Ann. occup. Hyg., Vol. 46, Supplement 1, pp. 304–307, 2002

Published by Oxford University Press
DOI: 10.1093/annhyg/mef687

Respiratory Symptoms among Inuit Carvers in Nunavut

KAREN M. TOFFLEMIRE[1], PATRICK A. HESSEL[2]* FRANCIS H. Y. GREEN[3], KEN YOSHIDA[4], DENNIS MICHAELCHUK[1] and ROBERT L. COWIE[3]

[1]Department of Public Health Science, 13-103 Clinical Sciences Building, University of Alberta, Edmonton, AB, Canada T6G 2G3; [2]Two North Riverside Plaza, Suite 1400, Chicago, IL 6060, USA; [3]Faculty of Medicine, University of Calgary, 3330 Hospital Drive NW, Calgary, AB, T2N 4N1; [4]2108 Urbana Road NW, Calgary, AB, Canada T2N 4B8

Artists in northern Canada carve soft stones that are mineralogically diverse. In addition, some artists carve organic media such as ivory, bone and antler. In recent decades, power tools have replaced traditional methods for producing artworks, resulting in the production of more dust and finer particles. The objective of this study was to determine whether these artists had increased prevalence of respiratory symptoms related to their work. A cross-sectional survey documented respiratory symptoms of 232 carvers and 232 non-carvers. Logistic regression analysis was used to model the role of exposure in relation to symptoms. Some symptoms suggestive of bronchial responsiveness were found in excess among carvers. However, there was little evidence of exposure–response relationships among these symptoms, an exception being wheeze with chest tightness. Symptoms suggestive of non-specific airway irritation were not found in excess, although the odds ratios for chronic phlegm increased with increasing number of pieces carved. No strongly suggestive patterns were found for cough. Many, but not all, symptoms were more common among those carving organic media in addition to stone.

Keywords: Inuit health; respiratory symptoms; stone carving; occupational lung disease

INTRODUCTION

Inuit art has an evolving history within the harsh environs of northern Canada. In the past, artists hunted or scavenged for traditional carving materials: ivory, bone, antler and driftwood (Gustavison, 1999). Today, stone (previously carved into tools and toys) has succeeded organic material as the primary carving material for artworks. Stone carving has grown into an industry that is an important part of the Inuit economy and culture. The mineralogy of the stones varies among regions and includes steatite, green serpentine, serpentinite, talc, limestone, agillite and marble (McDermott, 1992). Carvers may also be exposed to other dusts, such as silica, as well as organic dusts from ivory, antler and bone, which are still used by some.

Traditional carving tools included axes, adzes, rasps and files. Within the last 20 yr, power tools have become more popular, considerably shortening roughing out and shaping time. Use of these tools has resulted in the production of more dust and finer particles. Workplaces are often poorly ventilated and respiratory protection is not used regularly.

Respiratory problems are common among the Inuit. Approximately one-quarter of visits to community health clinics are attributed to diseases of the respiratory system (DHSS, 1999). Tuberculosis case rates for the Inuit have been among the highest in Canada (Enarson, 1998).

This study was undertaken to determine whether stone carvers had increased prevalence of respiratory symptoms that might be related to their work.

MATERIALS AND METHODS

A cross-sectional survey was undertaken in four communities in Nunavut, Canada. The communities are major centres for Inuit art and a preliminary investigation suggested that the stones used in these areas differed.

*Author to whom correspondence should be addressed.
Tel: +1-312-627-2004; fax: +1-312-627-1617; e-mail: phessel@exponent.com

Participants

Carvers were defined as: (i) age ≥35 yr; (ii) carved for at least 1 yr (could be retired); and (iii) produced stone carvings for sale.

Lists of Inuit artists were obtained from the Department of Indian Affairs and Northern Development. Within each community, a knowledgeable individual reviewed the list and made additions (carvers that were missed, or perhaps had moved into the community recently) or deletions (those who had died or moved out of the community).

In three of the communities, random samples of non-carvers were frequency matched to the carvers by sex. In the fourth community, all residents over the age of 35 were invited to participate.

Questionnaire

Trained individuals within each community conducted the interviews under the guidance of a field manager. Interviewers were fluent in English, and the local language, Inuktitut. Respiratory symptoms were documented using the American Thoracic Society questionnaire (Ferris, 1978). Questions related to carving exposure and practices were added.

Data analysis

Initial bivariate comparisons were followed by logistic regression analysis to model the role of exposure in relation to symptoms using a backward elimination procedure, including age, sex, history of tuberculosis, community of residence, smoking category and cigarette pack-years. Exposure–response relationships were examined using the number of years spent carving and the number of carvings produced. In addition, the role of exposure to stone only vs. stone plus organic media was examined in relation to symptoms.

Ethics approval was obtained from the Health Ethics Review Board at the University of Alberta.

RESULTS

The response rate was 85% (n = 464 individuals), including 232 carvers (75 using stone only and 159 using stone plus organic media) and 232 non-carvers (Table 1). Most carvers were males (70%), whereas 56% of the comparison group were females. Over 60% were current smokers.

Some symptoms suggestive of bronchial responsiveness were found in excess among stone carvers (Table 2). These symptoms included wheeze with chest tightness, chest tightness and attacks of wheeze with shortness of breath. However, there was little evidence of exposure–response patterns in the odds ratios when examined by years of carving (Table 3) or the number of pieces of art produced (Table 4). The exception was wheeze with chest tightness in relation to the number of pieces carved. Current, physician-diagnosed asthma was found in 7.8% of the total group and was equally prevalent in carvers and non-carvers. Asthma was significantly related to symptoms of bronchial responsiveness, but did not modify the associations between carving and these symptoms.

Table 1. Characteristics of carvers and non-carvers

Characteristic	Carver (n = 232)	Non-carver (n = 232)
Age (mean ± SD)	54.04 ± 11.81	50.05 ± 12.21
Sex (n, %)		
Female	69 (29.7)	130 (56.0)
Male	163 (70.3)	102 (44.0)
Smoking category (n, %)		
Non-smoker	10 (4.3)	28 (12.1)
Ex-smoker	87 (37.5)	52 (22.4)
Current smoker	135 (58.2)	152 (65.5)
Cigarette pack-years (mean ± SD)	21.43 ± 21.31	14.83 ± 13.97
Community (n, %)		
Baker Lake	56 (24.1)	68 (29.3)
Gjoa Haven	33 (14.2)	33 (14.2)
Taloyoak	28 (12.1)	37 (15.9)
Cape Dorset	115 (49.6)	94 (40.6)

Table 2. Prevalence of symptoms reported by carvers and non-carvers, odds ratios and 95% confidence intervals (CI)

Symptom	Carvers (n, %)	Non-carvers (n, %)	Odds ratio	95% CI
Usual cough	68 (29.3)	64 (27.6)	1.03	0.64–1.65
Chronic cough	41 (17.7)	35 (15.1)	0.92	0.52–1.64
Usual phlegm	79 (34.1)	62 (26.7)	1.33	0.85–2.08
Chronic phlegm	56 (24.1)	41 (17.7)	1.28	0.77–2.13
Shortness of breath	105 (45.3)	88 (37.9)	1.23	0.82–1.85
Wheeze (last 12 months)	48 (20.7)	43 (18.5)	1.00	0.60–1.68
Wheeze with chest tightness	45 (19.4)	20 (8.6)	2.32	1.31–4.11
Chest tightness	63 (27.2)	43 (18.5)	1.80	1.45–2.82
Attacks of wheeze with SOB	44 (19.0)	26 (11.2)	1.92	1.08–3.42

Odds ratios adjusted for age, sex, community of residence, history of tuberculosis, smoking category and cigarette pack-years.
SOB, shortness of breath.

Table 3. Odds ratios (95% confidence intervals), symptoms in relation to years of carving, compared to non-carvers

Symptom	<10 yr (n = 105)	11–25 yr (n = 61)	>25 yr (n = 66)
Usual cough	1.03 (0.58–1.83)	1.00 (0.50–2.00)	1.16 (0.58–2.33)
Chronic cough	0.92 (0.46–1.86)	0.83 (0.35–1.95)	1.07 (0.48–2.38)
Usual phlegm	1.13 (0.64–1.99)	0.97 (0.49–1.94)	2.37 (1.23–4.55)
Chronic phlegm	0.93 (0.48–1.78)	1.25 (0.57–2.56)	2.15 (1.07–4.34)
Shortness of breath	1.17 (0.70–1.94)	1.18 (0.64–2.21)	1.80 (0.96–3.39)
Wheeze (last 12 months)	0.85 (0.46–1.57)	0.61 (0.27–1.38)	1.68 (0.89–3.21)
Wheeze with chest tightness	2.05 (1.02–4.09)	1.60 (0.67–3.83)	4.61 (2.30–9.25)
Chest tightness	1.72 (0.97–3.02)	1.42 (0.71–2.85)	2.17 (1.13–4.16)
Attacks of wheeze with SOB	1.75 (0.87–3.53)	1.73 (0.74–4.03)	2.44 (1.12–5.32)

Odds ratios adjusted for age, sex, community of residence, history of tuberculosis, smoking category and cigarette pack-years. SOB, shortness of breath.

Table 4. Odds ratios (95% confidence intervals), symptoms in relation to number of pieces carved, compared to non-carvers

Symptom	<100 pieces (n = 102)	101–1000 pieces (n = 70)	>1000 pieces (n = 60)
Usual cough	0.95 (0.53–1.69)	1.02 (0.53–1.97)	1.38 (0.68–2.80)
Chronic cough	0.68 (0.32–1.44)	1.13 (0.53–2.43)	1.21 (0.54–2.71)
Usual phlegm	1.11 (0.63–1.98)	1.46 (0.77–2.76)	1.97 (0.99–3.87)
Chronic phlegm	1.02 (0.54–1.95)	1.24 (0.60–2.55)	1.93 (0.94–3.97)
Shortness of breath	1.25 (0.76–2.07)	1.71 (0.97–3.05)	0.73 (0.38–1.41)
Wheeze (last 12 months)	0.66 (0.34–1.28)	1.32 (0.69–2.55)	1.24 (0.62–2.51)
Wheeze with chest tightness	1.22 (0.56–2.66)	3.01 (1.46–6.23)	3.89 (1.85–8.18)
Chest tightness	1.25 (0.69–2.26)	3.51 (1.90–6.48)	1.19 (0.57–2.49)
Attacks of wheeze with SOB	1.75 (0.86–3.48)	2.11 (0.98–4.55)	2.08 (0.89–4.85)

Odds ratios adjusted for age, sex, community of residence, history of tuberculosis, smoking category and cigarette pack-years. SOB, shortness of breath.

Notably, neither cough nor phlegm was significantly related to a history of carving (Table 2), although odds ratios were generally greatest in the highest categories of years of carving and number of pieces carved. The odds ratios for chronic phlegm showed some evidence of an exposure–response relationship with the number of years carved (Table 3). No strongly suggestive patterns were found for cough.

Most symptoms were more common among those who carved with stone plus organic media, such as ivory, antler and bone (Table 5). Some symptoms suggestive of bronchial responsiveness were found significantly in excess in this group, including wheeze with chest tightness, chest tightness and attacks of wheeze with shortness of breath.

Table 5. Odds ratios (95% confidence interval), symptoms in relation to carving media used, compared to non-carvers

Symptom	Stone only (n = 75)	Stone and organic media (n = 159)
Usual cough	0.96 (0.49–1.89)	1.11 (0.66–1.88)
Chronic cough	0.65 (0.28–1.53)	0.99 (0.53–1.85)
Usual phlegm	0.94 (0.48–1.87)	1.66 (1.02–2.70)
Chronic phlegm	1.21 (0.56–2.61)	1.57 (0.88–2.81)
Shortness of breath	1.37 (0.76–2.48)	1.22 (0.75–1.96)
Wheeze (last 12 months)	0.86 (0.41–1.83)	1.34 (0.76–2.35)
Wheeze with chest tightness	2.79 (1.29–6.00)	2.54 (1.32–4.91)
Chest tightness	1.36 (0.66–2.80)	2.44 (1.43–4.16)
Attacks of wheeze with SOB	1.20 (0.51–2.85)	2.66 (1.41–5.02)

Odds ratios adjusted for age, sex, community of residence, history of tuberculosis, smoke category and cigarette pack-years.

DISCUSSION

Because most of the dusts were inorganic, dust levels were observed to be high, and respiratory protection was not commonly used, symptoms suggestive of non-specific airway irritation were expected to be found in excess among the carvers (Morgan, 1978). The relatively low odds ratios (overall) for cough and phlegm may have resulted from the high prevalence of smoking in this region. The estimate of 62% current smokers in the present study is consistent with other findings from this region (Northwest Territories Bureau of Statistics, 1996). The presence of chronic phlegm, however, showed a graded response with years of carving.

Relatively increased odds ratios for symptoms suggestive of bronchial responsiveness were also unexpected, given the predominance of inorganic

dust exposures. The excess of symptoms suggestive of bronchial responsiveness was explained, in part, by exposure to organic media such as ivory, antler and bone. Although not extensively studied, case reports have documented asthma-like symptoms in response to working with organic media such as ivory (Armstrong *et al.*, 1988) and bone (Patterson *et al.*, 1991). In addition, materials used for polishing the carvings (including seal and walrus oil, corn oil, waxes, jewellery compounds and others) should be considered in relation to these symptoms. Physical labour in a cold climate might also be considered. Previous reports have shown bronchial responsiveness during activity in low temperatures, but mainly for individuals suffering from asthma (Strauss *et al.*, 1977; Koskela *et al.*, 1994).

CONCLUSIONS

Carvers reported an increased prevalence of respiratory symptoms suggestive of bronchial responsiveness, particularly for those carving with stone plus organic media. Cough and phlegm were not generally found in excess.

Acknowledgements—The study was funded by the Canadian Institutes of Health Research. The field team included Ms Faith Studds and Ms Marilyn Dixon.

REFERENCES

Armstrong RA, Neill P, Mossop RT. (1988) Asthma induced by ivory dust: a new occupational cause. Thorax; 43: 737–8.

Enarson DA. (1998) Tuberculosis in aboriginals in Canada. Int J Tuberc Lung Dis; 2: S16–S22.

DHSS. (1999) Department of Health and Social Services, Government of the Northwest Territories. The NWT Health Status Report 1999. Yellowknife: Office of the Chief Medical Officer of Health.

Ferris BG. (1978) Epidemiology standardization project. Am Rev Respir Dis; 118: 11–23.

Gustavison S. (1999) Northern Rock: Contemporary Inuit Stone Sculpture. Kleinburg, ON: McMichael Canadian Art Collection.

Koskela H, Tukiainen H, Kononoff A, Pekkarinen H. (1994) Effect of whole-body exposure to cold and wind on lung function in asthmatic patients. Chest; 105: 1728–31.

McDermott G. (1992) Carving Stone Occurrences of the Northwest Territories. Ottawa: Indian and Northern Affairs Canada, Canada Economic Geology Series 15.

Morgan WKC. (1978) Industrial bronchitis. Br J Ind Med; 35: 285–91.

Northwest Territories Bureau of Statistics. (1996) Drug and Alcohol Survey. Yellowknife: Government of the Northwest Territories.

Patterson R, Ganz M, Roberts M. (1991) Anaphylaxis and asthma in a scrimshander due to deer bone dust. Ann Allergy; 67: 529–32.

Strauss RH, McFadden ER, Ingram RH, Jaeger JJ. (1977) Enhancement of exercise-induced asthma by cold air. N Engl J Med; 297: 743–6.