

# PREVALENCE OF SLEEP DISTURBANCES AMONG EMERGENCY RESPONSE TEAM PARAMEDICS WORKING IN SHIFT SYSTEMS

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## ABSTRACT

**INTRODUCTION:** Due to the nature and specifics of their work, paramedics carry out work activities in an organized shift system. Working in shifts is related to various health complications, disturbing the natural biological rhythm and adversely affecting the quality of sleep. The purpose of the study was the evaluation of the effect of shift work on the quality of sleep of the paramedics who are members of Emergency Response Teams.

**MATERIAL AND METHODS:** The research took place between May and September 2019, using diagnostic survey methodology on 238 (223 male, 15 female) paramedics in mobile Emergency Response Teams (ERT) employed in five operational areas of the Masovian voivodeship. The mean age was  $39.03 \pm 9.27$  years for males, and  $31.93 \pm 7.76$  years for females. To examine the differences between the groups, the  $\chi^2$  test was employed, with an established statistical significance value of  $p < 0.05$ .

**RESULTS:** Insomnia was most often reported by paramedics aged between 45 and 54 (29; 12.18%) and above the age of 55 (23; 9.66%). The participating paramedics are most often in the above-norm bounds of the Athens Insomnia Scale norms (112; 47.05%) or in the group classified as suffering from insomnia (77; 32.35%).

**CONCLUSIONS:** In order to minimize the possible health consequences resulting from the nature of shift work, it is suitable to implement elements of sleep hygiene theory into the health education of paramedics, as well as to continuously monitor their health condition as part of occupational medicine practice.

**KEY WORDS:** paramedic; shift work; sleep

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## INTRODUCTION

Shift work, defined as working in changing periods of the day, is the basic form of functioning of the healthcare system, including the national Emergency Medical Services (EMS). Adopting this form of organizing the workload by Emergency Response Teams (ERTs) is dictated by the need to ensure those whose health or life is at risk have continuous access to health care.

In general terms, the work of a paramedic involves saving human life and health through undertaking medical emergency procedures which stabilize basic life functions, as well as preparing the patient for transport in case of a sudden threat to their life or health. The emergency procedures are carried out in varied conditions and circumstances, during the day and at night, which causes a physical and mental load being put on paramedics. Therefore, the people working as paramedics need not only possess the specialist medical knowledge required to perform their professional duties but also exhibit a high resilience to stress and possess a strong inner motivation and self-control related to undertaking risks and quick decisions. The work environment and its conditions, shift work hours, and its nature in and of itself, predispose paramedics to a range of various negative health complications, such as the risk of cardiovascular disease, infections, cancer, mental disorders, and sleep disturbance. Among healthcare professionals, paramedics are the group most often diagnosed with occupational illnesses every year [1–10].

It should be noted that the explosion of the COVID-19 pandemic significantly highlighted the daily issues of the ERT paramedic workday. It changed the perception of health prophylaxis and its importance in the healthcare system, exposing the issue of insufficient personnel, lack of self-protective equipment, ever-changing and forced-upon working conditions, and occupational overload. This situation negatively affected the health condition of healthcare workers, including their mental well-being and functioning in the workplace [5, 6, 10, 11].

Sleep issues constitute an increasing health problem worldwide. Research carried out so far shows that due to the differences in the application of diagnostic tools, the setting of the examination, and operational definitions used, the prevalence of sleep problems in the population varies greatly between studies, ranging anywhere from 6% to 50% [12].

A tendency towards overweight and obesity, higher cholesterol levels, cardiovascular and digestive system diseases, diabetes, cancers, and mood disorders has been noted in shift workers [13]. Due to epidemiological reasons and its potential health consequences, this phenomenon is no longer examined on an individual basis, becoming a societal concern of public health [14].

The aim of the following study was the evaluation the effect that shift work ERT paramedics engage in has on their quality of sleep. The reason for undertaking this research was the fact that such investigations into the relationship between shift work and sleep problems of ERT paramedics have not been carried out in the Polish context. The following paper fills this gap in knowledge and may serve as a starting point for the development of health promotion initiatives aimed at this professional group.

## MATERIAL AND METHODS

The study was carried out as part of a joint project between the Health Department of the Mazovian Voivodeship Office in Warsaw and the Health and Social Policy Department of the Marshal's Office for the Mazovian Voivodeship in Warsaw. It involved professionally active ERT paramedics in the Mazovian Voivodeship from 5 operational regions located in Warsaw, Płock, Ostrołęka, Siedlce, and Radom.

The sample choice was deliberately given that on the national scale, the Mazovian voivodeship has the highest number of mobile ERTs functioning. According to the data from Statistics Poland, there were 1577 (100%) mobile ERTs functioning in Poland in 2019 as part of the National Emergency Medical Services (369 specialist teams and 1208 basic teams). In this period, there were 200 mobile ERTs, constituting 12.7% of the entire pool (46 specialist teams and 154 basic teams) [15].

The study was carried out in compliance with the rules outlined in the Helsinki Declaration [16], as it was anonymous and voluntary in nature. All of the participants granted informed consent regarding their participation were informed about the aims of their study, as well as their ability to withdraw participation at any stage, and that their participation was voluntary. The questionnaires were filled out independently without the researcher present.

The data was collected in the period between May and September of 2019 on the basis of a self-developed, anonymous interview questionnaire

created for the purpose of the study, as well as using the Athens Insomnia Scale.

The investigative tools were used to evaluate the sleep problems of paramedics employed in a shift work system. A self-developed, anonymous questionnaire consisted of 20 closed questions single and multiple choice. The questions investigated the following elements: sociodemographic data (age, gender, years of work experience, level of education) and the incidence of sleep disturbances, factors that disturb sleep as well as following sleep hygiene in the participant group. The questions were verifying in nature. The Athens Insomnia Scale (AIS) enabled a quantitative measure of insomnia symptoms. Obtaining up to 5 points on the scale is a sign of maintaining sleep norms, a score between 6 and 10 points suggests that sleep is above norms, while a score of 11 points or above is an indicator of insomnia [17].

For the qualitative variables, incidence (n) and frequency (%) were provided, for the quantitative variables like age and years of work experience, basic statistical measures describing the variables were provided (value of the mean, standard deviation, minimum and maximum values) and the non-parametric Mann-Whitney U test was applied. In order to assess sleeplessness, the Athens Insomnia Scale was used. To investigate the relationship between the incidence of sleep and sleep quality disturbances and the gender and level of education of the participants, the  $\chi^2$  test of independence was used. The statistical analysis was conducted using the Statistica 13.1 PL statistical software. The study established a significance level of  $\alpha = 0.05$ . Taking into account that the education norms for paramedics contemporary to the time of the research

[18] involve completing an undergraduate degree, in the examination of the relationship between the level of education and the effect of shift work on the quality of sleep of the paramedics, the level of education was defined as secondary (including upper secondary) and higher (including a vocational or masters degree).

## RESULTS

The final analysis included 238 participants (100%), of which 223 were male and 15 were female. The mean age of the participants was  $39.03 \pm 9.27$  years for males, and  $31.93 \pm 7.76$  years for females (Tab. 1).

The mean years of work experience of the paramedics differed significantly between genders ( $p = 0.000$ ). Among males, it was  $12.62 \pm 9.41$  years, while for females, it was  $5.36 \pm 7.04$  years. In each of the participating groups, the shortest work experience was around half a year (Tab. 2).

The observed paramedics declared a higher vocational or master's degree (189; 79.41%), as well as secondary/upper secondary education (49; 20.59%). The level of education was not related to the gender of the participants ( $p = 0.168$ ).

In the participating paramedic group, the incidence of sleep disturbance and deficiencies in its quality were found. Over 76% of the participants wake up in the middle of the night (12; 80.0 % of females and 170; 76.23% of males), while 71.01 % (9; 60.00% of females and 160; 71.55% of males) report disturbed sleep, and almost 48% of the participants declared they had issues falling asleep (8; 53.33% of females and 106; 47.53% of males). Almost 70% go to sleep at different times every

**Table 1. Age of the participants between genders**

Participant gender	n	M	SD	Min	Max	p-value
Male	223	39.03	9.27	23.00	65.00	0.003*
Female	15	31.93	7.76	23.00	50.00	

\*Mann-Whitney U Test,  $p < \alpha$ ,  $\alpha = 0.05$

**Table 2. Years of work experience of the participants between genders**

Participant gender	n	M	SD	Min	Max	p-value
Male	223	12.62	9.41	0.50	41.00	0.000*
Female	15	5.36	7.04	0.50	28.00	

\*Mann-Whitney U Test,  $p < \alpha$ ,  $\alpha = 0.05$

**Table 3. Prevalence of disturbances in sleep and sleep quality of participants between genders among the participating paramedics**

Responses/gender		Overall	Female	Male	p-value*
		n (%)	n (%)	n (%)	
		238 (100.00)	15 (100.00)	223 (100.00)	
I experience sleep induction issues	Yes	114 (47.90)	8 (53.33)	106 (47.53)	0.663
	No	124 (52.10)	7 (46.67)	117 (52.47)	
I wake up in the middle of the night	Yes	182 (76.47)	12 (80.00)	170 (76.23)	0.739
	No	56 (23.53)	3 (20.00)	53 (23.77)	
It is hard for me to fall back asleep after waking up	Yes	76 (31.93)	4 (26.67)	72 (32.29)	0.651
	No	162 (68.06)	11 (73.33)	151 (67.71)	
When I wake up I feel tired	Yes	71 (29.83)	6 (40.00)	65 (29.15)	0.374
	No	167 (70.17)	9 (60.00)	158 (70.85)	
I take sleeping pills in order to fall asleep	Yes	31 (13.03)	7 (46.67)	24 (10.76)	0.001**
	No	207 (86.97)	8 (53.33)	199 (89.24)	
I go to sleep at different times	Yes	163 (68.49)	11 (73.33)	152 (68.16)	0.676
	No	75 (31.51)	4 (26.67)	71 (31.84)	
I sleep to make up for the lack of sleep	Yes	115 (48.32)	6 (40.00)	89 (39.91)	0.994
	No	123 (51.68)	9 (60.00)	134 (60.09)	
I experience breathlessness while sleeping	Yes	17 (7.14)	5 (33.33)	12 (5.38)	0.000**
	No	221 (92.86)	10 (66.67)	211 (94.62)	
My hours of sleep vary and are irregular	Yes	140 (58.82)	9 (60.00)	131 (58.74)	0.924
	No	98 (41.18)	6 (40.00)	92 (41.25)	
I experience fatigue and sleepiness during the day	Yes	151 (63.45)	9 (60.00)	142 (63.68)	0.775
	No	87 (36.55)	6 (40.00)	81 (36.32)	
Hours of sleep in a day	< 5 hours	112 (47.06)	7 (46.67)	105 (47.09)	0.975
	> 5 hours	126 (52.94)	8 (53.33)	118 (52.91)	
Disturbed sleep (I dream of distressing or unpleasant things)	Rarely	169 (71.01)	9 (60.00)	160 (71.55)	0.311
	No	69 (28.57)	6 (40.00)	63 (28.25)	
I wake up at night with a feeling of anxiety	A few times a month	147 (61.76)	9 (60.00)	107 (47.98)	0.742
	A few times a year	91 (38.24)	6 (40.00)	85 (38.121)	

\*  $\chi^2$  test, \*\*p <  $\alpha$ ,  $\alpha = 0.05$  statistical significance confirmed

day (11; 73.33% of females and 152; 68.16% of males), and every second paramedic reported that the quantity of sleep does not exceed 5 hours (7; 46.67% of females and 105; 47.09% of males). This causes 63.64% of them to experience fatigue and sleepiness during the day (9; 60.00% of females and 142; 63.68% of males). This may be a result of shift work as well as the high number of shifts that the participating paramedics undertake. A statistically significant difference between genders was found as far as taking sleeping pills to help induce sleep ( $p = 0.001$ ), as well as the feeling of breathlessness during sleep ( $p = 0.000$ ), where for women

this percentage incidence was higher than for men. The detailed results are presented in Table 3.

While analyzing the phenomena in discussion in regards to the level of education of the paramedics, significant differences were found in issues such as waking up in the middle of the night ( $p = 0.000$ ), going to sleep at different times every day ( $p = 0.000$ ) and the hours of sleep in the group that slept less than 5 hours ( $p = 0.001$ ), where the frequency of such issues is higher among participants with a higher vocational or masters degree (Tab. 4).

In the group of paramedics with secondary or upper-secondary education, participants more often

**Table 4. Prevalence of disturbances in sleep and sleep quality of participants between levels of education among the participating paramedics**

Responses/gender		Overall n (%) 238 (100.00)	Secondary/ Upper secondary n (%) 49 (100.00)	Higher vocational/ masters n (%) 189 (100.00)	p-value
		114 (47.90)	29 (59.18)	85 (44.97)	
		124 (52.10)	20 (40.82)	104 (55.03)	0.076
I experience sleep induction issues	Yes	182 (76.47)	18 (36.73)	164 (86.77)	0.000*
	No	56 (23.53)	21 (42.86)	35 (18.52)	
I wake up in the middle of the night	Yes	76 (31.93)	32 (65.31)	44 (23.28)	0.000*
	No	162 (68.06)	17 (34.69)	145 (76.72)	
It is hard for me to fall back asleep after waking up	Yes	71 (29.83)	23 (46.94)	48 (25.40)	0.003*
	No	167 (70.17)	26 (53.06)	141 (74.60)	
When I wake up, I feel tired	Yes	31 (13.03)	9 (18.37)	22 (11.64)	0.212
	No	207 (86.97)	40 (81.63)	167 (88.36)	
I take sleeping pills in order to fall asleep	Yes	163 (68.49)	19 (38.78)	144 (76.19)	0.000*
	No	75 (31.51)	30 (61.22)	45 (23.81)	
I go to sleep at different times	Yes	115 (48.32)	21 (42.86)	94 (49.74)	0.391
	No	123 (51.68)	28 (57.14)	95 (50.26)	
I sleep to make up for the lack of sleep	Yes	17 (7.14)	4 (8.16)	13 (6.88)	0.756
	No	221 (92.86)	45 (92.84)	176 (93.12)	
I experience breathlessness while sleeping	Yes	140 (58.82)	27 (55.10)	113 (59.79)	0.552
	No	98 (41.18)	22 (44.90)	76 (40.21)	
My hours of sleep vary and are irregular	Yes	151 (63.45)	32 (65.31)	119 (62.96)	0.761
	No	87 (36.55)	17 (34.69)	70 (37.04)	
I experience fatigue and sleepiness during the day	< 5 hours	112 (47.06)	11 (22.45)	101 (53.44)	0.001*
	> 5 hours	126 (52.94)	38 (77.55)	88 (46.56)	
Hours of sleep in a day	No	169 (71.01)	35 (71.43)	134 (70.90)	0.942
	A few times a month	69 (28.99)	14 (28.57)	55 (29.10)	
Disturbed sleep (I dream of distressing or unpleasant things)	A few times a year	147 (61.76)	32 (65.31)	115 (60.85)	0.567
	No	91 (38.24)	17 (34.69)	74 (30.15)	

\*  $\chi^2$  test, \*\*p <  $\alpha$ ,  $\alpha = 0.05$  statistical significance confirmed

reported issues with falling asleep after waking up ( $p = 0.000$ ) and the feeling of tiredness after waking up ( $p = 0.003$ ) (Tab. 4).

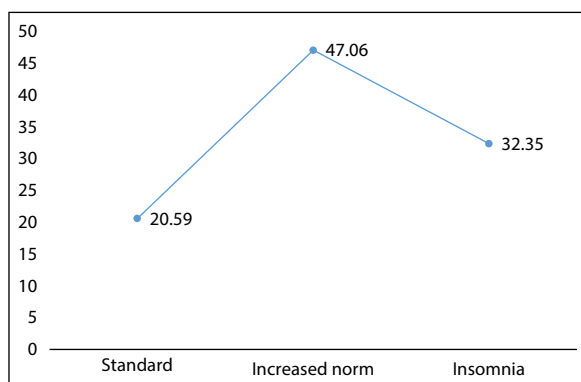
It can be observed that insomnia is reported most often by participants aged 45–54 years (29; 12.18%) and those who are above 55 years old (23; 9.66%). People who were above the norms were most often aged 45–54 years (53; 22.26%) and in the 35–44 years age bracket (29; 12.18%). The analysis of the general results yielded the conclusion that the participating paramedics are most often in the above norm group (112; 47.05%) or the

insomnia group (77; 32.35%) as per the Athens Insomnia Scale (Tab. 5, Fig. 1).

The participants most frequently reported that their falling asleep after going to bed and turning off the light was markedly (87; 36.55%) or slightly delayed (71; 29.83%). During sleep, awakenings in the middle of the night were a minor (86; 36.13%) or considerable (79; 33.19%) problem. Only every fifth participating paramedic reported a sufficient quantity of sleep (51; 21.42%), while participants most often reported a slightly insufficient number of hours of sleep (123; 51.58%). The overall quantity

Table 5. Athens Insomnia Scale results between age groups

Result interpretation	Overall n (%) 238 (100.00)	Age brackets				
		≤ 24 years n (%)	25–34 years n (%)	35–44 years n (%)	45–54 years n (%)	> 55 years n (%)
≤ 5 points — norm	49 (20.58)	4 (1.68)	23 (9.66)	15 (6.30)	7 (2.94)	–
6–10 points — above the norm	112 (47.05)	3 (1.26)	12 (5.04)	29 (12.18)	53 (22.26)	15 (6.30)
> 10 points — insomnia	77 (32.35)	–	7 (2.94)	18 (7.56)	29 (12.18)	23 (9.66)



**FIGURE 1.** Athens Insomnia Scale results between participant age (data in %)

of sleep undoubtedly has an effect on its quality, where every fifth participant reported it to be satisfactory (43; 18.06%) or slightly unsatisfactory (131; 55.04%). Their well-being the following day could be slightly decreased (93; 39.07%), normal (74; 31.09%), or very decreased (52; 21.84%). Sleep determined both physical and mental abilities on the following day, which has been reported most often by participants as normal (91; 38.23%), slightly decreased (85; 35.71%), or very decreased in every fifth paramedic (46; 19.32%). Participants most often reported mild sleepiness experienced the following day (93; 39.07%) or its complete lack (87; 36.55%).

On the basis of the undertaken data analysis, it can be observed that the participating paramedics exhibit sleep problems. The cause of this state of affairs may be shift work, overload, or issues related to stress (Tab. 6).

## DISCUSSION

While conducting research into sleep disturbances, a significant challenge is setting objective and reliable parameters, such as e.g. its quality. The study constitutes an attempt at evaluating the effect

of undertaking professional duties by ERT paramedics in a shift system on their quality of sleep. The present research showed that shift work significantly affects the quality of sleep of ERT paramedics. It also proved that shift work aids in the development of improper hygiene behaviors impacting the quality of sleep, such as falling asleep at different times every day, irregular and varied hours of sleep, and taking sleeping pills.

Research shows that shift works, as well as the number of night shifts undertaken in a month, contribute to disturbances in the circadian sleep cycle, consequently leading to a multitude of negative health consequences, which may intensify with time and continuing to pursue shift work, affecting the functioning of the human body. Shift work increases the risk of cardiovascular and digestive system disorders, sleep disturbances, neuropsychiatric disorders, and chronic pain, and is related to a higher incidence of accidents at work and lower work satisfaction among employees. In the context of paramedics undertaking shift work, there is a limited number of health consequences documented [19–27].

In their research which aimed to investigate the available literature regarding the effect of paramedics' work on their health condition, Hegg-Deloye et al. [26] showed that sleep disturbances were widespread among paramedics, and they themselves were unable to control their health conditions. Additionally, they found that the impact of work in dangerous conditions, including shift work, has not been well documented and summarized in the professional group that paramedics constitute. The results regarding the sleep disturbances among paramedics obtained by the authors of the study are concurrent with those in the present study.

Between the 21<sup>st</sup> of December, 2018, and the 18<sup>th</sup> of January, 2019, Shriane et al. conducted a study that aimed to assess knowledge and understanding of sleep hygiene among paramedics working in a shift system, as well as its perceived

**Table 6. Subjective evaluation of the sleep problems experienced by the participants according to the Athens Insomnia Scale**

Symptom	Possible answers	Obtained answers n (%)
Sleep induction	No problem	53 (22.26)
	Slightly delayed	71 (29.83)
	Markedly delayed	87 (36.55)
	Very delayed or did not sleep at all	27 (11.34)
Awakenings during the night	No problem	56 (23.52)
	Minor problem	86 (36.13)
	Considerable problem	79 (33.19)
	Serious problem or did not sleep at all	17 (7.14)
Final awakening	Not earlier	67 (28.15)
	A little earlier	93 (39.07)
	Markedly earlier	59 (24.78)
	Much earlier or did not sleep at all	14 (5.88)
Total hours of sleep	Sufficient	51 (21.42)
	Slightly insufficient	123 (51.68)
	Markedly insufficient	49 (20.58)
	Very unsatisfactory, or did not sleep at all	15 (6.30)
Quality of sleep (regardless of its quantity)	Satisfactory	43 (18.06)
	Slightly unsatisfactory	131 (55.04)
	Markedly unsatisfactory	39 (16.38)
	Very unsatisfactory	25 (10.50)
Well-being during that day	Normal	74 (31.09)
	Slightly decreased	93 (39.07)
	Markedly decreased	52 (21.84)
	Very decreased	19 (7.98)
Physical and mental capacity during the day	Normal	91 (38.23)
	Slightly decreased	85 (35.71)
	Markedly decreased	46 (19.32)
	Very decreased	16 (6.72)
Sleepiness during the day	None	87 (36.55)
	Mild	93 (39.07)
	Considerable	39 (16.38)
	Intense	19 (7.98)

impact on sleep, and to examine the engagement paramedics exhibited in sleep hygiene practices. The study was carried out among Queensland Ambulance Service paramedics in Australia (final par-

ticipants sample  $n = 172$ ) working in a shift system. More than half of the participants (53.8%) reported experiencing sleep difficulties "often" or "always", while 26.3% reported "poor" or "very poor" sleep quality. Naps were "never" or "rarely" taken during the day by over half of the participants (58.2%). The study found that paramedics exhibited a limited understanding of the concept of sleep hygiene and they varied in their knowledge regarding the impact of specific sleep hygiene factors. Moreover, paramedics varied in their involvement in individual sleep hygiene practices. The findings of the authors are consistent with the present study's results in this area [27].

In the cross-sectional study carried out by Brahim et al. among 158 paramedics working for the Mongi Slim La Marsa University Hospital Center in Tunis, sleep disorders were detected in 40.5% of the subjects [28]. The present study's findings are consistent with those of the authors as far as people suffering from insomnia are concerned.

136 Australian paramedics participating in a cross-sectional study that aimed, among other things, to examine the prevalence of sleep problems, conducted by Khan et al. [29] reported significantly higher severity of insomnia symptoms and significantly poorer sleep quality. The authors' findings are concurrent with the results of the present study.

According to a study, whose aim was the investigation into the relationship between rotational shift schedules, sleep, fatigue, and sleepiness among 15 paramedics working in the state of Victoria in Australia, it was shown that shift work is related to limited sleep, fatigue, and sleepiness, which combined can be harmful to the health of the employees. Paramedics reported significantly higher levels of sleepiness and fatigue during, immediately after, and the entire day after a night shift, in comparison with the state before the shift and after two days [30].

In their study, Wanstall et al. [31] showed that sleep loss and fatigue negatively affect the behavior and attitude of paramedics. Study participants know that sleep problems affect their well-being. Paramedics have limited knowledge of how to identify and manage sleep disorders. Education about sleep disorders is recommended, and information must be provided by an expert and trusted voice.

The findings of a study by Samunev-Zhelyabov et al. [32] among 468 employees of emergency medical centers in Bulgaria indicating that sleep disorders

and fatigue are common among emergency health-care workers, are consistent with our own research.

The impact of sleep disorders among paramedics and their effect on mental health has been described in a study by Straud et al. [33]. The sleep disorders shown there are consistent with those shown in our own study.

## CONCLUSIONS

1. Research indicates a lack of sufficient knowledge regarding the concept of sleep hygiene and consequently varied levels of engagement in hygiene sleep practices in this occupational group.
2. In order to ensure safe and hygienic working conditions for paramedics and to identify all of the factors constituting potential threats, it is advised to pursue further research with the use of standardized diagnostic tools.
3. It seems advisable for obligatory screening consultations to be implemented for paramedics with more years of work experience (e.g., 10 years) as part of occupational medicine prophylactic testing which would allow for early identification of sleep disorders.
4. In order to minimize the possible health complications resulting from a shift system work schedule among paramedics, it seems reasonable to employ health education measures aimed at these issues in the paramedic training process. Health education aimed at minimizing health consequences resulting from the nature of the undertaken job ought to be provided as part of both formal and informal education.

## Conflict of interest

All authors declare no conflict of interest.

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