

Occupational Hazards and Diseases among Forestry Workers in Poland

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Abstract

This paper analysed the relationships between occupational exposure parameters according and occurrence of cases of occupational diseases among forestry workers in Poland and epidemiological data, clinical reports from other countries and recognition criteria of occupational diseases.

Material and Methods: The data as a basis for this analysis concerning exposure to occupational hazards and diseases, work and employment conditions in forestry in Poland.

Results and Discussion: The most often certified as an occupational diseases among forestry workers in Poland 2000-2009 are: borreliosis (2557 cases), hand-arm vibration syndrome (223) and noise-induced hearing loss (57 cases). A certain group of occupational diseases aren't not in statistics, probably by insufficient health awareness and medical diagnostics or don't cause serious diseases. The factors influenced probably on epidemiological data were in paper discussed. The accessible official statistical data are insufficient to determine the actual number of persons exposed to vibration and noise levels exceeding the Occupational Exposure Limits and loads of locomotion system in forestry in Poland. Based on the submitted officially available epidemiological data, there are grounds to claim that the incidence of occupational diseases in forestry in Poland probably does not quite reflect the actual exposure to occupational hazards. It has proved difficult to compare statistical data between countries on occupational diseases for example in forestry because there are significant differences in definition, classification and reporting systems.

Keywords: Forestry workers, Occupational hazards, Occupational diseases, Vibration, Noise, Borreliosis

Introduction

Forestry workers are exposed occupationally to a number of harmful or harmful factors in their working environment (whole body and hand-arm vibration, acoustic and infrasonic noise, biohazards, musculoskeletal loads and other) that may cause a variety of work-related or occupational diseases (e.g. vibration syndrome, noise-induced hearing loss, hand-arm, infectious and parasitic diseases, allergic diseases, photodermatoses, toxic reactions and spine pain syndrome and peripheral nervous system diseases and others) [1-16].

In medical terms, occupational diseases are described as health disorders specifically associated with working environment and occupational activity. In terms of medical and legal aspects in majority of countries in Europe (and especially in Poland), particular diseases are considered "occupational diseases" if mentioned in the current list of occupational diseases and caused by exposure to occupational hazards at the workplace. The European List of Occupational Diseases has been in existence since 1990 (updated in 2003). This list is a recommendation of European Commission for European Union member states [17,18]. For example in Poland, the current list of occupational diseases features 26 points denoting groups of diseases and particular types of occupational diseases [17-19]. Polish law states that "occupational diseases are recognized as such if included in the list of occupational diseases and considered obviously or most probably to be caused by exposure to deleterious factors in the working environment or associated with the occupational activities". The affected employee is often entitled to receive specific financial benefits on the basis of a certification of occupational disease. Therefore, official data on the number of certified occupational diseases are to be analysed not only in terms of medical (exposure level, actual epidemiology of the disease and access to suitable diagnostic services and treatment), but also economic and social aspects. For example in Poland the forestry industry is dominated by self-employed individuals and small enterprises. These entrepreneurs - working as a

logger or saw operator - are not committed to obligatory prophylaxis within the framework of occupational medicine services, training, lack common knowledge in this respect and have no access to prophylaxis and diagnostic services. Moreover, this applies predominantly to diseases which cause permanent or chronic health impairment [20]. Furthermore, in terms of at least some of the diseases, access of the exposed individuals to suitable high-quality medical diagnostics may be of significance.

Examples from Poland

Occupational diseases- Epidemiology: The number of employees in forestry (official data) decreased in the last decade in Poland. The number of exposed forestry workers working in exposure to noise (from 2296 [year 2000] to 857 persons [year 2009]) and vibration (from 2109 [year 2000] to 728 [year 2009]) decreased, too. Unfortunately official statistical data in Poland on occupational exposure feature no data concerning small enterprises (with up to 9 employees)- most popular in this branch in Poland [21-23]. In polish forestry the percentage of persons exposed to noise and whole body and hand-arm vibration in time period 2004-2007 equalled: 3.7-4.2% and 3.5-3.9%, respectively (with reference to physical workers only, which amounted to 16.5% and 2.7% in 2007 with respect to noise and hand-arm and whole body vibration, respectively) [21-24]. In this time period, occupational diseases among forestry workers accounted for among 4.2% of the total number of occupational diseases in Poland. In Poland in years 2000-

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2009, 2891 certified cases of occupational diseases among forestry workers were reported. Infectious diseases (particularly borreliosis - Lyme disease) were in the last years the most common occupational disease among forestry employees in Poland (2557 cases in 2000-2009), followed by vibration syndrome (223 cases in this time period), noise-induced hearing loss (57 cases) and other occupational diseases (54 cases) [21-24].

Occupational infectious diseases among forestry workers in Poland in relation to other countries: The biggest incidence of the borreliosis certified as an occupational disease was earlier observed in Poland in time period between 2001 and 2003 [20]. The population occupationally exposed to ticks and borreliosis is very difficult to determine (there are not only individuals employed as physical workers) and is connected with presence of endemic areas in different regions. Borreliosis is a chronic multisymptomatic zoonosis characterized by dermatologic, osteoarticular, organ and neurologic symptoms and with typical development in three clinical phases. The etiologic cause of borreliosis is a spirochete. The reservoirs of this pathogen are small rodents living in forestry areas, and vectors are ticks: *Ixodes ricinus* and *Ixodes persulcatus* in European countries and *Ixodes dammini* (*scapularis*) in Northern America [25]. Farmers and forestry workers more often have specific antibodies against *Borelia burgdorferi* than the rest of population [25]. The Polish studies provided evidence that the exposed population lived in majority of country area, but there are a regions with bigger exposure (e.g. the east and south-west Poland), described as endemic areas (Białowieża, Białystok, Mazury, Suwałki and Karkonosze Mountains) [20-33]. Seroepidemiologic studies performed in Poland showed 49.7% positive results in inhabitants and 60-71% in forestry workers [26-33]. Occurrence of the cases of borreliosis certified as an occupational disease is influenced by both

the level of real occupational exposure to infection with spirochaetes *Borelia burgdorferi* and also various socio-economic conditions and access to medical diagnostics. According to the Polish law regulations (“occupational disease can be diagnosed in the existing or former employee during the period of occupational exposure or thereafter, provided documented disease symptoms occur in the relevant period as mentioned in the list of occupational diseases”) [19]. In this case the majority of certified cases of borreliosis (e.g. in the Polish Wielkopolska province [represented by author] were “cumulated cases” from previous years, that appeared in the official statistical data most probably as a result of deteriorating employment figures in this market sector) [20] (Tables 1,2). Very interesting is the quantitative prevalence of borreliosis over other infectious diseases among forestry workers. Epidemiological situation may be connected with occurrence of endemic areas, prophylactic activities (vaccinations), individual sensitivity to infection (e.g. tick-borne encephalitis virus), but also to shortcomings in the diagnostics of infectious diseases. For example, in Poland, the cases of tick-borne encephalitis are only a small part of borreliosis cases (in general population about 1-2%), but in the Czech Republic tick-borne encephalitis (large endemic regions) is more frequently certified as an occupational disease (in the years 1996-2000 the number of its cases in this country accounted for ca 50% of borreliosis cases certified as an occupational disease) [34,35].

Vibration syndrome as an occupational disease in Poland: In recent years (2000-2009), 223 cases of vibration syndrome were certified as an occupational disease in Poland among forestry workers. The number of certified cases of the vibration syndrome according to level of exposure could be considered underestimated. According to Harazin & Zieliński [36] analyses, approximately 1/2 individual logging workers in Poland are exposed to vibrations exceeding the Occupational Exposure

Year	Noise-induced hearing loss *,**	Infectious or parasitic diseases and consequences thereof	Vibration syndrome*	Other	Total	Employment in forestry in Poland (enterprises up to 10 workers)
2000	14 (61,0/3,1)	120 (26,8)	27 (128,0/6,0)	8	169 (37,7)	44851
2001	5 (24,8/1,1)	170 (38,5)	28 (147,0/6,3)	10	213 (48,3)	44118
2002	12 (79,9/2,9)	251 (59,6)	30 (213,7/7,1)	5	298 (70,8)	42108
2003	7 (62,4/1,9)	173 (45,7)	31 (280,8/8,2)	5	216 (57,0)	37888
2004	4 (34,7/1,0)	166 (43,0)	23 (214,4/5,9)	4	201 (52,0)	38623
2005	8 (74,6/2,1)	214 (65,2)	19 (205,0/5,1)	4	245 (66,3)	36964
2006	1 (9,0/0,3)	219 (58,9)	23 (225,2/6,2)	4	247 (66,5)	37154
2007	4 (36,4/1,0)	285 (74,0)	12 (123,0/3,1)	2	303 (78,8)	38471
2008	2 (16,9/0,5)	508 (120,7)	15 (149,1/3,6)	1	526 (125,0)	42077
2009	0 (0,0/0,0)	457 (110,9)	15 (206,0/3,6)	1	473 (114,8)	41204

** - Years 2000-2002: permanent noise-induced bilateral hearing loss, cochlear damage type, expressed as an increase of hearing threshold by at least 45 dB for better ear, calculated as an arithmetic mean of audiometric frequencies 1,2 & 4 kHz. Years 2002-2009: permanent noise-induced bilateral hearing loss, cochlear damage type, expressed as an increase of hearing threshold by at least 45 dB for better ear, calculated as an arithmetic mean of audiometric frequencies 1,2,3 kHz.

Table 1: Incidence of certified occupational diseases in forestry and employment in forestry in Poland (2000-2009) and respectively per 10 000 exposed employees (official data)* / and per 10 000 total number of employees in forestry (self analysis by the author).

Year	Number of cases	Number of cases in relation to employed in forestry (per 1000 employees)
2000	5	0.93
2001	48	10.2
2002	67	14.4
2003	58	13.2
2004	8	1.9
2005	4	0.9
2006	13	2.9
2007	8	2.5
2008	6	1.9

Table 2: Number of certified cases of borreliosis among forestry workers as an occupational disease for example of the province of Wielkopolska (central-west Poland) in years 2000-2008.

Poland	Permanent noise-induced bilateral hearing loss, cochlear damage type, expressed as an increase of hearing threshold by at least 45 dB for better ear, calculated as an arithmetic mean of audiometric frequencies 1, 2 and 4 kHz (pure-tone audiometry). The current statutory definition of this disease in Poland is as follows: Permanent noise-induced bilateral hearing loss, cochlear damage type, expressed as an increase of hearing threshold by at least 45 dB for better ear, calculated as an arithmetic mean of audiometric frequencies 1, 2, 3 kHz (pure tone audiometry) (Journal of Laws. no. 105, item 869 of 2009).
Germany	Speech audiogram for both ears. Pure-tune audiogram when there are problems with the speech audiogram.
the Netherlands	All these parameters may be taken into account, depending on the individual case. None are obligatory.
United Kingdom	Audiometric criteria for occupational deafness must be met i.e. average sensorineural hearing loss 50 dB over 1, 2 & 3 kHz (pure-tone audiometry) in each ear and in at least one ear due to occupational noise and criteria connected with noise exposure at work.
Denmark	The system doesn't make use of pure-tune audiometry thresholds as a predominant audiological measure, but is based on speech perception. Combination of individual self assessment of semantic speech perception and objective audiological measurements are the most important.
Austria	Speech audiogram Hearing loss + discrimination loss in keeping with the tables compiled in accordance with Boenninghaus and Röser. Percentage hearing loss is the most important.
France	In pure-tone audiometry a weighted average of the hearing loss in both ears (2x0.5kHz + 4x1kHz + 3x2kHz + 1x4kHz)/10 is calculated.
Ireland	In pure-tone audiometry- minimum hearing loss of 50 decibels in each ear.

Table 3: Examples of the parameters as the main determinants for recognition noise-induced hearing loss in different countries in Europe [59].

Limits (OEL) (logging workers are the ¼ population which is exposed to vibrations exceeding OEL). Statistical data concerning exposure level among forestry workers are insufficient. The data collected by the Polish Central Statistical Office does not include a significant share of individuals, who are under exposure to this occupational hazard in their working environment [36]. Unfortunately, in Poland, no small enterprises (those employing up to 9 persons, and self-employed individuals) which account for a considerable part of all firms operating in the forestry industry are represented in the official statistical data [21-24]. In this case, the estimated population of logging workers exposed to hand-transmitted vibration in Poland is probably about 170% higher than the one reflected in the official statistical data. It is noteworthy that exposure to hand-transmitted vibrations in case of logging workers may also be due to tractors and other transport machines [37]. The majority of employees exposed to hand-arm vibrations do not have their working conditions evaluated in terms of occupational hygiene based on documented measurements. According to Harazin & Zieliński [36] analyses, the occupational exposure to vibrations in working conditions has not been measured and documented with reference to over 60% of employees exposed to vibrations. At present in Poland, all laboratories that perform measurements of occupational hazards need to be accredited by the Polish Centre of Accreditation (according to the requirements of the European Standard EN ISO/IEC 17025:2005). As a result, the measurements of exposure to vibrations in Poland are less accessible. There are no extensive analyses in Poland of exposure to hand-arm vibrations that would be based on the evaluation of other secondary factors (e.g. quantity of wood produced, consumed fuel, working days with use of wood cutting saws) [38,39]. It is remembered that the quantity of wood produced per each wood cutting saw operator as a good assessment criterion of exposure to vibration may be of preventive value. Enterprises are in possession of detailed data on the quantity of wood produced by each wood cutting saw operator, and are in a position to control the working process and to limit the exposure to vibrations to minimum [38]. The wood cutting saw vibrations and the tasks performed by the wood cutting saw operators, as well as the wood hardness and technical condition of the wood cutting saw are closely interrelated (e.g. higher vibration levels are observed when cutting down a tree as compared to logging and branching) [38,39]. In relatively old analyses performed by Bernacki [40], the symptoms of a hand-arm vibration syndrome were observed in 22.6% motor-sawers and the syndrome was suspected in 6.7%.

Moreover, attention should be paid to the fact that microclimatic conditions may influence the appearance of symptoms involved in hand-arm vibration syndrome and the data concerning countries

of remarkably different climate may not be extrapolated in a simple way [41,42]. It is very important that the assessment of hand-arm vibration syndrome certified cases as an occupational disease in Poland is very difficult to compare with epidemiological data from other countries because there are different medical recognition and disability assessment criteria.

Moreover, exposure of self-employed persons may be assumed to be exceptionally high, as the earnings of such saw operators are proportional to the number of working hours, and it may be suspected that the permitted occupational exposure to local vibrations is frequently exceeded. These limits are usually no more than several hours for the operators of wood cutting saws. Pursuant to the Polish Labour Code, the measurement of hazards in the working conditions are obligatory, however, in the absence of an employment contract, these measurements are not legally required. On the other hand, wood-cutting by self-employed loggers may be associated with insufficient social facilities (no shelters for loggers), and the workers may lack the opportunity to warm their hands up or to dry their clothes - this type of facilities are available in large wood-cutting undertakings. Many years' work with vibrating tools was strongly associated with peripheral neuropathies, carpal tunnel syndrome and upper-limb musculotendinous syndromes, epicondylitis and rotator cuff syndrome. Adverse microclimate conditions also exacerbate the effects of exposure to local vibrations [42]. In addition to that, by boreliosis "the "cumulated cases" of this occupational disease not appeared in Poland. In Poland is limited time period for diagnosis of occupational disease after ending of occupational exposure period according to vibration syndrome up to 1-3 years.

Noise-induced hearing loss among forestry workers in Poland

Wood cutting saws are the most popular tools in the woodcutting industry in Poland. Wood cutting saws generate noise levels over 100 dB-A. Polish Occupational Exposure Limits: exposure to noise according to 8 working hours (Lex,8h): 85 dB-A, maximal noise level (LAm_{ax}): 115 dB-A, peak noise level (LC_{peak}): 135 dB-C) [43,44]. For example, according to Solecki analyses [45-47], the noise exposure levels are around 90 dB-A, and pose serious risk of hearing damage among tractors operators. In Poland, the fallen trees are usually transported using tractors. Exposure level to noise in this type of vehicles typically varies from 63 to 81 dB-A inside the tractor and 53 to 77 dB-A at 5-10 meter distance from the vehicle (the highest noise levels appear at the operator places when the tractors don't have a cabins (often exceeded OEL by old models) [44]. It may be nevertheless assumed that the noise level in closed-cabin tractors may be comparable, for example, to the

noise exposure levels of farmers. The use of special tractors equipped with wood transportation and cutting machines is cost-ineffective in Poland. The so-called forwarders and harvesters are typically used in large-scale forest areas in other countries (e.g. Scandinavia, Canada).

Officially, 57 cases of certified noise-induced hearing loss were reported among forestry workers in the years 2000-2009 in Poland but, it is difficult to assess whether this figure represents the accurate number of certified cases of this occupational disease in this population as compared to the actual occupational exposure and the actual preventive measures typically employed in Poland since there are no comprehensive analyses concerning the actual exposure of loggers and saw operators to noise [48].

It is important that currently in Poland the fallen trees are transported using horses (without significant occupational exposure to noise) currently in Poland only in forest areas located in mountains. Hand-transmitted vibrations the logging workers and noise may also affect the hearing organ (Corti's organ), too. Local vibrations are assumed to adversely affect blood vessels delivering blood to inner ear, which may result in the development of hypersensitivity of the Corti's organ to noise [49-56]. This may in turn cause high-pitch hearing loss [49]. Interesting is exposure to infrasonic noise. The machines used in forestry industry may be a significant source of this hazard, but the measurements of infrasound were in Poland rarely performed.

It is very important that the assessment of noise-induced hearing loss cases certified as an occupational disease in Poland is difficult to compare with epidemiological data from other countries because there are different recognition and disability assessment criteria.

Musculoskeletal complains: The work in forestry is connected with static, dynamic loads and monotypical movements. The most frequent diseases in this group include spine diseases, upper-limb diseases, carpal tunnel syndrome and different after-injury complains. For example, in Poland, spine diseases are not in the list of occupational diseases, and carpal tunnel syndrome and musculotendinous disease may be certified as an occupational disease. For example symptoms of carpal tunnel syndrome appeared in as many as 19-21.4% of forestry services workers in Italy. Compared to other European countries (e.g. Finland, Spain), the number of cases of musculoskeletal complaints in Poland in official data concerning occupational diseases among forestry workers is underestimated [57]. As an example, according to epidemiological data on occupational diseases in forestry in Spain, musculoskeletal injuries account for ca 20.6% of the total number of occupational diseases in forestry in this country [57].

The forestry industry in Poland is dominated by small enterprises or self-employed individuals. These entrepreneurs - working as a logger or saw operator - are not committed to obligatory prophylaxis within the framework of occupational medicine services, training, lack common knowledge in this respect and have no access to prophylaxis and diagnostic services (this may in particular apply to the vibration syndrome or the noise-induced hearing loss).

The problem of epidemiological data on certified occupational diseases in Poland also deserves attention. In the light of the latest publications, changes need to be introduced to produce more practical knowledge on the development directions of preventive measures [58,59]. It also needs to be considered that there are no means to evaluate the actual exposure level to occupational hazards in forestry using the data collection methods currently used in Poland.

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