

## A SURVEY OF OCCUPATIONAL HEALTH IN THE ROYAL NORWEGIAN NAVY

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### ABSTRACT

**Objective** The aim of this article is to describe possible risk factors in the work environment that can affect the health of staff of the Royal Norwegian Navy (RNoN). The article presents the main results from a subproject related to a major surveillance of the health and work environment in this population. The project was performed as a response to general concerns regarding harmful work environment and negative health effects for these employees.

**Participants and methods** In 2002, a questionnaire was sent out to all the employees in RNoN, and they answered during a period of three months. The overall response rate was 58% (n=2265), 2001 men and 250 women (14 unknown sex). 1581 military employees and 580 civilians participated (104 unknown). Mean age was 38 (range 18-70). Questions about years at work, exposure to chemical, physical and

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ergonomic hazards were developed for this particular study. Questions about allergy, asthma, hand eczema, hearing loss, cardiovascular disease, diabetes mellitus and cancer were asked. Musculoskeletal disorders were obtained by a standardized instrument.

**Results** Exposure to noise, heavy lifting, twisted work positions and work close to antennas and communication equipment occurred often in this population. The most commonly reported diseases that might be work related were hand eczema, hearing loss and low back pain.

**Conclusions** The results indicate the presence of several possible risk factors to health related to the work environment in this population. The project gives a basis for further action regarding the Health Safety and Environment work within RNoN.

## INTRODUCTION

Different potential health problems related to the work in the Royal Norwegian Navy (RNoN) have been discussed for several years in Norway, giving many headlines in Norwegian newspapers. There are few studies in the literature about work and health in general among employees in the navy. Articles concerning health among marine employees mainly discuss health related to events at war (1, 2) or historical problems (3). In 2004, the Head of the RNoN made the decision that a project should be performed to make a surveillance of the work environment in the RNoN. The University of Bergen was given the task to study the different problems, as an independent unit outside the navy. This was a large surveillance with several subprojects. One subproject was a questionnaire study of working conditions and health among all workers in the RNoN. The main results from this study are presented here. The purpose was to examine if there were any possible risk factors in the work environment that could be related to health problems in this population.

## PARTICIPANTS AND METHODS

The data were collected in a cross-sectional study from a questionnaire sent by mail at the end of 2002 to all the employees in the Navy, both military and civilians. There are different types of work within both these groups. The military population is different from the civilians as many of the military employees work on ships, while the civilians work ashore. However, some of the military employees may work ashore, and some of the civilians may perform repair work on the ships. The questionnaires were returned

directly to the research group at the University of Bergen. The name, address and the National Insurance number were pre-printed on the form.

Before the questionnaire was designed, the research group visited 42 work places in the RNoN in 2001-2002, to be able to evaluate what sort of questions to ask in the survey.

In the questionnaire, the respondents were asked about years at work in the RNoN and exposure during their work in the RNoN to organic solvents, skin contact with oil/petrol, vapor from oil/petrol, smoke from oil fires, exhaust, pesticides, welding, lead, explosives, high-frequency aeriels, radar and communication equipment, noise, vibration, heavy lifting, twisted work positions, work with arms above the shoulders, passive smoking and asbestos. The scoring was on a scale divided into “never, very little, some, much, very much”, and not related to any specific time period. These questions were constructed especially for this study. Questions were also asked about any experience (yes/no) of allergy (reactions from skin, airways and gastrointestinal tract, asthma, hand eczema), hearing loss, cardiovascular disease, diabetes mellitus and cancer. Musculoskeletal disorders were recorded according to a modification of the Standardized Nordic Questionnaire (4). The questions were phrased as follows: “Have you had complaints (pain or discomfort) during the past 12 months in your \_\_\_?” The list included the neck, shoulders, elbows, hands, upper back, lower back, hips, knees and feet. A five-point response scale “never, seldom, sometimes, often, very often” was used.

Data was analysed by using the statistical package SPSS 15.0, using descriptive statistics. Groups were compared using chi-square tests for categorical variables, significance level set to  $< 0.05$ .

## RESULTS

The overall response rate was 58% (2265 of 3878). The response rate was 59% among the men (n=2001) and 52% among the women (n=250). The mean age for the total respondents was 38 years, range 18-70, for men 42 years and for women 37 years. The mean duration of work in RNoN was 16 years for men and 13 years for women. 1581 of the responders were military employees, 580 were civilians and 104 gave no information about this point. Many of the employees had been working at different places in the Navy. The mean work duration in the Navy for military employees was 14.7 years, while for the civilians it was 18.5 years. As an average, military employees had been working 4.7 work places, while the civilians had been working 2.4 work

places. The distribution of work places these workers had experienced in total is shown in Table I, showing their great variety.

Table I. Number of persons who were employed at different work places in the Royal Norwegian Navy. Information obtained from the working population (n=2265) in 2002/2003. One person might have worked in several places.

Work place	Number of workers
Destroyer	25
Frigate	517
Corvette	93
Minelayer/mine sweeper	388
Missile torpedo boat	716
Submarine	412
Coastal guard	418
Supplier	121
The Royal ship	48
Different other ships	124
Naval fortress	420
Coastal radar station	33
Mine diving	77
Work shop	416
Ware house	77
Canteen	26
Office work, administration	1127
Other types of work	892

Table II. Self reported occupational exposure during work in the Royal Norwegian Navy, expressed as some, much or very much. The information was given by 2265 persons.

Exposure	Some		Much		Very much	
	No	%	No	%	No	%
Asbestos	230	10.5	47	2.2	16	0.7
Organic solvents	614	28.0	96	4.4	43	2.0
Skin contact with oil/petrol	503	23.0	192	8.8	109	5.0
Oil/petrol vapour	476	22.0	166	7.7	67	3.1
Smoke from oil fires	94	4.4	15	.7	6	.3
Exhaust fumes	562	25.9	181	8.3	112	5.2
Pesticides	9	.4	1	0	0	0
Welding	193	8.9	34	1.6	10	.5
Lead	399	18.4	133	6.1	67	3.1
Explosives	356	16.4	134	6.2	81	3.7
Work closer to HF-antennas than 10 m	517	23.7	242	11.1	232	10.7
Work closer to transmitter antennas than 3m	417	19.2	186	8.6	157	7.2
Work closer to radar than 5 m	426	19.6	210	9.7	178	8.2
Noise	797	36.2	490	22.2	350	15.9
Vibration	559	25.8	271	12.5	252	11.6
Heavy lifting	817	37.2	260	11.8	120	5.5
Twisted work positions	716	32.6	305	13.9	157	7.2
Work with arms above shoulders	602	27.5	167	7.6	72	3.3
Passive smoking	784	35.7	290	13.2	119	5.4

Noise, vibration, heavy lifting, twisted work positions and work close to antennas and communication equipment occurred most often in this population (Table II). About 38% of the total population had been “much” or “very much” exposed to noise, and this exposure was most common among the military employees (41%) and significantly different from the civilians (26%) (chi-square,  $p=0.001$ ). Heavy lifting and twisted work positions had been more commonly experienced “much” or “very much” among the civilians than military employees (chi-square tests,  $p=0.001$  for both exposures). Almost nineteen percent had been exposed “much” or “very much” to passive smoking at work and thirteen percent had been exposed to asbestos, but these findings were the same for the military and the civilian population. Work close to antennas and communication

equipment had also been experienced equally in the two population groups. Female workers had experienced much less of all these types of exposures than the men.

The most common diseases reported by the workers were allergy, hand eczema and hearing loss (Table III). There were no significant differences between the military and the civilian populations regarding these diseases. Comparing men and women revealed a higher occurrence of skin allergy and asthma among women and higher occurrence of hearing loss among men. Musculoskeletal pain or discomfort was also very commonly reported, mostly from the lower back, shoulder and neck (Table IV). The civilians reported significantly more often pain or discomfort for all body parts than the military personnel. Women reported significantly more often pain or discomfort of head, neck, shoulder and hands than men; otherwise the results were similar with respect to gender.

Table III. Diseases reported by workers in the Royal Norwegian Navy; total number of persons and percent of the total number of workers, percent of men, women, military and civilians.

Disease	Total number	% of total	% of men (n=2001)	% of women (n=250)	% of military (n=1581)	% of civilians (n=580)
Airways allergy	585	26	25	26	28	24
Skin allergy	366	16	15	32	15	20
Food allergy	205	9	9	9	9	11
Asthma	144	6	6	10	6	9
Hand eczema	442	21	21	22	20	24
Hearing loss	531	24	25	14	23	25
Myocard. infarction	20	1	1	0	0.5	2
Angina pectoris	20	1	1	0	1	2
Cerebral ischemia	7	0.5	0.5	0	0.3	0.5
Diabetes mellitus	15	1	1	0	0.5	1
Cancer	50	3	3	1	0,3	2.5

Table IV. Prevalence of “pain or discomfort” in different body parts reported during the past year by employees (n=2265) in the Royal Norwegian Navy, expressed as the percentage of workers.

Body part	Never	Seldom	Sometimes	Often	Very often
Head	53.8	25.3	15.7	3.7	1.5
Neck	42.9	24.8	22.1	7.5	2.8
Shoulder	48.2	21.0	19.0	8.3	3.5
Elbow	79.0	11.2	6.9	1.6	1.3
Wrists and hands	72.2	15.1	8.8	2.8	1.1
Upper back	65.5	17.5	11.4	4.2	1.5
Lower back	37.5	23.6	25.4	9.5	4.1
Hip	77.8	10.6	6.7	3.2	1.7
Knee	57.6	18.2	15.6	6.2	2.4
Ankle/foot	70.6	17.5	7.6	2.9	1.4

## DISCUSSION

This survey points at several risk factors in the working environment in the RNoN that might be explored further. Noise is reported to occur among many persons in RNoN, and a large number of persons also report hearing loss. It is likely that there is a relationship between these factors. In an interview survey of the general Norwegian working population, eight percent of people told that they were in general exposed to high noise levels at work (5). This is much lower than the thirty-eight percent of the employees of RNoN who reported “much” or “very much” noise exposure. However, the employees of RNoN have reported the noise exposure for their whole work period in RNoN and not only the present exposure, making the two studies not quite comparable. In the same Norwegian population study, hearing loss was reported by only three percent (6), which is high in contrast to the 24% found in RNoN personnel. The military personnel reported more noise exposure than the civilians. It therefore might seem confusing that the two groups had about the same occurrence of hearing loss. The explanation might be that many civilians had worked in the military part of the Navy previously in their life. Men had higher occurrence of hearing loss than women, and they also reported more noise exposure. This might be caused by differences in exposure time, as the women had experienced a shorter work period in the Navy than the men. But it can also be caused by the fact that men and women had different work tasks.

Hand eczema is reported by 21% of employees in the RNoN. Other population studies show lower figures, the prevalence has been shown to be 11% in a Swedish study (7). Skin exposure to oil or petrol is a possible cause of occupational hand eczema (8). Only five percent of the employees of the RNoN report skin exposure to oil at “very much” level, but as many as 37% report “some” or “much” or “very much” exposure of this type. These high figures for dermal oil exposure is probably related to mechanical work on the ships or in workshops, and it is likely that this exposure may explain some of this high prevalence of hand eczema. Preventive measures are clearly indicated. This problem has been known on other ships as well (8), and increased use of gloves is recommended (9).

Work close to antennas and transmission systems is reported rather frequently by employees in RNoN, both the military and civilians. This is probably mainly due to work on ships, where such installations and systems always exist. No difference existing between military and civilian workers might be explained by the fact that civilians had military work previously, and because some groups of civilians perform work on this type of equipment. The RNoN has implemented a systematic survey system (RADHAZ) for exposure to different types of radiation on the ships. This type of surveillance seems to be needed and should be continued.

Heavy lifting and work in twisted positions is also reported by a high number of workers in RNoN, with the highest occurrence among civilian workers. This should be examined further. Seen in relation to the high prevalence of musculoskeletal pain especially among civilian workers in the RNoN, some of these complaints might be related to these types of working conditions and should be further examined. On the other hand, the occurrence of musculoskeletal pain is similar to figures found in the general working population (10). Women report more musculoskeletal complaints than men for certain body parts. This gender difference is often found in working populations (11), and should be examined further to find out if these problems are related to their work.

Many employees in the RNoN report allergies of different types. The total prevalence of allergy in the Norwegian population is about 30% (12), which is comparable to the figures found in the RNoN. These findings are probably not related to the work environment, but to the lifestyle in the Western world in general (13). However, the women in our study report higher occurrence than men for skin allergy and also for asthma. It is difficult to explain the reason for this finding, but women in general tend to report higher occurrence of symptoms both from skin and airways (14, 15). On the other hand, these findings may be related to their work, and the issue should be examined further.

Quite a few workers in RNoN report exposure to passive smoking. This might have been reported as a historical issue, and is probably not a problem today. New regulations forbid smoking at the work places in the RNoN. However, the subject ought to be checked.

Thirteen percent of the workers had been exposed to asbestos in their work in the RNoN. This may have taken place in older ships, as asbestos was used as insulation material in earlier days. The asbestos is no longer in use in RNoN. However, it is important for RNoN to provide follow-up health studies of this asbestos exposed group.

There are several weaknesses of our study. As it is a cross-sectional study, no certain causal relationships can be established between exposure and health outcomes. Also, the information is self reported, no objective examinations were performed. The diagnoses have not been verified by any physician. The information given about exposures is related to the whole work period in the Navy, and this makes it difficult to study relations between exposure and occurrence of diseases. The response rate was only 58%, meaning we have no information from 42% of the employees. On the other hand, information from 2265 persons is a large information unit and ought to be of interest, giving a basis for further surveillance and improvements both for the RNoN and naval populations in other countries.

## CONCLUSIONS

The results indicate the presence of several possible risk factors to health related to the work environment in this population, in particular noise, skin exposures, heavy lifting and work in twisted positions. These exposures may be related to high occurrence of hearing loss, hand eczema and musculoskeletal complaints. Despite several weaknesses in the material, this project gives a basis for further action regarding the Health Safety and Environment work within RNoN.

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