particular importance in regard to cancer [64–66], with immunological involvement varying across different cancers [64]. Psychological stress, both among healthy individuals experiencing stress and individuals with cancer-related psychological stress, is linked to the downregulation of immune responses immune responses, which has implications regarding cancer progression. Engaging in cultural events could promote immune functions by serving as a buffer against stress [23]. For example, interventions involving dance-movement therapy groups have shown positive effects regarding stress reduction [67], and art therapy has been found to increase overall coping resources among women with breast cancer [18]. A physically active lifestyle strengthens the ability to manage stress exposure and stress-related disorders [68]; in particular, cardiorespiratory fitness moderates stress and seems to be associated with fewer symptoms of depression and burnout [68]. Cultural activities can counteract adverse stress-related effects by promoting social networks and resilience [69, 70]. We suggest new studies regarding fair access to participation in cultural life, not least in view of the possible stress reducing effects from cultural engagement.

In observational studies such as this, causality is difficult to demonstrate. Cultural participation may serve as a proxy for other factors [71], such as social capital and factors related to SES. Fancourt and Steptoe explored cultural engagement in relation to mental health, and found it to be independent of socioeconomic status [72]. Another important public health aspect is the mental health challenges in the population. Anxiety and depression are prevalent conditions and found to be barriers for cultural engagement by Fancourt et al. [73]. Those participating in cultural activities may also be a healthier population than non-participants, and frequent attendees may be healthier than those who seldom participate. When compared to less-active people, such people may have greater knowledge, network support (representing a support mechanism), and ability to take advantage of knowledge regarding lifestyle and treatment options, and some may have access to private health-care financing through private insurance. Disease onset may encourage people to adopt healthier lifestyles, strengthening factors that improve their psychological and physical health, well-being, and quality of life, helping them to enjoy life.

Strengths and limitations

This study involved data for a large population-representative cohort that had an acceptable response rate and obtained rich information regarding a range of receptive and creative activities. The survey collected information on important confounders. A major strength is this research's exploration of the risk of cause-specific mortality for a range of receptive and creative activities. Participants were blinded to future research questions when invited to participate in the HUNT3 Survey, which reduced social-desirability bias. Lastly, the use of cause of death data from the national register provided high degrees of coverage and completeness regarding cause-specific mortality.

Limitations include a lack of adjustment for changes over the follow-up period in relevant characteristics, health, and behaviours; further, possible joint effects of multiple risk factors (e.g. a cluster of risk factors within a single individual) and comorbidities were not examined. Some of the activities could not be separated (e.g. music, singing, and theatre). In addition, isolating activities is complex, as participating in creative activities could increase the likelihood of attending a concert, theatre, and/or cinema, or vice-versa. Consequently, the single-effect estimates may be confounded and may have measured attributable effects from other activities. Furthermore, other activities may be more strongly linked to sub-causes of mortality within the CVD and cancer categories. Statistically, we took a conservative approach by presenting 99% CIs; this was because we performed multiple testing and used 99% CIs to limit the type I error rate.

Conclusion

The results of this study have important implications for research, leisure-service providers and policy-makers. Researchers should continue to explore causal paths between stress reducing, social capital and mental well-being effects from cultural engagement among the general population. Leisure-service providers should increase the opportunities to engage in outdoor recreational activities, increase the number of clubs with affordable memberships, and create more opportunities to consistently engage in music, singing, and theatre. Policy-makers should review whether there is sufficient access to museums and artistic events across all regions of the country. Such activities will increase social interaction in the community, foster psychosocial benefits and, hopefully, promote and maintain health and enhance longevity.

Supporting information

S1 Fig. Diversity of receptive activities in association with CVD mortality, n = 35,902. The HUNT Study (2006–08). *Number of activities from 1, 2 or maximum 3–4 activities attended, for the total sample and stratified for genders.
(TIF)

S2 Fig. Diversity of creative activities in association with CVD mortality, n = 35,902. The HUNT Study (2006–08). *Number of activities from 1, 2 or maximum 3–5 activities engaged in, for the total sample and stratified for genders.
(TIF)

S3 Fig. Total diversity of activities, combined receptive and creative activities, in association with CVD mortality, n = 35,902. *Number of activities from 1, 2 and up to maximum 7–9 activities engaged in, for the total sample and stratified for genders.
(TIF)

S4 Fig. Diversity of receptive activities in association with cancer mortality, n = 35,902. The HUNT Study (2006–08). *Number of activities from 1, 2 or maximum 3–4 activities engaged in, for the total sample and stratified for genders.
(TIF)

S5 Fig. Diversity of creative activities in association with cancer mortality, n = 35,902. The HUNT Study (2006–08). *Number of activities from 1, 2 or maximum 3–5 activities engaged in, for the total sample and stratified for genders.
(TIF)

S6 Fig. Total diversity of activities, combined receptive and creative activities, in association with cancer mortality, n = 35,902. The HUNT Study (2006–08). *Number of activities from 1, 2 up to maximum 7–9 activities engaged in, for the total sample and stratified for genders.
(TIF)

Acknowledgments

The Trøndelag Health Study (The HUNT Study) is a collaboration between HUNT Research Centre, (Faculty of Medicine and Health Sciences, NTNU, Norwegian University of Science and Technology), Trøndelag County Council, Central Norway Health Authority, and the Norwegian Institute of Public Health. Data on cause of death were obtained from the Norwegian Cause of Death Registry.

I would confirm that all authors have seen and approved the manuscript as submitted. I certify that each author participated sufficiently in the study conception or design, data analysis or interpretation, and drafting or revision of the manuscript, so that each author takes responsibility for the validity, integrity, and objectivity of the entire study.

The corresponding author confirms on behalf of all authors that there have been no involvements that might raise the question of bias in the work reported or in the conclusions, implications, or other competing interests.

Author Contributions

Conceptualization: Bente I. Løkken, Dafna Merom, Erik R. Sund, Steinar Krokstad, Vegar Rangul.

Data curation: Bente I. Løkken.

Formal analysis: Bente I. Løkken, Dafna Merom, Erik R. Sund.

Funding acquisition: Bente I. Løkken, Steinar Krokstad, Vegar Rangul.

Investigation: Bente I. Løkken.

Methodology: Bente I. Løkken, Dafna Merom, Erik R. Sund, Steinar Krokstad, Vegar Rangul.

Project administration: Bente I. Løkken.

Supervision: Vegar Rangul.

Validation: Bente I. Løkken, Dafna Merom, Erik R. Sund.

Visualization: Bente I. Løkken, Vegar Rangul.

Writing – original draft: Bente I. Løkken, Dafna Merom.

Writing – review & editing: Bente I. Løkken, Dafna Merom, Erik R. Sund, Steinar Krokstad, Vegar Rangul.

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Paper III.

Engagement in cultural activities and general practitioner consultations. Observational findings from The HUNT Study, Norway

Bente Irene Løkken^{1,2}, Erik Reidar Sund^{1,2,4}, Steinar Krokstad^{2,3,4}, Ottar Bjerkeset^{1,5}, Vegar Rangul^{1,2,3}

¹Nord University, Faculty of Nursing and Health Sciences, Levanger, Norway.

²HUNT Research Centre, Department of Public Health and Nursing, faculty of Medicine and Health Sciences, Norwegian University of Science and Technology (NTNU), Levanger, Norway.

³Norwegian Resource Centre for Arts and Health.

⁴Levanger Hospital, Nord-Trøndelag Hospital Trust, Norway.

⁵Department of Mental Health, faculty of Medicine and Health Sciences, Norwegian University of Science and Technology (NTNU), Norway.

Correspondence to Bente Irene Løkken, Nord University, Faculty of Nursing and Health Sciences, Levanger, Norway. Email: bente.i.lokken@nord.no

Word count: 3766

This paper is awaiting publication and is not included in NTNU Open

Appendix 4

Consent, HUNT3 2006-08.



Samtykke til bruk av helseopplysninger i forskning
Helseundersøkelsen i Nord-Trøndelag 2006-08 (HUNT 3)

I brosjyren jeg har fått tilsendt har jeg lest om helseundersøkelsens innhold og formål, og jeg har hatt mulighet til å stille spørsmål.

Jeg samtykker i å delta i undersøkelsen.

Sted, dato, klokkeslett

Navn

Fødselsdato

Appendix 5

Questionnaire 1, HUNT3 2006-08.

Invitasjon til HUNT 3

Viktig
Enkelt
Gratis

Du inviteres herved til å delta i den tredje store Helseundersøkelsen i Nord-Trøndelag (HUNT 3). Ved å delta får du en enkel undersøkelse av din egen helse, og du gir samtidig et viktig bidrag til medisinsk forskning.

Hver deltaker er like viktig, enten du er ung eller gammel, frisk eller syk, er HUNT-veteran eller møter for første gang. Tilsvarende undersøkelse er tidligere gjennomført i 1984-86 (HUNT 1) og 1995-97 (HUNT 2 og Ung-HUNT). For å kunne studere årsaker til sykdom, er det viktig at også de som tidligere har deltatt møter fram.

Vennligst fyll ut spørreskjemaet, og ta det med når du møter til undersøkelse.

Undersøkelsen tar vanligvis ca 1/2 time. Du vil få brev med resultater fra dine prøver etter noen uker. Dersom noen av resultatene er utenom det normale, vil du bli anbefalt undersøkelse hos fastlegen din.

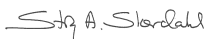
Du kan lese mer om HUNT 3 i den vedlagte brosjyren eller på www.hunt.ntnu.no. Har du spørsmål, kan du også ringe til HUNT forskningscenter, tlf 74075180.

Vel møtt til undersøkelsen!

Vennlig hilsen


Steinar Krokstad
Førsteamanuensis
Prosjektleder HUNT 3


Jostein Holmen
Professor, daglig leder
HUNT forskningscenter


Stig A. Slørdahl
Professor, dekanus
Det medisinske fakultet, NTNU

Tid og sted for oppmøte

Dersom det foreslåtte tidspunktet ikke passer for deg, behøver du ikke bestille ny time. Du kan møte når det passer deg innenfor åpningstiden, men det kan da bli noe ventetid. Du kan også møte i en annen kommune, hvis det skulle passe bedre. Takk for at du deltar!

Åpningstida:

 **hunt 3**
Helseundersøkelsen i Nord-Trøndelag

 **NTNU**

HUNT forskningscenter



En time for bedre folkehelse

Slik fyller du ut skjemaet

- Skjemaet vil bli lest maskinelt.
- Det er derfor viktig at du krysser av riktig: **Rett** **Galt**
- Krysser du feil sted, retter du ved å fylle boksen slik:
- Skriv tydelige tall: 0 1 2 3 4 5 6 7 8 9
- Bruk bare svart eller blå penn. Ikke bruk blyant eller tusj.

HELSE OG DAGLIGLIV

1 Hvordan er helsa di nå?

Dårlig Ikke helt god God Svært god

2 Har du noen langvarig (minst 1 år) sykdom, skade eller lidelse av fysisk eller psykisk art som nedsetter dine funksjoner i ditt daglige liv? Ja Nei

Hvis ja:

Hvor mye vil du si at dine funksjoner er nedsatt?

	Litt nedsatt	Middels nedsatt	Mye nedsatt
Er bevegelsehemmet.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Har nedsatt syn	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Har nedsatt hørsel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hemmet pga. kroppslig sykdom.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hemmet pga. psykisk sykdom.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3 Har du kroppslige smerter nå som har vart mer enn 6 måneder? Ja Nei

4 Hvor sterke kroppslige smerter har du hatt i løpet av de siste 4 uker?

Ingen	Meget svake	Svake	Moderate	Sterke	Meget sterke
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

5 I hvilken grad har din fysiske helse eller følelsesmessige problemer begrenset deg i din vanlige sosiale omgang med familie eller venner i løpet av de siste 4 uker?

Ikke i det hele tatt	En del	Litt	Mye	Kunne ikke ha sosial omgang
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

HELSETJENESTER

6 Har du i løpet av de siste 12 måneder vært hos:

	Ja <input type="checkbox"/>	Nei <input type="checkbox"/>
Fastlege/allmenlege	<input type="checkbox"/>	<input type="checkbox"/>
Annen legespesialist utenfor sykehus	<input type="checkbox"/>	<input type="checkbox"/>
Konsultasjon uten innleggelse		
- ved psykiatrisk poliklinikk.....	<input type="checkbox"/>	<input type="checkbox"/>
- ved annen poliklinikk i sykehus	<input type="checkbox"/>	<input type="checkbox"/>
Kiropraktor	<input type="checkbox"/>	<input type="checkbox"/>
Homøopat, akupunktør, soneterapeut, håndspålegger eller annen alternativ behandler ...	<input type="checkbox"/>	<input type="checkbox"/>

7 Har du vært innlagt i sykehus i løpet av de siste 12 måneder? Ja Nei

SYKDOMMER OG PLAGER

8 Har du hatt noe anfall med pipende eller tung pust de siste 12 måneder? Ja Nei

9 Har du noen gang de siste 5 år brukt medisiner for astma, kronisk bronkitt, emfysem eller KOLS? Ja Nei

10 Bruker du, eller har du brukt, medisin mot høyt blodtrykk? Ja Nei

11 Har du, eller har du noen gang hatt, noen av disse sykdommene/plagene: (Sett ett kryss pr. linje)

	Ja <input type="checkbox"/>	Nei <input type="checkbox"/>	Hvis ja, hvor gammel var du første gang? Eksempel: 34 år gammel
Hjerteinfarkt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text" value="34"/> år gammel
Angina pectoris (hertekrampe) ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Hjertesvikt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Annen hjertesykdom	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Hjerneslag/hjerneblødning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Nyresykdom	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Astma	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Kronisk bronkitt, emfysem, KOLS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Diabetes (sukkersyke).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Psoriasis.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Eksem på hendene	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Kreftsykdom	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Epilepsi.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Leddgikt (reumatoid artritt)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Bechterews sykdom	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Sarkoidose	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Beinskjørhet (osteoporose)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Fibromyalgi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Slitasjegikt (artrose)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel
Psysiske plager som du har søkt hjelp for	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/> år gammel

12 Har du noen gang fått påvist for høyt blodsukker? Ja Nei

Hvis ja: I hvilken situasjon første gang?

Ved helseundersøkelse...	<input type="checkbox"/>	Under sykdom	<input type="checkbox"/>
Under svangerskap	<input type="checkbox"/>	Annet.....	<input type="checkbox"/>

SKADER

13 Har du noen gang hatt:

Hvis ja, hvor gammel var du **første** gang?

Eksempel:

3 4 år gammel

Lårhalsbrudd	Ja	Nei	<input type="text"/>	år gammel
Brudd i handledd/underarm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	år gammel
Brudd/sammenfall av ryggvirvler	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	år gammel
Nakkesleng (whiplash).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>	år gammel

14 Har du foreldre, søsken eller barn som har, eller har hatt, følgende sykdommer?

(Sett ett kryss pr. linje)

	Ja	Nei	Vet ikke
Hjerneslag eller hjerneblødning før 60 års alder.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hjerteinfarkt før 60-års alder	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Astma.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Allergi/høysnue/neseallergi.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kronisk bronkitt/emfysem/KOLS.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kreftsykdom	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Psykiske plager	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Beinskjørhet (osteoporose).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nyresykdom (ikke nyresten, urinveisinfeksjon, urinlekkasje).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Diabetes (sukkersyke).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

15 Har noen av dine besteforeldre, dine foreldres søsken eller dine søskenbarn fått diagnosen diabetes (type 1 eller type 2)?

Ja Nei

HVORDAN FØLER DU DEG?

16 Har du de to siste uker følt deg:

(Sett ett kryss pr. linje)

	Nei	Litt	En god del	Svært mye
Trygg og rolig?.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Glad og optimistisk?.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nervøs og urolig?.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Plaget av angst?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Irritabel?.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nedfor/deprimert?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ensom?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

17 Har du noen gang i livet opplevd at noen over lengre tid har forsøkt å kue, fornedre eller ydmyke deg?

Ja Nei

TOBAKK

18 Røykte noen av de voksne **innendørs** da du vokste opp?

Ja Nei

19 Røykte mora di da du vokste opp?

Ja Nei

20 Røyker du selv?

Nei, jeg har **aldri** røykt.....

Hvis du **aldri** har røykt, hopp til spørsmål 22.

Nei, jeg har sluttet å røyke.....

Ja, sigaretter **av og til** (fest/ferie, ikke daglig).....

Ja, sigarer/sigarillos/pipe **av og til**.....

Ja, sigaretter **daglig**.....

Ja, sigarer/sigarillos/pipe **daglig**.....

21 Svar på dette hvis du **nå** røyker **daglig** eller **tidligere** har røykt **daglig**:

Hvor mange sigaretter røyker eller røykte du vanligvis **daglig**? sigaretter pr. dag

Hvor gammel var du da du begynte å røyke **daglig**? år gammel

Hvis du tidligere har røykt daglig, hvor gammel var du da du sluttet? år gammel

21 Svar på dette hvis du røyker eller har røykt **av og til**, men **ikke daglig**:

Hvor mange sigaretter røyker eller røykte du vanligvis **i måneden**? sigaretter pr. mnd

Hvor gammel var du da du begynte å røyke **av og til**? år gammel

Hvis du tidligere har røykt **av og til**, hvor gammel var du da du sluttet? år gammel

22 Bruker du, eller har du brukt, snus?

Nei, aldri..... Ja, av og til.....

Ja, men jeg har sluttet... Ja, daglig.....

Hvis du **aldri** har brukt snus, hopp til spørsmål 23.

Hvis ja:

Hvor gammel var du da du begynte med snus? år gammel

Hvor mange esker snus bruker/brukte du **pr. måned**? esker snus pr. måned

Hvis du bruker eller har brukt både sigaretter og snus, hva begynte du med først?

Snus..... Sigaretter.....
 Omtrent samtidig Husker ikke.....
 (innenfor 3 måneder)

Da du begynte å bruke snus, var det for å prøve å slutte å røyke eller for å redusere røykinga?

Nei..... Ja, for å
 Ja, for å slutte å røyke redusere røykinga.....

MATVARER

23 Hvor ofte spiser du vanligvis disse matvarene?

(Sett ett kryss pr. linje)

	0-3 ganger pr. mnd.	1-3 ganger pr. uke	4-6 ganger pr. uke	1 gang pr. dag	2 ggr el mer pr. dag
Frukt/bær.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Grønnsaker.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sjokolade/smågodt....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kokte poteter.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pasta/ris.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pølser/hamburgere.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fet fisk (laks, ørret, sild, makrell, uer som pålegg/middag)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

24 Bruker du følgende kosttilskudd?

(Sett ett kryss for hvert kosttilskudd)

	Ja, daglig	Av og til	Nei
Tran	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Omega-3-kapsler.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vitamin- og/eller mineraltilskudd.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

25 Hvor mange glass drikker du vanligvis av følgende?

1/2 liter = 3 glass (Sett ett kryss pr. linje)

	Sjelden eller aldri	1-6 gl. pr uke	1 gl. pr. dag	2-3 gl. pr. dag	4 gl. eller mer pr. dag
Vann, farris o.l	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Helmelk (søt/sur).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Annen melk (søt/sur) ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Brus/saft med sukker....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Brus/saft uten sukker....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Juice eller nektar	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

26 Hvor mange kopper kaffe/te drikker du pr. døgn?

(Sett 0 dersom du ikke drikker kaffe/te daglig)

	Koke- kaffe	Annen kaffe	Te
Antall kopper	<input type="text"/>	<input type="text"/>	<input type="text"/>

27 Hvor mange kopper kaffe drikker du om kvelden (etter kl 18)?

Antall kopper

ALKOHOLBRUK

28 Omtrent hvor ofte har du i løpet av de siste 12 måneder drukket alkohol? (Regn ikke med lettøl)

4-7 ganger pr. uke..... Ca 1 gang pr. måned..
 2-3 ganger pr. uke..... Noen få ganger pr. år.
 ca 1 gang pr. uke Ingen ganger siste år..
 2-3 ganger pr. måned..... Aldri drukket alkohol...

29 Har du drukket alkohol i løpet av de siste 4 uker? Ja Nei

Hvis ja:

Har du drukket så mye at du har kjent deg sterkt beruset (full)?

Nei.....
 Ja, 1-2 ganger
 Ja, 3 ganger eller mer

30 Hvor mange glass øl, vin eller brennevin drikker du vanligvis i løpet av 2 uker? (Regn ikke med lettøl) (Sett 0 hvis du ikke drikker alkohol)

	Øl	Vin	Brenne- vin
Antall glass	<input type="text"/>	<input type="text"/>	<input type="text"/>

31 Hvor ofte drikker du 5 glass eller mer av øl, vin eller brennevin ved samme anledning?

Aldri..... Ukentlig.....
 Månedlig Daglig.....

MOSJON/FYSISK AKTIVITET

Med mosjon mener vi at du f.eks går tur, går på ski, svømmer eller driver trening/idrett.

32 Hvor ofte driver du mosjon? (Ta et gjennomsnitt)

Aldri
 Sjeldnere enn en gang i uka
 En gang i uka
 2-3 ganger i uka.....
 Omtrent hver dag.....

33 Dersom du driver slik mosjon, så ofte som en eller flere ganger i uka; hvor hardt mosjonerer du? (Ta et gjennomsnitt)

Tar det rolig uten å bli andpusten eller svett.....
 Tar det så hardt at jeg blir andpusten og svett.....
 Tar meg nesten helt ut

34 Hvor lenge holder du på hver gang?

(Ta et gjennomsnitt)

Mindre enn 15 minutter.. 30 minutter – 1 time...
 15-29 minutter..... Mer enn 1 time.....

35 Har du vanligvis minst 30 minutter fysisk aktivitet daglig på arbeid og/eller i fritida? Ja Nei

36 Omtrent hvor mange timer sitter du i ro på en vanlig hverdag? (Regn med både jobb og fritid) Antall timer

ARBEID

37 Hvis du er i lønnet eller ulønnet arbeid, hvordan vil du beskrive arbeidet ditt? (Sett ett kryss)

For det meste stillesittende arbeid (f.eks skrivebordsarbeid, montering)

Arbeid som krever at du går mye (f.eks ekspeditørarbeid, lett industriarb., undervisning)

Arbeid hvor du går og løfter mye (f.eks postbud, pleier, bygningsarbeid)

Tungt kroppsarbeid (f.eks skogsarbeid, tungt jordbruksarbeid, tungt bygningsarbeid)

HØYDE/VEKT

38 Omtrent hva var din høyde da du var 18 år? cm Husker ikke

39 Omtrent hva var din kroppsvekt da du var 18 år? kg Husker ikke

40 Er du fornøyd med vekta di nå? Ja Nei, for lett Nei, for tung

41 Har du forsøkt å slanke deg i løpet av de siste 10 år? Nei Ja, noen ganger Ja, mange ganger

42 Er din kroppsvekt minst 2 kg lavere nå enn for 1 år siden? Ja Nei

Hvis ja:

Hva er grunnen til dette?

Slanking Sykdom/stress Vet ikke

ALVORLIGE LIVSHENDELSER SISTE 12 MÅNEDER

43 Har det vært dødsfall i nær familie? (barn, ektefelle/samboer, søsken eller foreldre) Ja Nei

44 Har du vært i overhengende livsfare pga. alvorlig ulykke, katastrofe, voldssituasjon eller krig? Ja Nei

T

45 Har du hatt samlivsbrudd i ekteskap eller i lengre samboerforhold? Ja Nei

46 Hvis du har svart ja på et eller flere av spm 43, 44 eller 45; i hvilken grad har du hatt reaksjoner på dette de siste 7 dager?

Ikke i det hele tatt..... I moderat grad.....

Litt..... I høy grad.....

OPPVEKST - DA DU VAR 0-18 ÅR

47 Hvem vokste du opp sammen med?

Mor..... Andre slektninger.....

Far..... Adoptivforeldre.....

Stemor/stefar..... Foster-/pleieførelde...

48 Ble dine foreldre skilt, eller flyttet de fra hverandre, da du var barn? Nei.....

Ja, før jeg var 7 år....

Ja, da jeg var 7-18 år

49 Døde noen av dine foreldre da du var barn? Nei.....

Ja, før jeg var 7 år....

Ja, da jeg var 7-18 år

50 Vokste du opp med kjæledyr? Nei.....

Ja, katt..... Ja, hund.....

Ja, hest..... Ja, annet levende dyr.

51 Hvor mye melk eller yoghurt drakk du vanligvis?

Sjelden/ aldri	1-6 gl. pr. uke	1 glass pr. dag	2-3 gl. pr. dag	Mer enn 3 glass pr. dag
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

52 Vokste du opp på gård med husdyr? Ja Nei

53 Når du tenker på barndommen/oppveksten din, vil du beskrive den som:

Svært god..... Vanskelig.....

God..... Svært vanskelig.....

Middels.....

ALT I ALT

54 Når du tenker på hvordan du har det for tida, er du stort sett fornøyd med tilværelsen eller er du stort sett misfornøyd? (Sett ett kryss)

Svært fornøyd..... Nokså misfornøyd.....

Meget fornøyd..... Meget misfornøyd.....

Ganske fornøyd..... Svært misfornøyd.....

Både/og.....

Appendix 6

Questionnaire 2, HUNT3 2006-08.

Kjære HUNT-deltaker

Takk for at du møtte til Helseundersøkelsen. Vi vil også be deg om å fylle ut dette spørreskjemaet. Noen av spørsmålene likner de som du har svart på før, men det er viktig at du allikevel besvarer alt. Opplysningene blir brukt til forskning og forebyggende helsearbeid. Forskere vil kun ha tilgang til aidentifiserte data, det vil si at opplysningene ikke kan spores tilbake til en enkeltperson.

Slik fyller du ut skjemaet

- Skjemaet vil bli lest maskinelt.
- Det er derfor viktig at du krysser av riktig: **Rett** **Galt**
- Krysser du feil sted, retter du ved å fylle boksen slik:
- Skriv tydelige tall: 0 1 2 3 4 5 6 7 8 9
- Bruk bare svart eller blå penn. Ikke bruk blyant eller tusj.

Dato for utfylling: / 20
Dag Måned År

Vennligst fyll ut skjemaet, og post det snarest mulig. Porto er betalt.

Kvinne 30 - 69 år

En time for bedre folkehelse

BOLIGFORHOLD OG VENNER

1 Hvem bor du sammen med?

(Sett ett eller flere kryss)

Ingen Andre personer over 18 år

Foreldre Personer under 18 år

Ektefelle/samboer..... Antall under 18 år ..

2 Er det kjæledyr i boligen?

Ja, katt

Nei Ja, hund

Ja, andre pelsdyr/fugl

3 Har du venner som kan gi deg hjelp når du trenger det?

Ja Nei

4 Har du venner som du kan snakke fortrolig med?

Ja Nei

DITT NÆRMILJØ, DVS. NABOLAGET/GRENDA

5 Jeg føler et sterkt fellesskap med de som bor her

(Sett ett kryss)

Helt enig Delvis enig Usikker Delvis uenig Helt uenig

6 Man kan ikke stole på hverandre her (Sett ett kryss)

Helt enig Delvis enig Usikker Delvis uenig Helt uenig

7 Folk trives godt her (Sett ett kryss)

Helt enig Delvis enig Usikker Delvis uenig Helt uenig

AKTIVITET

- 8 Hvordan har din fysiske aktivitet i fritida vært det siste året? (Tenk deg et ukentlig gjennomsnitt for året. Arbeidsvei regnes som fritid.)

	Timer pr. uke			
	Ingen	Under 1	1-2	3 el. mer
Lett aktivitet (ikke svett/andpusten)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hard fysisk aktivitet (svett/andpusten)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- 9 Hvor lang tid bruker du til sammen daglig foran dataskjerm? (Sett 0 hvis du ikke bruker data)

I arbeid timer I fritid timer

- 10 Hvor mange timer ser du på TV/video/DVD daglig?

Mindre enn 1 time 4-6 timer
 1-3 timer Mer enn 6 timer

KULTUR/LIVSSYNN

- 11 Hvor mange ganger har du i løpet av de siste 6 måneder vært på/i:

	Mer enn 3g /mnd	1-3g /mnd	1-6g siste 6 mnd	Aldri
Museum, kunstutstilling.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Konsert, teater, kino.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kirke, bedehus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Idrettsarrangement.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- 12 Hvor mange ganger har du i løpet av de siste 6 måneder selv drevet med:

	Mer enn 1g /uke	1g /uke	1-3g /mnd	1-5g siste 6 mnd	Ingen gang
Foreningsvirksomhet ...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Musikk, sang, teater....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Menighetsarbeid.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Friluftsliv.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Trening, idrett.....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- 13 Hvilket livssyn vil du si ligger nærmest opp til ditt eget? (Sett ett kryss)

Kristent livssyn Ateistisk livssyn
 Humanetisk livssyn Annet livssyn

- 14 Når det skjer vonde ting i livet mitt, tenker jeg: "det er ei mening med det".

Ja..... Nei Vet ikke.....

- 15 Jeg søker hjelp hos Gud når jeg trenger styrke og trøst.

Aldri Av og til Ofte

PERSONLIGHET

- 16 Beskriv deg selv slik du vanligvis er: Ja Nei

Klarer du å få fart i et selskap?.....	<input type="checkbox"/>	<input type="checkbox"/>
Er du stort sett stille og tilbakeholden når du er sammen med andre?.....	<input type="checkbox"/>	<input type="checkbox"/>
Liker du å treffe nye mennesker?.....	<input type="checkbox"/>	<input type="checkbox"/>
Liker du å ha masse liv og røre rundt deg?.....	<input type="checkbox"/>	<input type="checkbox"/>
Er du forholdsvis livlig?.....	<input type="checkbox"/>	<input type="checkbox"/>
Tar du vanligvis selv initiativet for å få nye venner?.....	<input type="checkbox"/>	<input type="checkbox"/>
Er du ofte bekymret?.....	<input type="checkbox"/>	<input type="checkbox"/>
Blir dine følelser lett såret?.....	<input type="checkbox"/>	<input type="checkbox"/>
Hender det ofte at du "går trøtt"?.....	<input type="checkbox"/>	<input type="checkbox"/>
Plages du av "nerver"?.....	<input type="checkbox"/>	<input type="checkbox"/>
Har du ofte følt deg trøtt og likeglad uten grunn?.....	<input type="checkbox"/>	<input type="checkbox"/>
Bekymrer du deg for at fryktelige ting kan skje?.....	<input type="checkbox"/>	<input type="checkbox"/>

HODEPINE

- 17 Har du vært plaget av hodepine det siste året? Ja Nei

Hvis nei, gå til spørsmål 24.

Hvis ja: Migrene
 Hva slags hodepine: Annen hodepine.....

- 18 Omtrent antall dager pr. måned med hodepine:

Mindre enn 1 dag 7-14 dager
 1-6 dager Mer enn 14 dager.....

- 19 Hvor sterk er hodepina vanligvis?

Mild (hemmer ikke aktivitet)
 Moderat (hemmer aktivitet)
 Sterk (forhindrer aktivitet).....

- 20 Hvor lenge varer hodepina vanligvis?

Mindre enn 4 timer 1-3 døgn
 4 timer – 1 døgn..... Mer enn 3 døgn.....

- 21 Er hodepina vanligvis preget av eller ledsaget av: (Sett ett kryss pr. linje)

	Ja	Nei
Bankende/dunkende smerte?.....	<input type="checkbox"/>	<input type="checkbox"/>
Pressende smerte?.....	<input type="checkbox"/>	<input type="checkbox"/>
Ensidig smerte (høyre eller venstre)?.....	<input type="checkbox"/>	<input type="checkbox"/>
Forverring ved moderat fysisk aktivitet?.....	<input type="checkbox"/>	<input type="checkbox"/>
Kvalme og/eller oppkast?.....	<input type="checkbox"/>	<input type="checkbox"/>
Lys- og lydskjyhet?.....	<input type="checkbox"/>	<input type="checkbox"/>

- 22 Før eller under hodepina; kan du ha forbigående: (Sett ett kryss pr. linje)

Synsforstyrrelse? (takkede linjer, flimring, tåkesyn, lysglimt).....
 Nummenhet i halve ansiktet eller i handa?.....

- 23 Angi hvor mange dager du har vært borte fra arbeid eller skole siste måned på grunn av hodepine:

dager

LUFTVEIER

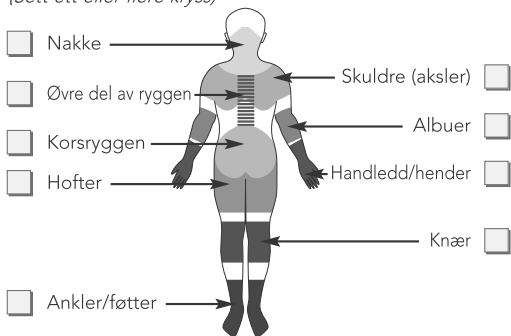
- 24 Hoster du daglig i perioder av året? Ja Nei
Hvis ja:
 Er hosten vanligvis ledsaget av oppspytt? Ja Nei
 Har du hatt hoste med oppspytt, i minst 3 måneder, sammenhengende i hvert av de to siste åra? Ja Nei
- 25 Har du, eller har du hatt, høysnue eller neseallergi? Ja Nei
Hvis ja:
 Har du hatt slike plager i løpet av de siste 12 måneder? Ja Nei
- 26 Har du i løpet av de siste 12 måneder blitt vekket av anfall med tung pust? Ja Nei

MUSKLER OG LEDD

- 27 Har du i løpet av det siste året vært plaget med smerter og/eller stivhet i muskler og ledd, som har vart i minst 3 måneder sammenhengende? Ja Nei
Hvis nei, gå til spørsmål 30.

Hvis ja:

Hvor har du hatt disse plagene?
 (Sett ett eller flere kryss)



- 28 Har du vært plaget både i høyre og venstre kroppshalvdel? Ja Nei
- 29 Har plagene hindret deg i å utføre daglige aktiviteter?
 I arbeid..... Ja Nei
 I fritid..... Ja Nei
- 30 Er du operert for ryggplager? Ja Nei
Hvis ja: Hvilken type operasjon?
 Prolaps/ischias-operasjon Annet.....
 Avstivning.....

STOFFSKIFTE

- 31 Har du noen gang fått påvist for lavt stoffskifte (hypothyreose)?
 Hvis ja, hvor gammel var du første gang?
 Eksempel: år gammel
 Ja Nei
- 32 Har du noen gang fått påvist for høyt stoffskifte (hypertyreose)?
 Hvis ja, hvor gammel var du første gang?
 Eksempel: år gammel
 Ja Nei
- Hvis ja:**
 Har du brukt Neo-Mercazole? Ja Nei år gammel
 Har du fått radiojodbehandling? Ja Nei år gammel

MAGE OG TARM

- 33 Har du vært plaget med smerter eller ubehag fra magen de siste 12 måneder?
 Ja, mye... Ja, litt.. Nei, aldri..
Hvis nei, gå til spørsmål 34.
- Hvis ja:**
 Er disse lokalisert øverst i magen?..... Ja Nei
 Har du de siste 3 måneder hatt disse plagene så ofte som 1 dag i uka i minst 3 uker?..... Ja Nei
 Blir smertene eller ubehaget bedre etter at du har hatt avføring?..... Ja Nei
 Har smertene eller ubehaget noen sammenheng med hyppigere eller sjeldnere avføring enn vanlig?..... Ja Nei
 Har smertene eller ubehaget noen sammenheng med at avføringen blir løsere eller fastere enn vanlig?..... Ja Nei
 Kommer smertene eller ubehaget etter måltid? Ja Nei

- 34 I hvilken grad har du hatt følgende plager i de siste 12 måneder?
- | | Aldri | Litt | Mye |
|-----------------------------------|--------------------------|--------------------------|--------------------------|
| Kvalme..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Halsbrann/sure oppstøt..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Diaré..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Treg mage..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Vekslende treg mage og diaré..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Oppblåsthet..... | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

HVORDAN FØLER DU DEG

Her kommer noen utsagn om hvordan du føler deg. For hvert spørsmål setter du kryss for ett av de fire svarene som best beskriver dine følelser *den siste uken*. Ikke tenk for lenge på svaret – de spontane svarene er best.

35 Jeg føler meg nervøs og urolig

Nei En god del
Litt Svært mye

36 Jeg gleder meg fortsatt over ting slik jeg pleide før

Avgjort like mye Bare lite grann
Ikke fullt så mye Ikke i det hele tatt

37 Jeg har en urofølelse som om noe forferdelig vil skje

Ja, og noe svært ille Litt, bekymrer meg lite
Ja, ikke så veldig ille Ikke i det hele tatt

38 Jeg kan le og se det morsomme i situasjoner

Like mye nå som før Avgjort ikke som før
Ikke like mye nå som før. Ikke i det hele tatt

39 Jeg har hodet fullt av bekymringer

Veldig ofte Av og til
Ganske ofte En gang i blant

40 Jeg er i godt humør

Aldri Ganske ofte
Noen ganger For det meste

41 Jeg kan sitte i fred og ro og kjenne meg avslappet

Ja, helt klart Ikke så ofte
Vanligvis Ikke i det hele tatt

42 Jeg føler meg som om alt går langsommere

Nesten hele tiden Fra tid til annen
Svært ofte Ikke i det hele tatt

43 Jeg føler meg urolig som om jeg har sommerfugler i magen

Ikke i det hele tatt Ganske ofte
Fra tid til annen Svært ofte

44 Jeg bryr meg ikke lenger om hvordan jeg ser ut

Ja, har sluttet å bry meg Kan hende ikke nok
Ikke som jeg burde Bryr meg som før

45 Jeg er rastløs som om jeg stadig må være aktiv

Uten tvil svært mye Ikke så veldig mye
Ganske mye Ikke i det hele tatt

T

46 Jeg ser med glede fram til hendelser og ting

Like mye som før Avgjort mindre enn før
Heller mindre enn før Nesten ikke i hele tatt.

47 Jeg kan plutselig få en følelse av panikk

Uten tvil svært ofte Ikke så veldig ofte
Ganske ofte Ikke i det hele tatt

48 Jeg kan glede meg over gode bøker, radio/TV

Ofte Ikke så ofte
Fra tid til annen Svært sjelden

SØVN

49 Hvor ofte har det hendt i løpet av de siste 3 måneder at du:

	Aldri/ sjelden	Av og til	Fle re ggr/ uka
Snorker høyt og sjenerende?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Får pustestopp når du sover?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Har vanskelig for å sovne om kvelden?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Våkner gjentatte ganger om natta?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Våkner for tidlig og får ikke sove igjen?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kjenner deg søvngig om dagen?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Har plagsom nattesvette?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Våkner med hodepine?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Får ubehag, kribling eller mauring i bein?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ALKOHOL

Hvis du ikke drikker alkohol, gå til spørsmål 54.

50 Har du noen gang følt at du burde redusere alkoholforbruket ditt?

Ja Nei

51 Har andre noen gang kritisert alkoholbruken din?

Ja Nei

52 Har du noen gang følt ubehag eller skyldfølelse pga. alkoholbruken din?

Ja Nei

53 Har det å ta en drink noen gang vært det første du har gjort om morgenen for å roe nervene, kurere bakrus eller som en oppkvikker?

Ja Nei

KOSTHOLD

54 Hvor mange skiver brød spiser du vanligvis?

(Sett ett kryss for hver type brød)

	0-4 /uke	5-7 /uke	2-3 /dag	4-5 /dag	6 el flere /dag
Loff/fint brød	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kneipp/mellomgrovt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Grovt brød	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

55 Hvor ofte spiser du vanligvis disse måltidene?

(Sett ett kryss pr. måltid)

	Sjelden /aldri	1-2 g /uke	3-4 g /uke	5-6 g /uke	Hver dag
Frokost	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Formiddagsmat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Varm middag	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kveldsmat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Annet måltid	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nattmat (kl 24-06)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

56 Hva slags fett bruker du oftest?

(Sett ett kryss pr. linje)

	Meieri- smør	Margarin Hard	Myk /lett	Oljer	Bruker ikke
På brød	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I matlaging	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

TANNHELSE

57 Har du de siste 12 måneder vært hos tannlege/tannhelsetjeneste?

Ja Nei

58 Hvordan vurderer du tannhelsen di?

Meget dårlig	<input type="checkbox"/>	God	<input type="checkbox"/>
Dårlig	<input type="checkbox"/>	Meget god	<input type="checkbox"/>
Verken god eller dårlig...	<input type="checkbox"/>		

59 Hva betyr god tannhelse for helsen di ellers?

Svært mye	<input type="checkbox"/>	Lite	<input type="checkbox"/>
Mye	<input type="checkbox"/>	Svært lite	<input type="checkbox"/>
Både og	<input type="checkbox"/>		

BRUK AV RESEPTFRIE MEDISINER

60 Hvor ofte har du brukt reseptfrie medisiner mot følgende plager i løpet av den siste måneden?

(Sett ett kryss pr. linje)

	Sjelden /aldri	1-3 g /uke	4-6 g /uke	Dag- lig
Halsbrann/sure oppstøt	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Treg mage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hodepine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Smerter i muskler/ledd	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

T

61 Har du brukt noen av disse reseptfrie medisiner minst en gang i uka i løpet av den siste måneden?

	Ja	Nei
Paracetamol, Paracet, Panodil, Pamol, Pinex, Peralgan	<input type="checkbox"/>	<input type="checkbox"/>
Albyl E (500 mg), Aspirin, Globoid, Dispril	<input type="checkbox"/>	<input type="checkbox"/>
Ibuprofen, Ibux, Ibuprox, Ibumetin, Brufen	<input type="checkbox"/>	<input type="checkbox"/>
Naproxen, Naprosyn, Ledox	<input type="checkbox"/>	<input type="checkbox"/>
Andre	<input type="checkbox"/>	<input type="checkbox"/>

HVORDAN FØLER DU DEG NÅ

62 Føler du deg stort sett sterk og opplagt, eller trøtt og sliten?

Meget sterk og opplagt	<input type="checkbox"/>
Sterk og opplagt	<input type="checkbox"/>
Ganske sterk og opplagt	<input type="checkbox"/>
Både – og	<input type="checkbox"/>
Ganske trøtt og sliten	<input type="checkbox"/>
Trøtt og sliten	<input type="checkbox"/>
Svært trøtt og sliten	<input type="checkbox"/>

SVANGERSKAP OG PREVENSJON

63 Når du ser bort fra svangerskap og barselperiode, har du noen gang vært blødningsfri i minst 6 måneder før overgangsalder?

Ja Nei

Hvis ja: Hvor mange ganger? ganger

64 Hvor mange ganger har du i alt vært gravid?

ganger

65 Har du noen gang prøvd i mer enn ett år å bli gravid?

Ja Nei

Hvis ja: Hvor gammel var du første gang du hadde problemer med å bli gravid? år gammel

66 Har du noen gang fått hormonbehandling for å bli gravid?

Ja Nei

Hvis ja: Har du fått slik behandling siste 3 måneder?

67 Bruker du, eller har du brukt:

(Sett ett kryss pr. linje)

Nå Før, ikke nå Aldri

P-piller?

P-plaster?

Annen hormonprevensjon?

(P-sprøyte, P-ring, P-implantat, hormonspiral)

68 Hvis du har brukt P-piller:

Hvor gammel var du første gang du begynte med dette? år gammel

Hvor mange år har du i alt brukt P-piller?

Mindre enn 1 år

4-10 år

1-3 år

Over 10 år

OVERGANGSALDER

Hvis ikke kommet i overgangsalder, hopp til spm. 75.

- 69 Merker/merket du hetetokter i forbindelse med overgangsalder?
- Om dagen Begge deler.....
 Om natten Merket ikke
- Hvis du merket hetetokter, hvordan vil du beskrive plagene?
- Store..... Middels.... Små
 Ja Nei
- Oppsøkte du lege i forbindelse med plagene?

- 70 Har du noen gang brukt medisiner som inneholder østrogen?
- Tabletter eller plaster (på resept fra lege) Nå Før Aldri
 Krem eller stikkpiller.....

- 71 Hvis du har brukt reseptpliktig østrogen, hvor gammel var du da du begynte? år gammel

- 72 Hvis du bruker eller har brukt reseptpliktig østrogen, hvor gammel er/var du siste gang du brukte dette? år gammel

- 73 Hvis du bruker eller har brukt østrogentabletter eller -plaster, hvorfor begynte du?
- Lindre plager i overgangsalder
 Forebygge beinskjørhet. Annet.....

- 74 Hvis du tidligere har brukt østrogentabletter eller -plaster, hvorfor sluttet du?
- Er/var kvitt plagene..... Redd for bivirkninger..
 Fikk plagsomme bivirkninger Annet.....

OPERASJONER/STRÅLEBEHANDLING I UNDERLIVET

- 75 Har du noen gang blitt operert for nedsunken livmor eller skjedevegg? Ja Nei Vet ikke

Hvis ja: Hvor gammel var du da? år gammel

- 76 Har du ved operasjon fått fjernet begge eggstokkene (totalt)? Ja Nei Vet ikke

Hvis ja: Hvor gammel var du da? år gammel

- 77 Har du ved operasjon fått fjernet hele livmoren? Ja Nei Vet ikke

Hvis ja: Hvor gammel var du da? år gammel

- 78 Har du noen gang hatt strålebehandling mot underlivet? Ja Nei Vet ikke

Hvis ja: Hvor gammel var du da? år gammel

URINVEIER

- 79 Hvor ofte later du vanligvis vannet om dagen?
- 1-4 ganger 8-11 ganger.....
 5-7 ganger Over 11 ganger

- 80 Hvor mange ganger må du opp om natta for å late vannet?
- Ingen 1 gang 2 ganger 3 ganger 4 ganger 5 ganger eller mer

- 81 Hvis du må opp om natta for å late vannet, hvordan opplever du dette?
- Ikke noe problem Mye plaget
 Litt plaget Svært stort problem ...

- 82 Opplever du plutselig og/eller sterk vannlatingstrang som er vanskelig å holde tilbake?
- Aldri..... Flere ganger i uka
 Månedlig..... Daglig.....

- 83 Har du ufrivillig urinlekkasje? Ja Nei
(Hvis nei, gå til spm. 84)

Hvis ja:

Hvor ofte har du urinlekkasje?

- Mindre enn 1 gang/mnd En el. flere ganger /uke
 En eller flere ganger/mnd Hver dag og/eller natt

Hvor mye urin lekker du vanligvis hver gang?

- Dråper..... Større mengder
 Små skvetter.....

- Har du lekkasje av urin i forbindelse med hosting, nysing, latter, tunge løft? Ja Nei

- Har du lekkasje av urin i forbindelse med plutselig og sterk vannlatingstrang? Ja Nei

Hvordan opplever du lekkasj plagene dine?

- Ikke noe problem Mye plaget
 En liten plage Svært stort problem
 En del plaget.....

Hvor gammel var du da du fikk urinlekkasje? år gammel

- 84 Har du søkt lege for urinlekkasje? Ja Nei

- 85 Har du noengang fått behandling for ufrivillig urinlekkasje?
- Nei, jeg har aldri hatt urinlekkasje
 Nei, jeg hadde urinlekkasje, men ble bra av meg selv..
 Ja

Hvis ja: Hvilken behandling?

(Du kan sette flere kryss)

- Operasjon Medisiner
 Bekkenbunnstrening..... Annet.....

AVFØRING

- 86 Har du hatt ukontrollert lekkasje av luft fra tarmen i løpet av den siste måneden? Aldri/ Hver Hver
sjelden uke dag
- 87 Har du hatt lekkasje av avføring fra tarmen i løpet av den siste måneden? Aldri/ Hver Hver
sjelden uke dag
- 88 Hvis ja på spm 86 eller 87; har plagen med lekkasje fra endetarmen innvirkning på ditt hverdagsliv? Aldri/ Hver Hver
sjelden uke dag
- 89 Har du evne til å holde igjen avføring og utsette toalettbesøk i 15 minutter etter første følelse av trang? Ja Nei

VURDERING AV DIN ARBEIDSPASS

Besvares hvis du er eller har vært i arbeid. Ta stilling til følgende påstander/spørsmål om arbeidsplassen din og arbeidet ditt.

- 90 Det er et godt samhold på arbeidsplassen
Stemmer helt..... Stemmer ikke særlig ...
Stemmer ganske bra Stemmer slett ikke.....
- 91 Mine kolleger stiller opp for meg (gir meg støtte)
Stemmer helt..... Stemmer ikke særlig ...
Stemmer ganske bra Stemmer slett ikke.....
- 92 Jeg trives godt med mine arbeidskamerater
Stemmer helt..... Stemmer ikke særlig ...
Stemmer ganske bra Stemmer slett ikke.....
- 93 Er du blitt mobbet/trakkassert på din arbeidsplass
Ja, ofte Nei, sjelden.....
Ja, iblant Nei, så godt som aldri
- 94 Krever arbeidet ditt at du må arbeide veldig hurtig?
Ja, ofte Nei, sjelden.....
Ja, iblant Nei, så godt som aldri
- 95 Krever arbeidet ditt at du må arbeide svært hardt?
Ja, ofte Nei, sjelden.....
Ja, iblant Nei, så godt som aldri
- 96 Krever arbeidet ditt for stor arbeidsinnsats?
Ja, ofte Nei, sjelden.....
Ja, iblant Nei, så godt som aldri
- 97 Krever arbeidet ditt oppfinnsomhet?
Ja, ofte Nei, sjelden.....
Ja, iblant Nei, så godt som aldri

T

- 98 Har du mulighet til selv å bestemme hvordan arbeidet skal utføres?
Ja, ofte Nei, sjelden.....
Ja, iblant Nei, så godt som aldri
- 99 Har du mulighet til selv å bestemme hva som skal gjøres i arbeidet ditt?
Ja, ofte Nei, sjelden.....
Ja, iblant Nei, så godt som aldri
- 100 Er arbeidet ditt så fysisk anstrengende at du ofte er sliten i kroppen etter en arbeidsdag?
Ja, nesten alltid..... Ganske sjelden.....
Ja, ganske ofte..... Aldri eller nesten aldri.

SMERTER I BEINA

- 101 Har du sår på tå, fot eller ankel som ikke vil gro? Ja Nei
- 102 Har du smerter i det ene eller i begge beina når du går? Ja Nei
- Hvis ja:**
Hvor gjør det mest vondt? Fot.....
Legg
Lår
Hofter.....
- Forsvinner smertene når du står stille en stund? Ja Nei
- 103 Har du smerter i beina når du er i ro? Ja Nei
- Hvis ja:**
Er smertene verst når du ligger i senga? Ja Nei
- Får du mindre vondt når beinet ligger lavt, f.eks. om beinet henger utfor sengekanten? Ja Nei
- Har du hatt smertene i beina sammenhengende i mer enn 14 dager? Ja Nei
- 104 Har du brukt smertestillende medisin pga. smerter i beina? Ja Nei

SYN

- 105 Har du noen av disse øyesykdommene? Ja Nei
- Katarakt (grå stær).....
- Glaukom (grønn stær, høyt trykk i øyet).....
- Aldersrelatert makuladegenerasjon.....
(forkalkning på netthinna)

HUKOMMELSE

106 Har du problemer med hukommelsen?

Nei Ja, noe.... Ja, store.....

107 Har hukommelsen endret seg siden du var yngre?

Nei Ja, noe.... Ja, mye

108 Har du problemer med å huske:

Aldri Av og til Ofte

Hendelser for få minutter siden?

Navn på andre mennesker?.....

Datoer?.....

Å gjøre det du har planlagt?

Hendelser som skjedde for noen dager siden?

Hendelser som skjedde for år siden?.....

Å holde tråden i samtaler?.....

T SPISEFORSTYRRELSER

Sett en ring rundt det tallet som best beskriver dine spisevaner, slik du synes det har vært *den siste måneden*.

109 Hvor fornøyd har du vært med dine spisevaner?

Svært fornøyd 1 2 3 4 5 6 7 Svært misfornøyd

110 Har du trøstespist eller spist ekstra på grunn av at du har vært nedstemt eller følt deg utilfreds?

Ikke i det hele tatt 1 2 3 4 5 6 7 Hver dag

111 Har du hatt skyldfølelse i forbindelse med spising?

Ikke i det hele tatt 1 2 3 4 5 6 7 Hver dag

112 Har du følt at det er nødvendig for deg å følge strenge dietter eller andre matritualer for å holde kontroll med hvor mye du spiser?

Ikke i det hele tatt 1 2 3 4 5 6 7 Hver dag

113 Har du følt at du er for tykk?

Ikke i det hele tatt 1 2 3 4 5 6 7 Hver dag

NB!

Det utfylte skjemaet returneres i den vedlagte svarkonvolutten.
Porto er betalt.



Takk for hjelpa!

ISBN 978-82-326-5785-8 (printed ver.)
ISBN 978-82-326-5923-4 (electronic ver.)
ISSN 1503-8181 (printed ver.)
ISSN 2703-8084 (online ver.)



NTNU

Norwegian University of
Science and Technology