

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

B I Løkken ^{1,2} 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 Health Science, Western Sydney University, Sydney, New South Wales, Australia

⁴Levanger Hospital, Nord-Trøndelags 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

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,



© Author(s) (or their employer(s)) 2020. No commercial re-use. See rights and permissions. Published by BMJ.

To cite: Løkken BI, Merom D, Sund ER, *et al.* *J Epidemiol Community Health* 2020;**0**:624–630.

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.

Casual 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/person-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
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)	
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*

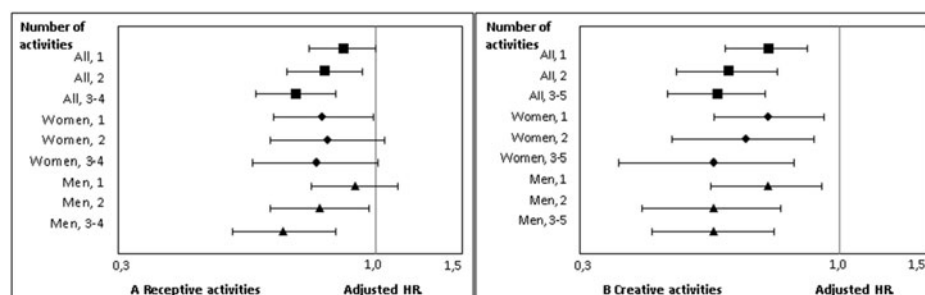


Figure 1 Sum of activities score (1, 2, 3–4) of receptive activities (A) and score (1, 2, 3–5) creative activities (B) and the fully adjusted HRs with all-cause mortality for the whole population and by gender. *Adjusted for age, gender, occupation, marital status, LLI, BMI, PA, alcohol consumption and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

ORCID iD

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

REFERENCES

- 1 Association of the compendium of cultural policies and trends. Cultural access and participation 2019. Available <https://www.culturalpolicies.net/web/cultural-participation.php> (accessed 3 Jan 2019).
- 2 Davies C, Pescud M, Anwar-McHenry J, et al. Arts, public health and the National Arts and Health Framework: a lexicon for health professionals. *Aust N Z J Public Health* 2016;40:304–6.
- 3 Cuypers K, Krokstad S, Lingaas Holmen T, et al. Patterns of receptive and creative cultural activities and their association with perceived health, anxiety, depression and satisfaction with life among adults: the HUNT study, Norway. *J Epidemiol Community Health* 2012;66:698.
- 4 Cuypers KF, Knudtsen MS, Sandgren M, et al. Cultural activities and public health: research in Norway and Sweden. An overview. *Arts Health* 2011;3:6–26.
- 5 Theorell T, Osika W, Leineweber C, et al. Is cultural activity at work related to mental health in employees? *Int Arch Occup Environ Health* 2013;86:281–8.
- 6 Theorell T, Ullén F. Epidemiological studies of the relationship between cultural experiences and public health. In: Clift S, Camic PM, eds. *Creative arts, health, and wellbeing international perspectives on practice, policy, and research*. Oxford, United Kingdom, Oxford University Press, 2016: 55–63.
- 7 Li S, Stampfer MJ, Williams DR, et al. Association of religious service attendance with mortality among women. *JAMA Intern Med* 2016; 176: 777–85.
- 8 Bruce MA, Martins D, Duru K, et al. Church attendance, allostatic load and mortality in middle aged adults. *PLoS One* 2017;12:1–14.
- 9 Muñiz C, Rodríguez P, Suárez MJ. The allocation of time to sports and cultural activities: an analysis of individual decisions. *Int J Sport Finance* 2011;6:245–64.
- 10 Davies C, Rosenberg M, Knuiam M, et al. Defining arts engagement for population-based health research: art forms, activities and level of engagement. *Arts Health* 2012;4.
- 11 Agahi N, Parker MG. Leisure activities and mortality: does gender matter? *J Aging Health* 2008;20:855–71.
- 12 Krokstad S, Langhammer A, Hveem K, et al. Cohort profile: the HUNT study, Norway. *Int J Epidemiol* 2013; 42: 968–77.
- 13 HUNT Research Centre. HUNT databank, NTNU. 08.17ed. (HUNT). 2017. Available <https://hunt-db.medisin.ntnu.no/hunt-db/#/instrument/229>.
- 14 Langhammer A, Krokstad S, Romundstad P, et al. The HUNT study: participation is associated with survival and depends on socioeconomic status, diseases and symptoms. *BMC Med Res Methodol* 2012;12:1–14.
- 15 Holmen J, Nguyen C, Haapnes O, et al. Kultur og helse i HUNT - En metodeevaluering. *Nor J Epidemiol* 2016;26:139–44.
- 16 Pedersen AG, Ellingsen CL. Data quality in the causes of death registry. *Tidsskr Nor Lægeforen* 2015;8:768–70.
- 17 (IOL) ILO. ISOC-88: International Labour Organization (ILO). 2004. Available <http://www.ilo.org/public/english/bureau/stat/isco/isco88/index.htm>
- 18 Brown J, MacDonald R, Mitchell R. Are people who participate in cultural activities more satisfied with life? *Int Interdiscip J Qual Life Meas* 2015;122:135–46.
- 19 Bygren L, Konlaan B, Johansson S. Attendance at cultural events, reading books or periodicals, and making music or singing in a choir as determinants for survival: swedish interview survey of living conditions. *BMJ* 1996;313:1577.
- 20 Konlaan B, Bygren L, Johansson SE. Visiting the cinema, concerts, museums or art exhibitions as determinants of survival: a Swedish fourteen-year cohort follow-up. *Scand J Public Health* 2000a;28:128–78.
- 21 Väänänen A, Murray M, Koskinen A, et al. Engagement in cultural activities and cause-specific mortality: prospective cohort study. *Prev Med* 2009;49:142–7.
- 22 Hyyppä MT, Mäki J, Impivaara O, et al. Leisure participation predicts survival: a population-based study in Finland. *Health Promot Int* 2006;21:5.
- 23 Caldwell LL. Leisure and health: why is leisure therapeutic? *Br J Guid Coun* 2005;33:7–26.
- 24 Niilen C, Agahi N, Shaw BA. Does the association between leisure activities and survival in old age differ by living arrangement? *J Epidemiol Community Health* 2018;72:1–6.
- 25 Lennartsson C, Silverstein M. Does engagement with life enhance survival of elderly people in Sweden? The role of social and leisure activities. *J Gerontol Ser B* 2001;56: S335–S42.
- 26 Ngun TC, Ghahramani N, Sánchez FJ, et al. The genetics of sex differences in brain and behavior. *Front Neuroendocrinol* 2011; 32: 227–46.
- 27 Krieger N, Genders, sexes, and health: what are the connections: and why does it matter? *Int J Epidemiol* 2003; 32:652–7.
- 28 Rieker PP, Bird CE. Rethinking gender differences in health: why we need to integrate social and biological perspectives. *J Gerontol B Psychol Sci Soc Sci* 2005;60:40–7.
- 29 Krokstad S, Ding D, Grunseit AC, et al. Multiple lifestyle behaviours and mortality, findings from a large population-based Norwegian cohort study - the HUNT Study. (Nord-Trøndelag Health Study)(Report). *BMC Public Health* 2017;17.
- 30 Holt-Lunstad J, Smith TB, Layton JB, et al. Social relationships and mortality risk: a meta-analytic review (social relationships and mortality). *PLoS Med* 2010;7: e1000316.