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2021-06

Pukkala , E , Peltomaa , M , Mäkitie , A , Heikkinen , S , Kjærheim , K , Martinsen , J I , Sparén , P , Tryggvadottir , L & Weiderpass , E 2021 , ' Cancer incidence among musicians: 45 years of follow-up in four Nordic countries ' , Acta Oncologica , vol. 60 , no. 7 , pp. 835-841 . https://doi.org/10.1080/0284186X.2021.1924403

http://hdl.handle.net/10138/345449
https://doi.org/10.1080/0284186X.2021.1924403

Cancer incidence among musicians: 45 years of follow-up in four Nordic countries

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ABSTRACT

Background: There are studies suggesting that participation in musical activities may protect from cancer. On the other hand, some musicians have a lifestyle that might increase the risk of cancer. The objective of this study was to assess the cancer pattern of musicians in four Nordic countries.

Material and methods: This study combines census and cancer registry data from 1961 to 2005 for 13 million people from Finland, Iceland, Norway, and Sweden. Standardized incidence ratio (SIR) analyses were conducted with the cancer incidence rates for entire national populations used as reference rates.

Results: There were 11,401 male and 3,105 female musicians with 2,039 cancer cases. The SIR for all sites combined was 1.02 (95% confidence interval 0.97-1.07) in men and 1.04 (0.94-1.15) in women. In male musicians, there were statistically significant excesses in oropharyngeal cancer (4.36, 2.73-6.60), oesophageal cancer (2.08, 1.51-2.81), liver cancer (1.81, 1.26-2.52) and skin melanoma (1.40, 1.10-1.75). The risk was decreased in lip cancer (0.13, 0.02-0.48), stomach cancer (0.66, 0.50-0.82) and lung cancer (0.77, 0.65-0.90). In female musicians, there were no statistically significant SIRs in any of the cancer types studied, but the risk of breast cancer was significantly elevated in the age category of 70+ (1.52, 1.04-2.15). The overall SIR was stable over the 45 year period of observation, but strong decreases were observed in the SIRs of oesophageal cancer, liver cancer, laryngeal cancer, and skin melanoma.

Conclusion: Musicians have characteristics of indoor workers such as low incidence of lip cancer and high incidence of skin melanoma. The low incidence of lung cancer suggests that the prevalence of smoking among musicians is lower than in the general population while the elevated risk of alcohol-related cancer types suggest that drinking is likely more common among musicians. The cancer risk for all sites combined is still similar to that of the general population in the four countries studied.

KEYWORDS: Cancer incidence, Musician, Nordic, Cancer registry, Standardized incidence ratio analysis

BACKGROUND

Professional musicians are a heterogeneous group of individuals with a variety of occupational environments and exposure to variable health challenges. Elevated standardized incidence ratios (SIRs) for cancer of mouth and pharynx have been reported in this occupational group in the Nordic countries (1), and in the cause-of-deaths statistics the proportion of deaths due to cancer of the throat among professionals in popular music has been larger than in the general population (2,3). However, research on cancer incidence among musicians is scarce. A recent study on classical musicians showed a lower cancer mortality in Finnish church musicians than in the general population (4).

A survey from Finland suggests that the prevalence of alcohol consumption among musicians is higher than in the general population (5). The exposure of musicians to other carcinogens remains unstudied. However occupational and lifestyle exposures common amongst musicians may include suboptimal working arrangements and conditions, irregular working hours, challenges in quantity and quality of sleep and exposure to physical strains, all of which may directly or indirectly increase the risk for cancer (2). On the other hand, Nunez et al. (6) in their study in rodents demonstrated that music can be effective in countering the adverse effects of stress on the immune system and cancer development. Thus, the study of cancer incidence amongst musicians is of interest. A recent study (7) compared survival of musicians of different genres with malignant cerebral tumours because work as a musician is assumed to have an effect to the neuronal functions and organization of the brain and promote brain plasticity. There are no studies on whether such functional and structural changes would affect the incidence of brain cancer.

The Nordic Occupational Cancer (NOCCA) project (http://astra.cancer.fi/NOCCA) linked the census data on occupations from the five Nordic countries and their cancer registries for the period from 1961 to 2005. In this paper, we use data collected for the NOCCA study and present the results for cancer incidence among musicians in four Nordic countries. The objectives of these analyses were to demonstrate the patterns of cancer among musicians as compared to the general population. Our *a priori* hypotheses were that we would observe elevated risks in the alcohol-related cancers but non-elevated or even decreased risks in other cancer types.

MATERIALS AND METHODS

The details of study materials, coding systems and analysis methods have been described earlier (8). Briefly, the study base consists of approximately 15 million persons participating in any computerized population census in the Nordic countries. For the current study we had access to data from Finland (1970, 1980 and 1990 censuses), Iceland (1981 census), Norway (1960, 1970 and 1980 censuses) and Sweden (1960, 1970, 1980 and 1990 censuses), altogether 13 million persons. The study cohort included musicians aged 30–64 years still alive and in the country on January 1st of the year following the census.

Census questionnaires included questions related to the persons' economic activity, occupation and industry. All countries had a specific occupational code for professional musicians. A person was classified as a musician if he/she had been working as that for more than half the regular working hours during the census year.

A person entered the cohort on January 1st of the year after the first available census where he/she participated, provided his/her occupation was musician. Person-years were then counted until the date of emigration, death or to 31 December of the following years: in Norway 2003, in Iceland 2004 and in Finland and Sweden 2005. The source of the data on dates of death and emigration in all countries was the national population registry.

Data on tumours were derived from record linkage with the cancer registries from each of the four Nordic countries. National cancer registration started with cancer diagnosed in 1953 in Finland and Norway, in 1955 in Iceland and in 1958 in Sweden. During the follow-up period of the NOCCA study, all cancer registries received information on cancer cases from general and specialist practitioners, hospital departments and from pathology departments. Sweden was the only country not receiving copies of the death certificates. The completeness and accuracy of the Nordic cancer registries are remarkably high in international comparison, and much work has been done to reach comparability in cancer classifications between the Nordic countries over the more than five decades of cancer registration (9).

The cancer cases were grouped into 54 main categories and 21 diagnostic subgroups based on the national topography and morphology coding systems (Appendix tables 5-6 at http://astra.cancer.fi/NOCCA). The incident cancer cases included in the present study involve all invasive cancers and benign brain tumours. In the Swedish and Icelandic data, however, only the first incident cancer within a given diagnostic group was included. Basal cell carcinomas of the skin were excluded.

The SIR was calculated as the ratio of the observed and the expected number of cancer cases, using the cancer incidence rates for the entire national study populations as reference rates. For each country, the observed number of cancer cases and person-years were stratified into two sexes, into 5-year attained age categories (30-34; 35-39; …; 85+ years) and into 5-year calendar periods (1961-1965; 1966-1970; …; 2001-2005). The expected number of cancer cases was based on the number of person-years in each stratum (country, sex, age and calendar period) and the respective reference rate. Aggregate risk measures for all Nordic countries combined were calculated as the ratio of the total number of observed cases to the total number of expected cases of the four countries. For each SIR, the exact 95% confidence interval (CI) was defined assuming a Poisson distribution of the observed number of cases.

The study has permissions needed in the respective countries for a registry-based study. The tabulated raw data can be asked for checking purposes from the authors.

RESULTS

A total of 11,401 male and 3,105 female musicians were included in the cohort, with a total of 333,442 person-years. The cohort included 5,854 men and 1,299 women from Sweden; 3,910 men and 1,170 women from Finland; 1,506 men and 517 women from Norway; and 131 men and 119 women from Iceland.

Altogether, 2,039 cancer cases were observed, 1,663 in men and 376 in women. Of the cases, 1,033 were from Sweden, 453 from Norway, 516 from Finland and 37 from Iceland. The SIR for all sites combined was 1.02 (95% CI 0.97-1.07) in men (Table 1) and 1.04 (0.94-1.15) in women (Table 2). The SIRs were similar in all four countries (Table 3).

Site-specific risks, men

For male musicians of all four countries combined (Table 1), there were statistically significant excesses in pharyngeal cancer (SIR 2.71, 95% CI 1.85-3.82), oesophageal cancer (2.08, 1.51-2.81), liver cancer (1.81, 1.26-2.52) and skin melanoma (1.40, 1.10-1.75). The excess in pharyngeal cancer was mainly due to high risk in oropharynx (SIR 4.36, 95% CI 2.73-6.60). The risk among the musicians was significantly below that of the general population in cancers of the lip (SIR 0.13, 95% CI 0.02-0.48), stomach (0.66, 0.50-0.82) and lung (0.77, 0.65-0.90).

The SIRs for pharyngeal cancer and skin melanoma were above 1.0 in Finland, Norway and Sweden, while the SIRs for lip cancer and stomach cancer were below 1.0 in all three countries (Table 3). We excluded Icelandic results from Table 3 because the site-specific numbers of cases were less than 3 for all other sites except prostate (5 cases). In testicular cancer, there was a significantly elevated risk in Finland but only small excess in the other countries. For the other cancers, the SIRs were not consistently below or above 1.0 in the countries. The difference between the country-specific SIRs is statistically significant in lung cancer with the SIR varying from 0.50 in Finland (95% CI 0.37-0.68) to 1.01 in Sweden (05% CI 0.80-1.26).

Considering the period-specific risks, the SIRs for most cancer types were quite stable or decreased during the 45-year follow-up (Table 4). Strong decreases were observed in oesophageal cancer, liver cancer, laryngeal cancer, and skin melanoma.

The SIRs were also quite stable between the age categories (Table 5). The SIRs increased with increasing age in lung cancer and skin melanoma. There was a statistically significant excess in testicular cancer in the youngest age category.

Site-specific risks, women

In female musicians, none of the cancer sites studied showed a statistically significant SIR (Table 2). The SIR for breast cancer was slightly elevated, and the SIR for kidney cancer was below 1.0 in all three larger countries but not statistically significant in any of them (Table 3). The only statistically significant country-specific SIR was observed for cancer of the small intestine in Sweden, based on three observed cases (SIR 5.07, 95% CI 1.05-14.81). The risk of female breast cancer increased with age and was significantly elevated in the age category of 70+ (32 cases, SIR 1.52, 95% CI 1.04-2.15).

DISCUSSION

This is the first study of cancer incidence among musicians in four Nordic countries. The overall cancer incidence was similar to that of the general population in all countries, in both sexes, in all age categories and throughout the 45-year study period. Several statistically significantly elevated and decreased incidences were observed for various specific cancer types in men, while in female musicians the only significant finding was the elevated risk of breast cancer in older age categories.

Most of the elevated risks among male musicians were in alcohol-related cancer sites, which in the general population is typical for men with low socioeconomic status, while otherwise the cancer risk pattern of male musicians resembled that of men with a high socioeconomic status (10). High incidence of skin melanoma and low incidence of lip cancer are typical for Nordic indoor workers (11,12). The risk of skin melanoma for musicians in 1961-75 was more than two-fold as compared to other men, but the excess virtually disappeared before the end of the study period. A similar risk pattern has been observed among Nordic airline pilots (13) and was explained by the fact that in earlier decades, pilots had a chance of traveling to the Southern Europe or Asia and get sunburns while later on many other Nordic people also got such a possibility.

Kuusi et al. (4) studied causes of death of professional musicians in the classical genre in Finland and observed that the mortality from cancer among the performers of any sex and female church musicians was 7-10% lower than in the general population. This is close to the SIR estimates of all cancers combined for Finnish musicians in this study. Cancer mortality of male church musicians was 40% lower than in a comparable general population which is much lower than the respective SIR for male musicians in our study. It may be that the way of life of male church musicians is similar to that of Nordic male priests, bishops, and religious leaders who have significantly lower overall cancer incidence than other Nordic men (14). The results based on mortality may also be different from incidence-based results due to the healthy worker effect or variation in survival which is better in highly educated persons (15).

The findings by Kenny and Asher (2) among musicians who do not belong to the classical music genre also suggest that overall cancer mortality risk was similar to population averages. Cancer mortality was still statistically significantly elevated among the small categories of jazz, punk, rock, and metal musicians. In a later study (3) they reported that among male popular musicians, 11% of the deaths were due to throat cancer while the percentage among the reference population was only 5%. This observation is also in line with our findings of approximately two-fold excess incidence of pharyngeal and laryngeal cancers.

We could not identify systematic Nordic data about musicians' lifestyle factors which would help in interpretation of their cancer risk pattern in our study. We know some of the characteristics of Finnish musicians from surveys on the health habits of the Finnish adult population during 1978-91 (5) which were tabulated by occupation for the Finnish Job Exposure Matrix (16). The prevalence of daily smoking among musicians during 1978-91 was 42% among males and 29% in females. The respective percentages in the general population were 36% among males and 20% among females. The weekly alcohol consumption was 125 g among male and 78 g among female musicians (population: 90 g and 27 g, respectively). The average body mass index (BMI) among male musicians was 24.9 kg/m^2 and among female musicians 23.4 kg/m^2 (population: 25.5 kg/m^2 and 24.3 kg/m^2, respectively). The higher than average alcohol consumption is in line with the elevated SIRs of alcohol-related cancers among Finnish male musicians and increased risk of breast cancer among older female musicians. The observed low lung cancer risk, by contrast, is not at all in line with their smoking prevalence which is also higher than in the reference population. There are several possible reasons for such a mismatch. First, the number of musicians in the surveys is small and hence there may be large random variation in the prevalence estimates. Second, the estimate of prevalence of smoking does not take into account characteristics of smoking such as number of daily cigarettes or years smoked that have a strong effect on lung cancer risk (17). Third, due to the long latency in cancer process, we should know exposure information from the period of 10-50 years before the cancer diagnosis. If the life habits of musicians have developed in different direction than those in the population on average, the life habits measured in the 1970s or later do not necessarily match with their cancer pattern with majority of the cancers diagnosed after 1990.

Our results did not show statistically significant risks among female musicians, suggesting that they follow a quite similar way of life as the general population. Their SIRs for cancers of the breast, ovary and corpus uteri were above 1.0. Although none of these three site-specific SIRs was statistically significant, the similarity of the findings for these sites sharing similar aetiological factors may indicate that they have less children or that their age at first birth is higher than in the reference population, which would increase their risk of these cancer types. Our observation in significantly increased risk of breast cancer in older ages points to the same direction with the finding by Kenny and Asher (3), who observed that the proportion of deaths from breast cancer was significantly larger among female popular musicians than among women in the reference population. Kenny and Asher also reported 5% of the deaths among female popular musicians being due to throat cancer, while the percentage among the reference population was only 1%, and the proportion of lung cancer deaths was lower than in the reference population. Our study was not able to confirm such findings for Nordic female musicians. Direct comparison of the two studies should be done with caution because the study outcomes are different (cancer mortality vs. incidence), the study methods are different, and the cohorts of musicians are different.

The lowest SIR among female musicians was observed in kidney cancer. This may well be a chance finding but it is worth mentioning that the SIR is lower than the lowest SIRs observed among any of the 54 standard occupational categories in the NOCCA study (8) and close to the lowest rate ever seen for kidney cancer in any Nordic cohort, that of the Finnish world class elite athletes (SIR 0.23, 95% CI 0.06–0.57) (18).

There are very few hypotheses on direct occupational exposures in musicians' work that might increase their cancer risk. Ghabili et al. in their letter (19) commented on the observation of a remarkable number of jazz guitarists who died of prostate cancer. They speculated that during playing, the guitar is held in proximity of the pelvic region of the guitarists, and it is possible that the prostate gland could be affected by the potential carcinogenetic effects of both the electromagnetic field and loud noise. Ruano-Ravina et al. (20) investigated 132 musicians with confirmed diagnosis of lung cancer and 187 controls. Among the cases, they observed two musicians who played wind instruments, whereas there were no wind instrument players among the controls. They discussed the theoretical possibility of breathing large volumes of air making the lung alveoli expand more than in other people and thus facilitating the penetrance of carcinogens in the cells of the epithelium. In our study, there was no excess incidence of prostate cancer and a decreased incidence of lung cancer, but these results do not exclude the possibility that electric guitar or wind instrument players who form small subgroups in our data, could still have elevated risks of specific cancer types. In our setting it is impossible to estimate whether the improved immunological response suggested by the results of the study of music-exposed rodents (6) could have led to decreased cancer rates.

Epidemiological evidence concerning the interconnection between sleep and cancer is controversial (21) and not studied in musicians. Studies concerning sleep disturbances in professional musicians are scarce as well. Vaag et al. (22) reported higher prevalence of insomnia symptoms in musicians compared to the general population. While the causes for this remain largely unclear, this may be explained by the more frequent mental health symptoms in musicians than in general population (23). Sleep apnea however, may be less frequent in singers and wind instrument players because of the training of their upper airway muscles. The training may have a protective effect on respiration and may reduce obstructive sleep apnea and snoring (24,25). The data to explore the effect of sleep difficulties to the risk of cancer in musicians are unfortunately not available and this remains to be elucidated in further studies.

This study has several important strengths. Due to the relatively large size of the cohort and a long follow-up, the study had the capability to identify small excesses, even for rarer cancers. In terms of numbers of cancer cases, this is larger than any cohort study of musicians published before. The study had access to high-quality cancer registry data from across the Nordic countries. The cancer incidence data allowed for better identification of non-fatal cancers than would be possible in cancer mortality studies. We also had access to histology information, allowing examination of risks of histologic subtypes of cancer. Due to the high coverage, precision and validity of the linked files, the cancer risk estimates can be considered reliable. As the present study was based on incident cancer cases and exact person-years, there was no bias caused by occupational variation in cancer survival and in mortality from competing causes of death.

This study on musicians, however, has several specific limitations that should be considered. Information on duration of work and other characteristics of exposure were not available. The occupational affiliation at one point in time may not always correspond to the lifelong occupational history of a person. Comparison of results based on only one cross-sectional information on occupation with results from studies with complete occupational histories indicates that the diluting effect due to misclassification is small especially in specialized occupations (8). Most professional musicians probably stay in music-related occupations, and hence in this case we can assume that the results really describe the cancer pattern of musicians.

Finally, the musicians represent a heterogeneous population group in terms of lifestyles, with both health-conscious and unhealthy lifestyles represented. Unfortunately, we do not know how such categories are distributed and therefore cannot estimate the variation of cancer risk levels with this occupational branch. It would help in interpretation of the results, if we would be able to stratify the results according to musical genre mostly performed by the musicians, but such data were unfortunately only available for a very small fraction of the cohort. According to Statistics Finland, approximately 75% of the Finnish musicians born 1956-75 were in the classical music sector, and according to Statistics Iceland 58% of all Icelandic musicians in 2019 were in the classical sector.

Conclusions

In summary, the overall cancer risk among the musicians is similar to that in the general population in both sexes in the four Nordic countries studied. The musicians' cancer incidence pattern is similar to that of other indoor workers with, e.g., low incidence of lip cancer and high incidence of skin melanoma. Low incidence of lung cancer suggests that prevalence of smoking among musicians is lower than in the general population while the elevated risk of alcohol-related cancer types suggests that alcohol consumption is more common than in the general population. Although the overall SIR was stable over the 45 year period of observation, strong decreases in the SIRs of oesophageal cancer, liver cancer, laryngeal cancer, and skin melanoma suggest that the way of life of the musicians has changed to a gainful direction more rapidly than in the population on average.

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Table 1. Observed and expected numbers of cancers and standardized incidence ratios (SIR) with 95% confidence intervals (CI) among 11,401 male musicians in Finland, Iceland, Norway and Sweden, follow-up 1961–2005, for cancer sites with at least 5 expected cases. Shown in the order of the SIR of the main site.

ICD-7	Site	Observed	Expected	SIR	95% CI	
140-204	All sites	1663	1633.59	1.02	0.97	1.11
145-148	Pharynx	32	11.82	2.71	1.85	3.82
145	oropharynx	22	5.04	4.36	2.73	6.60
150	Oesophagus	43	20.64	2.08	1.51	2.81
155.0	Liver	35	19.32	1.81	1.26	2.52
141	Tongue	12	6.75	1.78	0.92	3.11
178	Testis	17	10.62	1.60	0.93	2.56
	seminoma	12	7.48	1.60	0.83	2.80
190	Skin melanoma	77	55.14	1.40	1.10	1.75
161	Larynx	24	18.38	1.31	0.84	1.94
143-144	Oral cavity	11	8.58	1.28	0.64	2.29
201	Hodgkin lymphoma	11	8.60	1.28	0.64	2.29
152	Small intestine	9	7.59	1.19	0.54	2.25
157	Pancreas	60	50.96	1.18	0.90	1.52
153	Colon	130	111.85	1.16	0.97	1.38
181	Bladder	124	109.87	1.13	0.94	1.35
154	Rectum, rectosigma	85	78.08	1.09	0.87	1.35
204	Leukaemia	40	39.08	1.02	0.73	1.39
	acute myeloid	6	10.52	0.57	0.21	1.24
177	Prostate	414	407.18	1.02	0.92	1.12
180	Kidney	61	60.56	1.01	0.77	1.29
194	Thyroid	9	9.05	0.99	0.45	1.89
197	Soft tissue	10	10.67	0.94	0.45	1.72
199	Other/unknown site	44	46.99	0.94	0.68	1.26
180.1	renal pelvis	5	5.50	0.91	0.30	2.12
191	Skin, squamous cell	57	64.72	0.88	0.67	1.14
193	Brain	41	47.68	0.86	0.62	1.17
	glioma	19	23.87	0.80	0.48	1.24
200,202	Non-Hodgkin lymphoma	43	52.60	0.82	0.59	1.10
162,163	Lung	161	209.35	0.77	0.65	0.90
	adenocarcinoma	33	37.34	0.88	0.61	1.24
	small cell	29	29.14	1.00	0.67	1.43
	squamous cell	46	67.45	0.68	0.50	0.91
	other	52	71.43	0.73	0.54	0.95
203	Multiple myeloma	18	24.18	0.74	0.44	1.18
155.1	Gallbladder	6	8.83	0.68	0.25	1.48
151	Stomach	57	85.74	0.66	0.50	0.86
179.0	Penis	3	5.01	0.60	0.12	1.75
158, 162.2	Mesothelioma	2	6.79	0.29	0.04	1.06
140	Lip	2	14.99	0.13	0.02	0.48

Table 2. Observed and expected numbers of cancers and standardised incidence ratios (SIR) with 95% confidence intervals (CI) among 3105 female musicians in Finland, Iceland, Norway and Sweden, follow-up 1961–2005, for cancer sites with at least 5 expected cases.

ICD-7	Site	Observed	Expected	SIR	95% CI	
140-204	All sites	376	360.8	1.04	0.94	1.15
191	Skin, squamous cell	16	9.96	1.61	0.92	2.61
200,202	Non-Hodgkin lymphoma	13	9.48	1.37	0.73	2.34
175.0	Ovary	26	20.11	1.29	0.84	1.89
172	Corpus uteri	26	20.14	1.29	0.84	1.89
157	Pancreas	12	9.81	1.22	0.63	2.14
181	Bladder	9	7.69	1.17	0.53	2.22
170	Breast	128	109.70	1.17	0.97	1.39
151	Stomach	13	11.53	1.13	0.60	1.93
153	Colon	26	27.20	0.96	0.62	1.40
194	Thyroid	6	6.46	0.93	0.34	2.02
193	Brain	12	12.99	0.92	0.48	1.61
154	Rectum, rectosigma	12	13.47	0.89	0.46	1.56
162,163	Lung	15	17.74	0.85	0.47	1.40
190	Skin melanoma	11	13.25	0.83	0.41	1.48
171	Cervix uteri	9	11.71	0.77	0.35	1.46
204	Leukaemia	3	6.41	0.47	0.10	1.37
180	Kidney	3	8.29	0.36	0.07	1.06

Table 3. Country-specific numbers (N) of selected cancers and standardized incidence ratios (SIR) with 95% confidence intervals (CI) among male musicians in Finland, Norway and Sweden, follow-up 1961–2005. Results for Iceland not shown because of small numbers of cases.

Site	Finland				Norway				Sweden			
	N	SIR	95% CI		N	SIR	95% CI		N	SIR	95% CI	
All sites	422	0.92	0.84	1.15	346	1.05	0.98	1.16	874	1.05	0.98	1.06
Pharynx	6	2.31	0.85	5.02	8	3.60	1.55	7.09	18	2.60	1.54	4.11
oropharynx	2	1.78	0.22	6.44	5	5.76	1.87	13.45	15	4.94	2.77	8.15
Oesophagus	6	1.04	0.38	2.26	8	2.14	0.92	4.21	29	2.67	1.79	3.84
Liver	12	1.87	0.96	3.26	1	0.46	0.01	2.58	22	2.07	1.30	3.14
Testis	7	3.33	1.34	6.86	3	1.34	0.28	3.93	7	1.15	0.46	2.36
Skin melanoma	15	1.07	0.60	1.77	17	1.54	0.90	2.46	43	1.44	1.04	1.95
Larynx	7	1.15	0.46	2.36	6	1.54	0.56	3.35	11	1.34	0.67	2.40
Oral cavity	7	3.29	1.32	6.79	2	1.04	0.13	3.77	2	0.45	0.05	1.62
Prostate	102	0.96	0.78	1.16	65	0.90	0.69	1.15	242	1.08	0.94	1.22
Skin, squamous cell	11	0.88	0.44	1.57	14	0.96	0.53	1.62	32	0.86	0.59	1.21
Lung	44	0.50	0.37	0.67	35	0.84	0.59	1.18	80	1.01	0.80	1.16
Stomach	16	0.64	0.36	1.03	17	0.81	0.47	1.30	22	0.56	0.35	0.85
Lip	0	0	0	0.68	0	0	0	1.13	2	0.13	0.04	1.15

Table 4. Numbers (N) of selected cancers and standardized incidence ratios (SIR) with 95% confidence intervals (CI) among male musicians in Finland, Iceland, Norway and Sweden, by period of follow-up.

Site	1961-75				1976-1990				1991-2005			
	N	SIR	95% CI		N	SIR	95% CI		N	SIR	95% CI	
All sites	182	1.08	0.93	1.25	559	1.05	0.97	1.15	922	0.98	0.92	1.05
Pharynx	4	2.56	0.70	6.54	7	1.87	0.75	3.86	21	3.22	1.99	4.93
oropharynx	3	8.09	1.67	23.63	5	3.91	1.27	9.13	14	4.12	2.25	6.92
Oesophagus	7	3.02	1.22	6.22	16	2.39	1.36	3.88	20	1.72	1.05	2.66
Liver	7	3.59	1.44	7.40	15	2.16	1.21	3.57	13	1.25	0.66	2.13
Testis	3	1.60	0.33	4.69	7	1.96	0.79	4.04	7	1.35	0.54	2.78
Skin melanoma	9	2.11	0.96	4.01	27	1.60	1.05	2.33	41	1.21	0.86	1.64
Larynx	7	2.35	0.95	4.89	11	1.54	0.77	2.75	6	0.75	0.26	1.58
Oral cavity	0	0	0	3.80	4	1.38	0.38	3.52	7	1.49	0.60	3.07
Prostate	23	1.04	0.66	1.56	103	1.01	0.83	1.23	288	1.02	0.90	1.14
Skin, squamous cell	3	0.85	0.18	2.49	22	1.29	0.81	1.96	32	0.72	0.49	1.02
Lung	20	0.77	0.47	1.18	64	0.78	0.60	0.99	77	0.76	0.60	0.95
Stomach	9	0.52	0.24	0.98	27	0.77	0.51	1.12	21	0.63	0.39	0.96
Lip	0	0	0	1.22	0	0	0	0.58	2	0.36	0.04	1.29

Table 5. Numbers (N) of selected cancers and standardized incidence ratios (SIR) with 95% confidence intervals (CI) among male musicians in Finland, Iceland, Norway and Sweden, by age at follow-up.

Site	30–49 years				50–69 years				70+ years			
	N	SIR	95% CI		N	SIR	95% CI		N	SIR	95% CI	
All sites	153	1.08	0.92	1.27	773	0.98	0.92	1.06	737	1.04	0.96	1.11
Pharynx	5	2.62	0.85	6.12	22	2.98	1.86	4.50	5	1.98	0.64	4.63
oropharynx	2	2.06	0.25	7.44	16	5.01	2.86	8.13	4	4.55	1.24	11.65
Oesophagus	4	3.19	0.87	8.18	21	1.82	1.12	2.78	18	2.30	1.36	3.63
Liver	2	1.56	0.19	5.64	15	1.62	0.90	2.56	18	2.06	1.22	3.25
Testis	14	1.85	1.01	3.10	3	1.15	0.24	3.36	0	0	0	8.45
Skin melanoma	17	1.16	0.68	1.86	37	1.37	0.96	1.88	23	1.71	1.08	2.57
Larynx	5	2.73	0.89	6.37	13	1.14	0.61	1.95	6	1.16	0.43	2.53
Oral cavity	2	1.66	0.20	6.01	8	1.60	0.69	3.14	1	0.42	0.01	2.36
Prostate	4	1.32	0.36	3.39	169	0.97	0.83	1.13	241	1.05	0.92	1.19
Skin, squamous cell	4	1.22	0.33	3.13	11	0.55	0.27	0.98	42	1.02	0.73	1.37
Lung	5	0.41	0.13	0.95	88	0.73	0.59	0.90	68	0.88	0.69	1.12
Stomach	8	1.08	0.47	2.13	27	0.63	0.42	0.92	22	0.62	0.39	0.94
Lip	0	0	0	2.60	0	0	0	0.47	2	0.35	0.04	1.27